VOA
YOUNG ADULT SHELTER TI

3104 W Augusta Ave.
Spokane, Washington

PROJECT MANUAL/ SPECIFICATIONS

Owner:
VOLUNTEERS OF AMERICA EASTERN WASHINGTON & NORTHERN IDAHO

Architect:
ARCHITECTURE ALL FORMS

Issued:
12/3/2021

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VOA YOUNG ADULT SHELTER TI
Spokane, Washington

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SECTION 00 01 00

INVITATION TO BID

PART 1 GENERAL

1.01 INCORPORATION

A. Invitation to Bid attached.

END OF SECTION

SECTION 00 02 00

INSTRUCTIONS TO BIDDERS

PART 1 GENERAL

1.01 INCORPORATION

A. Instructions to Bidders attached.

END OF SECTION

SECTION 00 32 00

GEOTECHNICAL REPORT

PART 1 GENERAL

1.01 INVESTIGATION

A. Soil and Subsurface investigations were conducted at the site by Intermountain Materials Testing & Geotechnical. The recommendations contained in this report are incorporated into the work of this project. A copy of the Geotechnical report, dated August 26, 2021 is attached herein.

B. The contractor shall review the soil investigation report, visit the site and confirm to their satisfaction the information contained therein.

END OF SECTION

SECTION 00 40 00

BID FORMS

PART 1 GENERAL

1.01 INCORPORATION

A. Bid Forms attached.

END OF SECTION

SECTION 00 43 00

BID SECURITY FORM

PART 1 GENERAL

1.01 INCORPORATION

A. Bid Security Form attached.

END OF SECTION

SECTION 00 43 36

PROPOSED SUBCONTRACTORS FORM

PART 1 GENERAL

1.01 INCORPORATION

A. Template attached.

END OF SECTION

SECTION 00 43 43

PREVAILING WAGE REQUIREMENTS

PART 1 GENERAL

1.01 INCORPORATION

A. Requirements attached.

END OF SECTION

SECTION 00 72 13

GENERAL CONDITIONS – STIPULATED SUM

PART 1 GENERAL

1.01 INCORPORATION

A. AIA Document A201 2017, General Conditions, the Contract for Construction, is incorporated as part of the Contract Documents and bound herein. Modications outlined in the Invitation to Bid apply to this project.

END OF SECTION

SECTION 00 73 00

SPECIAL CONDITIONS

PART 1 GENERAL

1.01 INCORPORATION– The following Special Conditions shall be incorporated into the Contract between Owner and General Contractor and likewise shall be incorporated into any and all subcontracts between General Contractor and Subcontractors.

A. Accessibility Requirements

As it relates to accessibility, the project shall be constructed in full compliance with the following codes: A) International Building Code (IBC) Chapter 11 Accessibility, (B) Uniform Federal Accessibility Standards (UFAS) in accordance with the Architectural Barriers Act (42 U.S.C. 4151-4157), (C) The Fair Housing Act (42 U.S.C. 3601-19 and ANSI A117.1)), and (D) the Americans with Disabilities Act (42 U.S.C. 1201 et seq.).

B. Refer to attachments for additional special conditions.

END OF SECTION

SECTION 01 11 13

WORK COVERED BY CONTRACT DOCUMENTS

PART 1 GENERAL

1.01 IDENTIFICATION

A. VOA YOUNG ADULT SHELTER TI

1.02 PROJECT ADDRESS

A. VOA YOUNG ADULT SHELTER
3104 E. Augusta Ave.
Spokane, WA 99202

1.03 LEGAL DESCRIPTION

A. EAST END ADD LTS 4 THRU 6 BLK 20

1.04 PROJECT DESCRIPTION

A. Construction of a new youth shelter to include the remodel of an existing 1-story commercial building and construction of a new 1-story addition.

1.05 OWNER

A. Volunteers of America Eastern Washington & Northern Idaho
525 W 2nd Ave.
Spokane, WA 99201
Telephone: (509) 624-2378
Contact: Fawn Schott

1.05 PROJECT CONTACT

A. Spokane Housing Authority
25 W Nora
Spokane, WA 99205
Telephone: (509) 252-7105
Contact: Brian Jennings, Housing Development Director

PART 2 THE DOCUMENTS

2.01 PROJECT MANUAL

Divisions 00 to 33 - Technical Specifications

2.02 PROJECT DRAWINGS

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See plans

INDEX: STRUCTURAL DRAWINGS

See plans

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See plans

INDEX: ELECTRICAL DRAWINGS

See plans

PART 3 DESIGN TEAM

3.01 ARCHITECT

Architecture All Forms
827 West 1st Ave., Suite 415
Spokane, WA 99201
Contact: Robert Vralsted
Ph: (509) 822-2254

3.02 CONSULTANTS

CIVIL ENGINEER

AHBL
827 W. 1st Ave., Suite 220
Spokane, WA 99201
Contact: Erick Fitzpatrick
Ph: (509) 252-5019

STRUCTURAL EGINEER

Ascend Structural Design
P.O. Box 18722
Spokane, Wa 99228
Contact: Ryan Barrett
Ph: (509) 465-3037

MECHANICAL/ELECTRICAL/PLUMBING ENGINEER

L&S Engineering Associates, Inc.
216 W Pacific Ave., Suite 211
Spokane, Wa 99201
Contact: Brad Bergler
Ph: (509) 747-2179

GEOTECHNICAL ENGINEER

Intermountain Materials Testing & Geotechnical
9401 E. Appleway Blvd.
Spokane Valley, WA 99206
Contact: Gregory Voigt
Ph: (509) 474-9764

FIRE ALARM

DESIGN BUILD

3.03 GOVERNING AGENCIES

Building Department: City of Spokane Building Department

END OF SECTION

SECTION 01 15 00

INSURANCE REQUIREMENTS

PART 1 GENERAL

1.01 INCORPORATION

A. Certificate of Insurance Requirements, Sample Certificate, Insurance Compliance Statement and project specific Subcontractor Insurance Requirements are incorporated as part of the Contract Documents and bound herein. Any subcontractor and vendor must show proof that they meet or exceed the requirements of these documents prior to entering into a contract with the CONTRACTOR.

B. Refer to attached documents for additional Requirements.

END OF SECTION

SECTION 01 16 00

SUBCONTRACTOR – VENDOR INFORMATION SHEET

PART 1 GENERAL

1.01 INCORPORATION

A. Subcontractor-Vendor Information Sheet, is incorporated as part of the Contract Documents and bound herein. This document will be required to be completed in full by all subcontractors and vendors prior to entering into a contract.

B. See attachedments for additional Vendor Information requirements.

END OF SECTION

SECTION 01 31 13

PROJECT COORDINATION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Title of Work, and Type of Contract.

B. Work Sequence.

C. Contractor Use of Premises.

D. Owner Occupancy.

E. Applications for Payment.

F. Coordination.

G. Field Engineering.

H. Reference Standards.

I. Request for Information (RFI's).

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Work of this Contract comprises general construction of the VOA Young Adult Shelter project located in City of Spokane, Washington, for Volunteers of America Eastern Washington & Northern Idaho, as described herein.

1.03 CONTRACT METHOD

A. See attached for Contract Method.

1.04 WORK SEQUENCE

A. Contractor may use any sequence of operations compatible with Contractor approved Progress Schedule.

B. These documents are not to be interpreted implicitly or explicitly as definition of procedure and sequence of operations. Order as to procedure and sequence of operations are Contractor options, consistent with contract documents.

1.05 CONTRACTOR USE OF SITE PREMISES

A. Limit use of site and premises for Work within the contract.

B. Work hours shall be limited as specified by the local governing authorities.

C. Contractor shall have use of the premises for execution of the work during the contract time, including, but not limited to, the following:

1. Assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site.

2. Move any stored products at no cost to the Owner, which interfere with operations of the Contractor or separate contractors.

3. Obtain and pay for the use of additional storage or work areas on or off site as needed for operations.

4. Do not allow storage of flammable liquid or hazardous materials in any portion of the building including mechanical or electrical equipment rooms.

1.06 OWNER'S USE OF PREMESIS

A. Owner's personnel and Owner's Representative may be present during the construction period as necessary to review construction.

B. Provide Owner's personnel reasonable and safe access and escort as needed.

1.07 APPLICATIONS FOR PAYMENT

A. Submit application for payment as required by HUD and described in the attached documents.

1.08 COORDINATION

A. General: The Contractor is responsible for construction means and methods and for the general coordination of the work in all trades.

B. Site: The Contractor is, in general, the custodian of the site of the project and will provide access, storage, and work space for those engaged in the Work. The site shall be maintained in an orderly manner.

C. Coordinate work of the various Sections of Specifications and related subcontractors to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.

D. Verify characteristics of elements of interrelated operating equipment are compatible; coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing such equipment in service.

E. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduits, as closely as practicable; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Execute cutting and patching to integrate elements of Work, uncover ill-timed, defective, and non-conforming work, provide openings for penetrations of existing surfaces, and provide samples for testing. Seal penetrations through floors, walls, and ceilings.

1.09 FIELD ENGINEERING

A. Provide field engineering services; establish grades, lines, and levels, by use of recognized engineering survey practices. All horizontal and vertical control work must be done by a surveyor registered in the state of Washington.

B. Control datum for survey is that established by Owner-provided survey. Locate and protect control and reference points.

C. Surveyor shall verify with architect set backs, separation, drive isle width, etc. prior to staking.

1.10 REQUESTS FOR INTERPRETATION (RFI)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, prepare and submit an RFI in the form specified:

1. RFI's shall originate with Contractor. RFI's submitted by entities other than Contractor will be returned with no response.

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

3. Each RFI must be numbered in sequential order.

B. Content of the RFI: Include a legible, detailed description of item needing interpretation, including dimensions, attatchments, etc., as necessary to facilitate Architect's response.

1. Identify each page of attachments with the RFI number and sequential page number.

C. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow 3 working days as indicated in Contract for Architect's response for each RFI.

1. The following RFI's will be returned without action:

a. Requests for approval of submittals.

b. Requests for coordination information already indicated in the Contract Documents.

c. Requests for adjustments in the Contract Time or the Contract Sum.

d. Requests for interpretation of Architect's actions on submittals.

e. Incomplete RFI's or RFI's with numerous errors.

2. Architect's action may include a request for additional information.

3. Architect's action on RFI's that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal per Contract.

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 20 days of receipt of the RFI response.

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

E. RFI Log: Contractor shall prepare, maintain and submit a tabular log of RFIs organized by the RFI number. Submit log monthly to Architect.

1.11 REFERENCE STANDARDS

A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified herein or are required by applicable codes.

B. The date of the standard is that in effect as of the date of Owner-Contractor Agreement except when a specific date is specified.

C. Obtain copies of standards when required by Contract Documents. Maintain copy at job site during progress of the specific work.

D. The following are the reference standards for these specifications:

507 THERMAL AND MOISTURE PROTECTION

507-3 BUILDING INSULATION

Cork Board - FS HH-I-525A

Cellular Glass - FS HH-I-551E

Cellulosic, Vegetable or Wood Fiber - STM C 739-91

Expanded Polystyrene Insulation Board - FS HH-I-524C

Fiberboard - FS LLL-I-535B Class C or E - ASTM C 209-84

Insulation Board (Urethane) - FS HH-I-530B

Insulation Board, Thermal (Mineral Aggregate) - FS HH-I-529B or ASTM C 726-88

Insulation Board, Thermal, Faced, Polyurethane or Polyisoyanurate - FS HH-I-1972/GEN; 1; 2; 3; 4; 5; & 6

Mineral Fiber, Board (Roof) - FS HH-I-526C

Mineral Fiber, Insulation Blanket - FS HH-I-521F

Mineral Fiber, Pneumatic or Poured - FS HH-I-1030B

Perimeter Insulation - FS HH-I-524C

Reflective, Thermal - FS HH-I-1252B

Cellulosic Fiber Insulating Board - PS 57-73

Application of Structural Insulating Board (Fiberboard) Sheathing - ASTM C 846-8

Perlite – FSHH-I-574B or ASTM C 549-81

Vermiculite (used as masonry wall filler) - FS HH-I-585C

Class 2 (for other uses) - ASTM C 516-85

Spray Applied Cellulosic Thermal Insulation - UM 80-79

507-6 CAULKING AND SEALANTS

Elastomeric Type; Multi-Compound - FS TT-S-227B

Elastomeric Type; Single-Compound - FS TT-S-230A

Oil and Resin Base Type - FS TT-C-598B

Silicone Rubber Base - FS TT-S-001543A

Butyl Rubber Base; Single-Compound - FS TT-S-001657A

Latex Sealing Compounds - ASTM C 834-91

Voluntary Specifications for Ductile Back-Bedding Glazing Tapes - AAMA 800-92

Voluntary Specifications for Non-Drying Sealants for Use with Architectural Aluminum - AAMA 800-92

Voluntary Specifications for Oil-Extended Cured Rubber Back-Bedding Glazing Tapes - AAMA 800-92

Cellular Neoprene - ASTM C 509-91

Specifications for Dense Rubber-like Compression Gasket Materials - ASTM C 864-90

508 DOORS, WINDOWS, GLAZING PANELS

Metal Doors and Frames:

Interior Steel Doors and Frames (flush) - PS 4-66

1 3/4 in. thick Steel Doors and Frames - CS 242-62

Aluminum Storm Doors - ANSI/AAMA 1102.7-89

Wood Doors and Frames:

Hardwood, Hardboard and Plastic Faced Flush Doors - ANSI/NWWMA IS 1-87 Interior

Prehung Wood Door Units - NSDJA 1-79

Ponderosa Pine Doors - ANSI/NWWMA IS 5-73

Douglas Fir, Sitka Spruce and Western Hemlock Doors - FHDA 7-79

Wood Storm Doors - ANSI/NWWMA IS 6-86

Exterior Wood Door Frames - WM 3-79

Special Doors:

Aluminum Prime Windows - ANSI/AAMA 101-88

Wood Sliding Patio Doors - ANSI/NWWMA IS 3-88

Metal Windows and Frames:

Aluminum Prime Windows – ANSI/AAMA 101-88

Aluminum Insulating Storm Products - ANSI/AAMA 1002.10-83

Thermal Transmittance and Condensation Resistance of Windows,

Doors and Glazed Wall Sections - AAMA 1503.1-88

Thermal Performance of Residential Windows and Sliding Glass Doors - AAMA 1504-88

Wood Windows and Frames:

Wood Window Units - ANSI/NWWMA IS 2-87

Hardware:

Lockset - ANSI A156.2-89

Insect Wire Screenings - IWS-089 or CS 138-55

Screening, Insect, Non-metallic - FS L-S-125B

Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Fiber Yarn - ANSI/ASTM D 3656-89

Glass and Other Glazing Panels:

Acrylic Plastic Sheets Glazing - UM 58a-75

Glass - FS DD-G-451D

Safety Standard for Architectural Glazing Materials - CPSC 16 CFR Part 1201

Safety Glazing Material Used In Buildings - SGCC Certified Products Directory

Tempered Glass - FS-DD-G-1403B

509 FINISH MATERIALS

509-1 EXTERIOR WALL FINISHES

Aluminum - AAMA 1402-86

Fiberboard Shingle Backer - ASTM C 208-82 (1982) Class G

Basic Hardboard (Revised 1988) - ANSI/AHA A135.4-82

Cellulosic Fiberboard - ANSI/AHA 1-194.1-95

Hardboard Siding - ANSI/AHA 135.6-90

Plywood - PS 1-83

Rigid PVC (polyvinyl chloride) - ASTM D 3679-92

Textured Plywood Panel Siding - UM 64b-75

Stucco (exterior plaster) - ASTM C 926-90

509-2 FINISH FLOORING-RIGID

Ceramic Tile - ANSI A137.1-88

Specification for Installation of Ceramic Tile - ANSI A108.1A-92

Terrazzo - NTMA Specifications, Details and Technical Data - 1990

Wood:

Block, Slat - PS 27-70

Laminated Hardwood Flooring - ANSI/HPMA LHF-87

Strip Oak Flooring - NOFMA-OFGR/ Vol. 1, No. 1-86 & 89 addendum

509-3 RESILIENT FLOORING

Asphalt Tile (Type I) - Vinyl Tile (Type III) - Rubber Tile (Type IV) -

ASTM F 1344-91 Linoleum - FS LLL-F-1238A

Rotovinyls (Unfilled Vinyl Sheet) - FS L-F-001641-71

Backed Vinyl Plastic Sheet or Tile (Grade C) - FS L-F-475A

Homogenous Vinyl Sheet Underlayment - FS L-F-00450A

Basic Hardboard - ANSI/AHA A135.4-88

Particleboard (Grade 1-M-1) ANSI A 208.1-89, ASTM D 1037-89

Plywood - PS 1-83

511 EQUIPMENT

Minimum Construction Performance Standards for Kitchen Cabinets - ANSI A 161.1-86 515

MECHANICAL

515-7 SPECIAL PIPING SYSTEMS

Gas Piping - NFPA 54-92 & 58-92

515-8 WATER SUPPLY SYSTEM

Water Filters - WQA S 200-88

Point-of-Use, Low Pressure Reverse Osmosis Water System - WQA S 300-84 Point-of-

Use, Distillation Drinking Water - WQA S 400-86

Community Water Systems Minimum Design Standards for Community Water Supply Systems – HUD Handbook 4940.2 8-73

515-9 SEWAGE DISPOSAL SYSTEM

Community Sewage Systems Minimum Design Standards for Community Sewage Systems – HUD Handbook 4940.3 Rev. 1-12/92

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Contractor participation in preconstruction conferences.

B. Contractor administration of progress meetings and pre-installation conferences.

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

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.

2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.

1.02 RELATED REQUIREMENTS

A. Section 01 31 13 – Project Coordination

B. Section 01 33 23 – Shop Drawings, Product Data, and Samples

C. Section 01 45 00 - Quality Control

D. Section 01 77 19 - Contract Closeout

1.03 PRECONSTRUCTION MEETINGS

A. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days prior to starting work. Hold the conference at project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress.

3. Distribute meeting notes to all attendees.

1.04 PROGRESS MEETINGS

A. Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.

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

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

    a. Contractor's Construction Schedule: Review progress since the last meeting.

    b. Review present and future needs of each entity present.

3. Minutes: Contractor will record and distribute to Owner the meeting minutes.

4. Reporting: Distribute minutes of the meeting to each party present, to parties who should have been present, and to others as deemed necessary.

1.05 PREINSTALLATION CONFERENCES

A. Conduct a Preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration.

3. Distribute minutes of the meeting to each party present, Architect, to parties who should have been present, and to others as necessary.

4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

PART 2 PRODUCTS
Not Used

PART 3 EXECUTION
Not Used

END OF SECTION

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Procedures.

B. Schedule of Values.

C. Shop Drawings.

D. Product Data.

E. Samples.

F. Manufacturer's Instructions.

G. Manufacturers' Certificates.

1.02 RELATED REQUIREMENTS

A. Section 01 31 13 – Project Coordination: Applications for Payment, Construction Progress Schedule and Schedule of Values.

B. Section 01 45 00 - Quality Control: Testing laboratory reports.

C. Section 01 45 00 - Quality Control: Manufacturers' field service reports.

D. Section 01 66 00 – Product Storage and Handling Requirements: Contractor's list of Products.

E. Section 01 77 19 – Closeout Requirements: Closeout submittals.

1.03 SUBMITTAL PROCEDURES

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

B. Submittal Schedule: Provide list of submittals and time requirements for scheduled performance of related construction activities.

C. Processing Time: Allow enough time for submittal review, including time for resubmittals.

D. Identification: Place a permanent label or title block on each submittal for identification.

E. Shop Drawings: submit 5 copies.

F. Submit shop drawings, as required herein, to Spokane County as required.

G. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

H. Transmit each submittal using a transmittal form.

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

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

K. Use for Construction: Use only final submittals with mark indicating “Approved for Construction” taken by Architect.

1.04 CONTRACTOR’S USE OF ARCHITECT’S CAD FILES

A. General: At Contractor’s written request, copies of Architect’s CAD files will be provided to Contractor for Contractor’s use in connection with Project, subject to conditions as listed in Architect’s Drawing Release Form.

PART 2 PRODUCTS

2.01 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

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

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

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location.

F. Submittals Schedule: Comply with requirements specified in paragraph 1.03, above.

2.02 INFORMATION SUBMITTALS

A. General: Prepare and submit informational Submittals required by other Specification Sections.

PART 3 EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with review stamp before submitting to Architect.

B. Review Stamp: Stamp each submittal with a uniform, review stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's review stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

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

END OF SECTION

SECTION 01 33 26

SOURCE QUALITY CONTROL REPORTING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. General Quality Control.

B. Industry Standards.

C. Workmanship.

D. Manufacturer's Instructions.

E. Manufacturer's Certificates.

F. Mockups.

G. Manufacturers' Field Services.

H. Testing Laboratory Services.

1.02 RELATED REQUIREMENTS

A. Document AIA A201 - General Conditions: Inspection and testing required by governing authorities.

B. Section 01 31 13 – Project Coordination: Applicability of specified reference standards.

C. Section 01 33 23 – Shop Drawings, Product Data, and Samples: Submittal of Manufacturer's Instructions.

D. Section 31 23 23.13 - Backfill: Tests required for earthwork.

E. Section 03 31 13 – Heavyweight Structural Concrete: Tests required for concrete.

F. Section 31 22 19 – Finish Grading: Tests required for import fill.

1.03 QUALITY CONTROL, GENERAL

A. Maintain quality control over subcontractors and suppliers, manufacturers, products, services, site conditions, delivery schedules, and workmanship, to produce work of specified quality.

1.04 INDUSTRY STANDARDS

A. Applicability if Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.05 WORKMANSHIP

A. Perform work by persons qualified to produce workmanship of specified quality.

B. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking; whether indicated herein or on the drawings.

1.06 MANUFACTURERS' INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from Architect before proceeding.

1.07 MANUFACTURERS' CERTIFICATES

A. When required by individual Specifications Section, submit manufacturer's certificate, in duplicate, that products meet or exceed specified requirements.

1.08 MOCKUPS

A. When required by individual Specifications Section, erect complete, full-scale mockup of assembly at Project site.

1.09 MANUFACTURERS' FIELD SERVICES

A. When specified in respective Specification Sections, selected manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship, as applicable, and to make appropriate recommendations.

B. Representative shall submit written report to Architect/Owner listing observations and recommendations.

1.10 TESTING LABORATORY SERVICES

A. Owner will employ and pay for services of an Independent Testing Laboratory to perform inspections, tests, and other services required by individual Specification Sections and Governmental Authorities.

B. Contractor shall cooperate with Testing Laboratory personnel; furnish tools, samples of materials, access to work, design mix, equipment, storage and assistance as requested.

1. Notify Testing Laboratory 24 hours prior to expected time for operations requiring testing services.

2. Make arrangements with Testing Laboratory and pay for additional samples and testing for Contractor's convenience.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION
Not Used

END OF SECTION

SECTION 01 51 00

TEMPORARY UTILITIES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Electricity, Lighting.

B. Heat, Ventilation.

C. Telephone Service.

D. Water.

E. Sanitary Facilities.

F. Barriers.

G. Enclosures.

H. Protection of Existing: structures, utilities, trees and shrubs to remain, bench marks and survey data.

I. Protection of Installed Work.

J. Security.

K. Dust Control.

L. Erosion and Sediment Control.

M. Pollution Control.

N. Cleaning During Construction.

O. Project Identification.

P. Field Offices and Sheds.

Q. Off Site Storage or Construction Materials.

1.02 RELATED REQUIREMENTS

A. Section 01 31 13 – Project Coordination: Work sequence. Contractor use of premises.

B. Section 01 77 19 – Closeout Requirements: Final Cleaning.

1.03 ELECTRICITY, LIGHTING

A. Provide service required for proper construction operations, with branch wiring and distribution boxes located appropriately to allow service and lighting by means of construction-type power cords.

1.04 HEAT, VENTILATION

A. Provide as required to maintain specified conditions for construction operations, to protect materials on and off site and finishes from damage due to temperature or humidity until substantial completion.

B. Provide heating and ventilation of enclosed areas to properly cure materials, to disperse humidity, and to prevent accumulations of dust, fumes, vapors, or gases that may cause delay of related trades or unsafe construction conditions.

1.05 TELEPHONE SERVICE

A. Provide telephone service to field office and include use of separate space and phone for sub contractors and owners when on site. Provide a Fax machine at field office with separate line for duration of construction.

1.06 WATER

A. Provide service required for construction operations. Extend branch piping with outlets located so that water is available by use of hoses.

1.07 SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures.

1.08 BARRIERS

A. Provide as required to prevent public entry to construction areas to provide for Owner's use of site, and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks. Construction: Commercial grade chain link fence.

C. Provide barricades as required by governing authorities for public rights-of-way.

D. Provide barriers around trees and plants designated to remain. Protect against vehicular traffic, stored materials, dumping, chemically injurious materials, and puddling of continuous running water.

1.09 ENCLOSURES

A. Provide temporary weather-tight closures of openings in exterior surfaces to provide acceptable working conditions and protection for materials, to allow for temporary heating, and to prevent entry of unauthorized persons. Provide doors with self-closing hardware and locks.

1.10 PROTECTION OF INSTALLED WORK

A. Provide temporary protection for installed products. Control traffic in immediate area to minimize damage.

B. Provide protective coverings at walls, projections, jambs, sills, bath tubs and plumbing fixtures, and soffits of openings. Protect finished floors and stairs from construction traffic, movement of heavy objects, and storage.

C. Prohibit traffic and storage on waterproofed and roofed surfaces, on lawn and landscaped areas.

D. Repair or replace any damaged items.

1.11 SECURITY

A. Protect site and installed work during construction from unauthorized entry, vandalism, and theft.

1.12 WATER CONTROL

A. Grade site to drain to and through temporary erosion control facilities. Maintain excavations free of water. Provide and operate pumping equipment on a 24 hour basis when required. Size pumping to adequately control water.

1.13 CLEANING DURING CONSTRUCTION

A. Control accumulation of waste materials and rubbish dumping. Periodically dispose of at off-site authorized facilities.

B. Clean interior areas prior to start of finish work satisfactorily to subsequent trades and maintain areas free of dust and other contaminants during finishing operations.

1.14 FIELD OFFICES AND SHEDS

A. Office: Weather-tight, with lighting, electrical outlets, heating, and ventilating equipment, and equipped with furniture. Provide, in addition, space for Project meetings, with table and chairs to accommodate 6 persons.

B. Storage Sheds for Tools, Materials, and Equipment: Weather-tight, with heat and ventilation for Products requiring controlled conditions, with adequate space for organized storage and access, and lighting for inspection of stored materials.

1.15 REMOVAL

A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary facilities. Remove underground temporary installations to a depth of 2 feet; finish grade site as indicated by civil plans.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 PROTECTION

A. Protect with approved methods the following existing or newly installed items, on or off site as required, that may be affected by this work, protect during the entire project or until protection is non applicable.

1. Adjacent structures.

2. On-site structures.

3. Utilities.

4. Trees & shrubs (existing & new).

5. Bench marks, corners and other survey data.

6. Fences.

B. This protection extends to all applicable sections and work.

C. Repair any damage items noted for protection.

3.02 DUST CONTROL

A. Execute Work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

3.03 EROSION AND SEDIMENT CONTROL

A. Follow erosion and sediment control plan as shown on Civil Drawings.

B. If erosion and sedimentation control plans are not included, plan and execute construction by methods to control erosion and sedimentation.

C. Minimize amount of bare soil exposed at one time.

D. Provide temporary measures such as berms, dikes, and drains to control water flow.

E. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

F. Separate sedimentation from water before discharging into storm system.

3.04 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by any construction operations.

END OF SECTION

SECTION 01 55 13

TEMPORARY ACCESS ROADS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Preparation.

B. Access Roads.

C. Parking.

D. Existing Pavements and Parking Areas.

E. Permanent Pavements and Parking Facilities.

F. Maintenance.

G. Removal, Repair.

1.02 RELATED REQUIREMENTS

A. Section 01 31 13 – Project Coordination: Owner occupancy.

B. Section 01 55 26 - Traffic Control

C. Section 031 22 13 - Rough Grading.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide all weather access roads.

B. For Earthwork, Paving Base and Topping Permanent Construction: As specified.

PART 3 EXECUTION

3.01 PREPARATION

A. Clear areas, provide surface and storm drainage of premises and adjacent areas.

3.02 ACCESS ROADS

A. Construct temporary access roads from public thoroughfares to serve construction area, of a width and load-bearing capacity to provide unimpeded traffic for construction purposes.

B. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.

C. Extend and relocate as work progress requires, provide detours as necessary for unimpeded traffic flow.

D. Location approved by Architect/Owner.

E. Provide unimpeded access for emergency vehicles. Maintain 20 foot width driveways with required minimum turning space between and around combustible materials.

F. Provide and maintain access to fire hydrants and control valves, free of obstructions.

3.03 PARKING

A. Construct temporary parking areas to accommodate use by construction personnel. When site space is not adequate, provide additional off-site parking.

B. Location approved by Architect/Owner.

3.04 PERMANENT PAVEMENTS AND PARKING FACILITIES

A. Prior to Substantial Completion, sub-base for permanent roads and parking areas may be used for construction traffic. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

3.05 MAINTENANCE

A. Maintain traffic and parking areas in a sound condition.

B. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.06 REMOVAL, REPAIR

A. Remove temporary materials and construction at Substantial Completion.

B. Remove underground work and compacted materials to a depth of 2 feet, fill and grade site as specified.

C. Repair existing and permanent facilities damaged by construction usage to specified condition.

END OF SECTION

SECTION 01 55 26

TRAFFIC CONTROL

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Construction Parking Control.

B. Flagmen.

C. Flares and Lights.

D. Haul Routes.

E. Traffic Signs and Signals.

F. Removal.

G. Street Use Permits (Permits/Approvals).

1.02 RELATED REQUIREMENTS

A. Section 01 31 13 – Project Coordination: Owner occupancy.

B. Section 01 51 00 – Temporary Utilities: Barriers and enclosures.

C. Section 01 55 13 – Temporary Access Roads

PART 2 PRODUCTS

2.01 SIGNS, SIGNALS, AND DEVICES

A. Traffic Cones and Drums, Flares, Lights and Traffic Control Barriers: As approved by local jurisdictions.

B. Flagman Equipment: As required by local jurisdictions.

PART 3 EXECUTION

3.01 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, construction personnel, and Owner's operations.

B. Monitor parking of construction personnel's vehicles. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.02 FLAGMEN

A. Provide trained and equipped flagmen to regulate traffic when construction operations or traffic encroach on public right of ways.

3.03 FLARES AND LIGHTS

A. Use flares and lights during hours of low visibility to delineate traffic lanes and to guide vehicular and pedestrian traffic.

3.04 HAUL ROUTES

A. Consult with authorities, establish acceptable public thoroughfares to be used for haul routes and site access.

3.05 TRAFFIC SIGNS AND SIGNALS

A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.

B. Relocate as Work progresses, to maintain effective traffic control measures.

3.06 REMOVAL

A. Remove equipment and traffic control devices when no longer required. Repair damage caused by installation. Remove post settings to a depth of 2 feet.

END OF SECTION

SECTION 01 66 00

PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Products.

B. Transportation and Handling.

C. Storage and Protection.

D. Product Options.

E. Products List.

F. Substitutions.

G. Systems Demonstration.

1.02 RELATED REQUIREMENTS

A. Section 01 31 13 – Project Coordination

B. Section 01 33 26 – Source Quality Control Reporting: Submittal of manufacturers' certificates.

C. Section 01 77 19 – Closeout Requirements: Operation and maintenance data.

1.03 PRODUCTS

A. Products include material, equipment, and systems.

B. Comply with Specifications and referenced standards as minimum requirements.

C. Components required to be supplied in quantity within a Specification section shall be the same, and shall be interchangeable.

D. Do not use materials and equipment removed from existing structure, except as specifically required, or allowed, by Contract Documents.

1.04 TRANSPORTATION AND HANDLING

A. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry and full and ready for installation.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.

C. Promptly inspect shipments to assure that products comply with specified requirements, quantities are correct, and products are undamaged.

1.05 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.

B. For exterior storage of fabricated products, place on dry supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation or damage.

C. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

D. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

1.06 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards and specification in all ways.

B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not specifically named.

1.07 PRODUCTS LIST

A. Within Bid, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1.08 SUBSTITUTIONS

A. Throughout construction of the project the Architect and the Owner will consider requests from Contractor for substitutions of specified products. Substitutions will also be considered when a product becomes unavailable due to no fault of Contractor.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

C. Request constitutes a representation that Contractor:

1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.

2. Will provide the same warranty for substitution as for specified product.

3. Will coordinate installation of substitution and will make other changes which may be required for Work to be complete equally in all respects.

4. Waives claims for additional costs which may subsequently become apparent.

D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals without separate written request, or when acceptance will require substantial revision of Contract Documents.

E. Architect will determine acceptability of proposed substitution, and will notify Contractor of acceptance or rejection in writing within a reasonable time.

F. Only three requests for a substitution will be considered for each product. When substitution is not accepted, provide specified product.

G. Make substitution requests in a timely manner to allow proper consideration, as if a submittal per Section 013 33 23 - Submittals.

1.09 SYSTEMS DEMONSTRATION

A. Prior to final inspection, demonstrate operation of each system to Architect and Owner and project management staff.

B. Instruct Owner's personnel in operation, adjustment, and maintenance of equipment and systems, using the operation and maintenance data as the basis of instruction.

C. Supply in three-ring notebook all written materials related to the installation, maintenance and warranty of all products and services supplied on the project.

PART 2 PRODUCTS
Not Used

PART 3 EXECUTION
Not Used

END OF SECTION

SECTION 01 77 19

CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Closeout Procedures.

B. Final Cleaning.

C. Project Record Documents.

D. Operation and Maintenance Data.

E. Warranties and Bonds.

F. Spare Parts and Maintenance Materials.

1.02 RELATED REQUIREMENTS

A. Document AIA A201 - General Conditions: Fiscal provisions, legal submittals, and other administrative requirements.

B. Section 01 31 13 – Project Coordination: Allowances.

C. Section 01 51 00 – Temporary Utilities

D. Additional requirements outlined in the attached documents.

1.03 CLOSEOUT PROCEDURES

A. Comply with procedures stated in General Conditions of the Contract for issuance of Certificate of Substantial Completion.

B. Owner will occupy designated portion of Project for the purpose of conduct of business, under provision stated in Certificate of Substantial Completion.

C. When Contractor considers Work has reached final completion, submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Owner's inspection.

D. In addition to submittals required by the conditions of the Contract, provide submittals required by governing authorities, and submit a final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.

E. Architect/Owner will issue a final Change Order reflecting approved adjustments to Contract Sum not previously made by Change Order.

F. Contractor shall inspect units, do “punchlist”, complete “punch list” items, and do final cleaning prior to notifying owner that work is complete.

1.04 FINAL CLEANING

A. Execute prior to notifying owner that work is complete.

B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted surfaces. Clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment. Clean roofs, gutters, downspouts, and drainage systems.

C. Clean site; sweep and hose down paved areas, rake clean other landscaped surfaces.

D. Remove waste and surplus materials, rubbish, and construction facilities from the Project and from the site and dispose of in authorized dump facilities as required.

1.05 PROJECT RECORD DOCUMENTS

A. Store documents separate from those used for construction.

B. Keep documents current; do not permanently conceal any work until required information has been recorded.

C. At Contract closeout, submit documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.

D. Provide manufacturer's literature for supplied and installed equipment and furnishings.

E. Documents shall include as-built drawings for Architectural, Mechanical, Electrical, Irrigation and other work as required by these specifications.

F. As-built drawings of the utilities as required by the city shall be the responsibility of the contractor.

1.06 OPERATION AND MAINTENANCE DATA

A. Provide data for equipment and controls as specified in individual sections.

B. Submit two sets prior to final inspection, bound in 8-1/2 x 11 inch three-ring side binders with durable plastic covers.

C. Part 1: Directory, listing names, addresses, and telephone numbers of: Architect/Engineer, Contractor, and Subcontractor.

D. Part 2: Operation and maintenance instructions, arranged by system. For each system, give names, addresses, and telephone numbers of subcontractors and suppliers.

E. List:

1. Appropriate design criteria.

2. List of equipment.

3. Parts list.

4. Operating instructions.

5. Maintenance instructions, equipment.

6. Maintenance instructions, finishes.

7. Shop drawings and product data.

8. Warranties.

1.07 WARRANTIES AND BONDS

A. Provide duplicate, notarized copies. Execute Contractor's submittals and assemble documents executed by sub- contractors, suppliers, and manufacturers. Provide table of contents and assemble in binder with durable plastic cover. The date of substantial completion to be the start date for all warranty periods, unless otherwise agreed.

B. Submit material prior to final application for payment. For items of Work delayed materially beyond Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.08 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, and maintenance materials in quantities specified in each Section, in addition to that used for construction of Work. Coordinate with Owner, deliver to Project site and obtain receipt prior to final payment.

PART 2 PRODUCTS
Not Used

PART 3 EXECUTION
Not Used

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

1.2 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Cedarwest Apartments. Date and time to be coordinated with the owner.

1.4 INFORMATIONAL SUBMITTALS

A. Engineering Survey: Submit engineering survey of condition of building.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control, and, for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of selective demolition activities with starting and ending dates for each activity.

D. Predemolition photographs or video.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.5 CLOSEOUT SUBMITTALS

A. Inventory of items that have been removed and salvaged.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

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

1. Before selective demolition, Owner will remove the following items:

a. All personal belongings and other items not considered part of the structure.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding
with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

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

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. The architect has performed an initial field survey of condition of building prior to design. Call the architect to inspect premises again after removal of sheetrock in the work area.

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

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove or contain any refrigerant or hazardous mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

    1. Electrical Panel, water heater, wall mounted air-conditioners

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

    1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
    2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
    3. Disconnect, demolish, and remove plumbing, equipment, and components indicated on Drawings to be removed.

        a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
        b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
        c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
        d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
        e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

B. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

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

    1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
    2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
    3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
    4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

5. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition, cleaned and reinstalled in their original locations after selective demolition operations are complete.

1. Doors/frames, water heater, smoke detectors, light fixtures, per the drawings.

3.6 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

B. Do not allow demolished materials to accumulate on-site.

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

C. Burning: Do not burn demolished materials.

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

END OF SECTION

SECTION 03 11 13

STRUCTURAL CAST-IN-PLACE CONCRETE FORMING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.

B. Openings for other affected work.

C. Form accessories.

D. Stripping forms.

1.02 RELATED WORK

A. Section 03 11 13 – Galvanized Reinforcing Steel

B. Section 03 31 13 – Heavyweight Structural Concrete

1.03 SYSTEM DESCRIPTION

A. Design, engineer, and construct formwork, shoring, and bracing to meet design and code requirements, so that resultant concrete conforms to required shapes, lines, and dimensions.

1.04 QUALITY ASSURANCE

A. Construct and erect concrete formwork in accordance with ACI 301 and 347.

PART 2 PRODUCTS

2.01 FORMS

A. Construct forms with material suitable for application, in new or like new condition.

B. Form material to provide smooth even surface without gaps or indentations at joints.

2.02 FORMWORK ACCESSORIES

A. Form Ties: Snap-off metal of fixed adjustable length; cone type; free of defects that will leave holes no larger than 1-1/4 inches diameter in concrete surface.

B. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

C. Fillets for Chamfered Corners: Rigid plastic or wood type; 3/4 x 3/4 inch size; maximum possible lengths.

D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required; of strength and character to maintain formwork in place while placing concrete.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify lines, levels, and measurements before proceeding with formwork.

3.02 PREPARATION

A. Hand - trim sides and bottoms of earth forms; remove loose dirt prior to placing concrete.

B. Minimize form joints. Symmetrically align joints.

C. Arrange and assemble formwork to permit stripping, so that concrete is not damaged during its removal.

D. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

3.03 ERECTION

A. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be over-stressed by construction loads.

B. Install void forms. Protect from moisture before concrete placement. Protect from crushing during concrete placement.

C. Do not displace or damage vapor barrier placed by Section 03 31 13.

D. Construct formwork to maintain tolerances in accordance with ACI 301.

3.04 APPLICATION OF FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for work embedded in or passing through concrete.

B. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

C. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

3.06 FORM REMOVAL

A. Do not remove forms, shoring and bracing until concrete has sufficient strength to support its own weight, and construction and design loads which may be imposed upon it.

B. Reshore structural members due to design requirements or construction conditions to permit successive construction.

C. Do not damage concrete surfaces during form removal.

D. Store reusable forms for exposed architectural concrete to prevent damage to contact surfaces.

3.07 CLEANING

A. Clean forms to remove foreign matter as erection proceeds.

B. Ensure that water and debris drain to exterior through clean-out ports.

C. During cold weather, remove ice and snow from completed forms, unless formwork and construction proceed within heated enclosure. Use compressed air to remove foreign matter.

END OF SECTION

SECTION 03 21 13

REINFORCING STEEL

PART 1 GENERAL

1.01 WORK INCLUDED

A. Reinforcing steel bars, welded steel wire fabric for cast-in-place concrete.

B. Support chairs and bar supports for supporting reinforcement.

1.02 RELATED WORK

A. Section 03 11 13 – Structural Cast-In-Place Concrete Forming

B. Section 03 31 13 – Heavyweight Structural Concrete

1.03 QUALITY ASSURANCE

A. Perform concrete reinforcement work in accordance with manual or ACI "Concrete Craftsman Series".

B. Conform to ACI 301 and 315.

1.04 INSPECTIONS AND TESTS

A. Conform to the requirements of Section 01 33 26, "Testing Laboratory Services." Submit testing results under provisions of 01 33 23.

B. All work shall be subject to inspection prior to placing any concrete.

C. Furnish mill test certificates identifying chemical and physical analysis of each heat of reinforcing steel delivered.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Steel: ASTM A615, yield grade as noted on drawings, billet-steel deformed bars, uncoated finish.

B. Welded Steel Wire Fabric: ANSI/ASTM A185 plain type; in flat sheets; uncoated finish.

2.02 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gauge annealed type.

B. Chairs, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

C. Chairs, Bar Supports, Spacers Adjacent to Architectural Concrete Surfaces: Plastic coated type; sized and shaped as required.

2.03 FABRICATION

A. Fabricate in accordance with ACI 315-83 & 318-83, providing concrete cover specified in Section 03 31 13.

B. Locate reinforcing splices not indicated on Drawings at points of minimum stress.

PART 3 EXECUTION

3.01 INSTALLATION

A. Before placing concrete, clean reinforcement of foreign particles or coatings.

B. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement.

C. Do not displace or damage vapor barrier required by Section 03 31 13.

END OF SECTION

SECTION 03 31 13

HEAVYWEIGHT STRUCTURAL CONCRETE

PART 1 GENERAL

1.01 WORK INCLUDED

A. Cast-in-place concrete foundation and stub walls.

B. Floors and slabs on fill with or without vapor barrier.

C. Equipment pads, light pole bases, catch basins and manhole bases.

D. Floor Toppings.

E. Garage Floor Slabs.

1.02 RELATED WORK

A. Section 32 13 00 - Site Concrete Paving

B. Section 03 11 13 – Structural Cast-In-Place Concrete Forming

C. Section 03 21 13 – Galvanized Reinforcing Steel

D. Section 03 35 00 – Concrete Finishing

E. Section 07 13 26 – Self-Adhering Sheet Waterproofing. Preparing concrete surfaces for waterproofing.

1.03 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Obtain materials from same source throughout the Work.

1.04 TESTS

A. Testing and analysis of concrete will be performed under provisions of Section 01 33 26.

B. Submit proposed mix design to Architect for review prior to commencement of work.

C. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.

1.05 PRODUCT DATA

A. Submit product data under provisions of Section 01 33 23.

B. Provide product data for specified products.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C150, air entraining - Type I, Portland type.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: Potable.

2.02 ADMIXTURES

A. Air entrainment ASTM C260.

B. Chemical Admixtures: ASTM C494, Type A - Water reducing. All other admixtures to be approved by Architect/Engineer prior to use.

2.03 ACCESSORIES

A. Non-shrink grout: premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 7000 psi in 8 days.

B. Bonding Agent: as recommended by manufacturer.

C. Joint and Crack Filler: Latex based.

2.04 CONCRETE MIX

A. Mix concrete in accordance with ASTM C94.

B. Mix concrete to proportions shown on plans.

C. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.

D. Add air entraining agent to concrete mix for all concrete work exposed to weather or freezing temperatures.

E. Use set-retarding admixtures during hot weather only when approved by Architect/Engineer.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause hardship in placing concrete.

3.02 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's instructions.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.

B. Hot Weather Placement: ACI 605-59.

C. Cold Weather Placement: ACI 306-66.

D. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.

E. Maintain minimum concrete coverage of 2 inches around all reinforcement, or as shown on plans.

F. Place concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur.

G. Saw cut control joints in slabs as shown on the drawings.

H. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.

3.04 SEPARATE FLOOR TOPPINGS

A. Prior to placing, verify substrate is structurally sound, free of mud, oil, grease or other contaminants and is ready to receive work of this section.

B. Prior to installation, inspect the area to be poured for proper nailing of the plywood and replace any areas of plywood that have weakened or de-laminated during construction.

C. Broom sweep and vacuum clean plywood substrate to receive work of this section.

D. To prevent leakage, fill all cracks and voids in plywood.

E. Apply bonding agent on base course in accordance with manufacturer's instructions.

F. Place concrete floor toppings to required lines and levels.

3.05 FINISHING

A. Provide concrete surfaces to be left exposed with smooth rubbed finish.

B. Finish floors in accordance with Section 03 35 00.

C. Pitch to drains 1/8 inch per foot or as indicated on drawings.

3.06 PATCHING

A. After forms are removed, remove projecting fins, bolts, form ties, nails, etc. not necessary for the work. Where surface defects such as honeycomb or rock pockets occur, repair the defective areas as directed by the Architect. Joint marks and fins in exposed work shall be smoothed off and cleaned.

B. Repair defects in concrete work as per ACI-301, and as directed by the Architect/Engineer. Chip voids and stone pockets to a depth of one inch (1") or more as required to remove all loose material. Voids, surface irregularities, chipped areas, form tie notes etc. shall be filled with non shrink grout.

C. Clean exposed concrete surfaces and adjoining work stained by leakage of concrete to approval of Architect.

3.07 DEFECTIVE CONCRETE

A. Modify or replace concrete not conforming to required levels and lines, details, and elevations.

B. Repair or replace concrete not properly placed or of the specified type.

3.08 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 33 26.

B. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.09 PROTECTION

A. Protect finished work under provisions of Section 01 66 00.

B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.10 ALLOWABLE TOLERANCES

A. Forming tolerances: See Section 03 11 13, "Structural Cast in Place Concrete Forming."

B. Finishing tolerances: Unless otherwise modified herein, finish flatwork surfaces to a tolerance of 1/8" per 10' in any direction.

END OF SECTION

SECTION 03 35 00

CONCRETE FINISHING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Finish of interior floor slabs and separate floor toppings.

B. Concrete Sealer.

1.02 RELATED WORK

A. Section 03 31 13 – Heavyweight Structural Concrete: Prepared concrete surfaces ready for finishing.

1.03 QUALITY ASSURANCE

A. Applicator: Company specializing in concrete floor surface finishing with 3 years experience.

B. Furnish sealer in manufacturer's packaging with application instructions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Sealer: industrial type, clear.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify floor surfaces are acceptable for application of this work.

B. Ensure floor surfaces are depressed to accommodate finish materials.

C. Beginning of installation means acceptance of surfaces.

3.02 FLOOR FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301.

B. Uniformly spread, screed, and float concrete. Do not use grate tampers or mesh rollers.

C. Steel trowel surfaces to receive carpeting, resilient flooring, thin set quarry tile and thin set ceramic tile.

D. Steel trowel surfaces which will be left exposed.

3.03 TOLERANCES

A. Maintain surface flatness with maximum variation of 1/8 inch in 10 feet.

B. In areas of floor drains, maintain floor level at walls and slope surface uniformly to drains at 1/8 inch per foot or as indicated on Drawings.

3.04 CURING

A. Cure finish floor surfaces in accordance with ACI 301.

END OF SECTION

SECTION 04 20 00

MASONRY

PART 1 GENERAL

1.01 INCLUDED

A. Provide unit masonry and/or simulated stone work including the following:

1. CMU masonry walls per plans.
2. Face brick masonry walls per plans.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product data, installation instructions, and mortar mix design.

B. Samples: Submit manufacturer's brick samples showing available colors, textures and finishes.

1. Texture, color and uniformity of all bricks shall be approved by the Architect.

C. Mock-Up: Install 6 ft. by 6 ft. minimum area of finished face brick wall including back-up system complete, in place for approval. Accepted mock-up may remain in place. Include typical stacked bond course and other bonding patterns shown in the drawings.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations.

B. Fire Performance for Fire-Rated Assemblies: ASTM E119.

C. Testing: Independent Testing Laboratory.

D. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Provide all exposed masonry units from a single manufacturer.

E. Use experienced installers.

F. Deliver, handle and store materials in accordance with manufacturer's instructions.

1.04 PROJECT CONDITIONS

A. Cold Weather Protection:

1. Do not lay masonry units/simulated stone which are wet or frozen.

2. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.

3. Remove all masonry determined to be damaged by freezing conditions.

B. Perform the following construction procedures while masonry work is progressing. Temperature indicated below apply to air temperatures existing at time of installation. In heating mortar and grout materials, maintain mixing temperature selected within 10°F.

1. 40°F to 32°F: Heating mixing water to produce mortar temperature between 70°F and 160°F.

2. 32°F to 25°F: Heat mixing water and sand to produce mortar temperatures between 70°F and 160°F; maintain temperature of mortar on boards above freezing. Do not scorch sand.

3. Do not install mortar at below 25°F without permission of the Owner/Contractor. When authorized to install masonry below 25°F, follow recommendations of the BIA Recommended practices for Cold Weather Masonry Construction.

C. Protect completed masonry and masonry not being worked on. Temperature ranges indicated apply to mean daily air temperatures.

1. 40°F to 32°F: Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.

2. 32°F to 20°F: Completely cover masonry with weather-resistive insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.

D. Store metal reinforcement in weatherproof enclosure.

PART 2 PRODUCTS

2.01 CMU & FACE BRICK MASONRY

A. CMU: Provide CMU masonry walls having the following characteristics:

1. CMU: Per plans

2. Unit Compressive Strength: Minimum 3,000 psi.

3. Shapes: Provide special shaped units for conditions which require shapes that cannot be cut from standard brick. Never expose cores or unfinished surfaces.

B. Face Brick: Provide face brick masonry walls having the following characteristics

1. Face Brick: Per plans

2. Unit Compressive Strength: Per plans

3. Shapes: Provide special shaped units for conditions which require shapes that cannot be cut from standard brick. Never expose cores or unfinished surfaces.

2.02 MORTAR MATERIALS

A. Portland Cement: Complying with ASTM C150, Type I, free from water soluble salts and alkalies. Provide cement that exhibits no efflorescence when tested in conformance with standard efflorescence test, ASTM C67, modified to use 2” x 7” x 2 1/2” mortar samples consisting of a mixture of 1 part by weight of cement under test and 2 parts sand mixed to a flow of 100% with water. Provide cement color as necessary to provide mortar color matching existing as acceptable to Architect.

B. Lime: ASTM C207, hydrated, type S.

C. Grout Aggregate: Complying with ASTM C144, well graded.

D. Mortar Pigment: Natural and synthetic oxides of iron and chrome, compounded for use in mortar. Use only pigments with proven record of satisfactory performance. Davis Colors and Solomon Grind-Chem pigments are acceptable products.

E. Water: Clean and potable.

2.03 REINFORCING TIES, ANCHORS, LINTELS AND CONNECTIONS

A. Provide reinforcing, ties, anchors, and connections as shown on drawings.

B. Corrosion Resistance:

1. Anchors to be AISI Type 304 or Type 316 stainless steel in accordance with ASTM A167.

2. Reinforcing ties, lintels and connectors to be hot-dipped galvanized in accordance with ASTM A153 or ASTM A123.

2.04 MISCELLANEOUS MATERIALS

A. Bond Breaker: 15 lb. roofing felt complying with ASTM D226 or ASTM D227.

B. Control Joints: Solid rubber strips with Shore A hardness of 60 to 80 and designed to fit standard control joint concrete masonry units and maintain the lateral stability of the wall.

C. “Mortar Net” to be installed at bottom of all cavities.

D. Flexible Sheet Membrane Flashing:

1. 40 mils. thick self-adhered SBS rubberized membrane with cross laminated polyethylene film. Acceptable Products:

a. Grace Perm-A-Barrier Wall Flashing.
b. Henry Blueskin TWF.

2.05 MORTAR AND GROUT MIXES

A. Mortar: Provide mortar complying with ASTM C270 property specifications. When mixing, use known volume measures; do not batch by shovel. Provide 1:1:6 mortar mix (for Type N) as approved.

1. Provide Type N mortar for exterior masonry above grade and interior non-load bearing partitions.

2. Provide Type S mortar for reinforced and load bearing masonry, for masonry below grade and in contact with earth and elsewhere as indicated. Refer to the Structural Drawings for additional requirements.

B. Grout: Provide grout complying with ASTM C476 and with consistency appropriate to conditions so that grout will completely fill all spaces intended to receive grout.

C. Do not use admixtures or anti-freeze agents. Do not use masonry cement. Do not use calcium chloride or any compounds or mortar ingredients containing chlorides. Do not retemper mortar.

D. Color: Provide mortar with color to match existing as acceptable to Architect. Do not exceed pigment to mortar ratio of 1:10.

2.06 CLEANING MATERIALS

A. Provide chemical cleaning products, SureKlean 600 by ProSoCo Inc. or approved equal.

2.07 PENETRATING WATER REPELLANTS

A. Provide 2 coats of Silane/Siloxane water repellant to surface of brick, per manufacturer's instructions.

B. Silane Products:

1. Anti-Hydro International, Inc; "Arisox 40m".

2. Sonneborn Building Products; White Rox 10 VOC.

3. Wacker Chemical Corp.; 1316.

C. Silane/Siloxane-Blend products:

1. Chempropbe Coating Systems, LP; Deck A Pell 15%.

2. Seal-Krete, Inc; Silane/Siloxane Water Repellant.

3. Sonneborn Building Products; White Roc 10 VOC.

4. Wacker Chemical Corp; OH 100.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine substrates, areas and conditions for compliance with requirements for installation tolerances and other conditions affecting installation and performance of masonry system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION - GENERAL

A. Strictly comply with industry standards and recommendations of Brick Institute of America, National Concrete Masonry Association, and Prestressed Concrete Institute, except where more restrictive requirements are specified in this section. Beginning work means Installer accepts substrates and conditions.

1. Remodel existing masonry walls as required for new construction.

2. Allow sufficient setting time for mortar so that weight of work above does not cause lower work to bulge or creep prior to full set of mortar.

3. Remove and replace with matching brick any spalled or otherwise damaged face brick.

4. Simulated stone is to be installed per manufacturer recommendations.

B. For unit masonry, lay masonry with ½" wide joints in bonds indicated. For running bond, lay masonry with each vertical joint centered over masonry unit in next lower course, except where indicated otherwise. Provide expansion, control and isolation joints in masonry work where shown, or if not shown, at locations approved by Architect.

C. Tool joints concave as work proceeds in accordance with Architect's approved joint. Compress mortar to form a dense, smooth weathertight surface. Rake out mortar where sealants are shown to be installed.

D. Lay masonry plumb and level with full bed and head joints, fully buttered and shoved into place. Do not slush joints. Keep cavity walls completely clear and free from projections and obstructions. Strike joints facing cavity flush. Prevent loose mortar from dropping into cavity.

E. Remove, clean and reset with fresh mortar all masonry units that are disturbed after laying.

F. Provide open head joints at every third head joint immediately above all flashings, at bottom of brick cavity, and ledges. Fill cavity solid with mortar below grade as indicated.

G. Cut masonry units with power saw designed for cutting masonry with sharp, unchipped edges. Cut masonry to form special shapes as indicated. Where special shapes cannot be cut or formed without exposing coring or frogging, provide custom-made special shaped units. No cut ends shall be exposed.

H. Install work with random color variations with no groups of lighter or darker units. Take masonry units from stacks randomly to avoid noticeable color variations. Work without random color variation, in the opinion of the Architect, will be rejected.

I. Lay out walls in advance for accurate spacing, uniform joint widths, and accurate bond pattern. Avoid the use of less-than-half size units. Review layout with Architect prior to proceeding. Architect reserves the right to reject work if layout is not as indicated.

J. Where work is interrupted, do not tooth masonry. Cut back one-half unit in each higher course.

K. Leave openings for other materials and equipment as necessary. Complete masonry work after installation of other work. Build in other work as masonry work progresses to the greatest extent possible.

L. Grout units wherever shown and at all reinforcing, masonry lintels, bond beams, jambs and bearing points. At bearing points, fully grout concrete masonry for two full courses immediately below bearing point. Fully grout metal frames built into masonry work.

M. For non-load-bearing work allow for deflection between top of walls and structure above. Maintain lateral stability in a manner acceptable to Architect and authorities having jurisdiction. Provide compressible fillers and joint sealers to maintain acoustical performance of wall assembly.

N. Place "Mortarnet" at the bottom of all cavities.

3.03 DAMPROOFING BEHIND BRICK

A. Vapor permeable membrane: Air Bloc 07 as manufactured by Henry, a one component elastomeric bitumen, trowel applied, spray or trowel applied to a wet film thickness of 120 and having the following characteristics:

1. Air Permeability: 0.0108 CFM/sq. ft. @ 1.6lbs/sq. ft. to ASTM E283 with no increased air leakage when subjected to a sustainable wind load of 20.9 lbs/sq. ft. for 1 hour and gustwind load pressure of 62 lbs/sq.ft. maintained for 10 seconds with no delamination.

2. Water Vapor Permeance: 7 perms to ASTM E96 Method E.

3. Long term flexibility to: Pass to CGSB 71-GP-24M.

B. Transition Membrane: Refer to Section 07551 – Self-Adhered Bituminous Membrane.

3.04 REINFORCING, TIE AND ANCHOR INSTALLATION

A. Provide reinforcing, seismic ties (ties) and anchors for all work using the appropriate detailed or specified type for each condition. Ensure sufficient anchorage of brick wythe to concrete back-up material to ensure deflection not to exceed L/600.

B. Space wall ties to comply with codes and manufacturer's recommendations. Provide ties 2' on center vertically and 16" on center horizontally. Do not space more than 2' o.c. vertically and horizontally. Provide ties within 12" of wall openings and within 24" of wall perimeters and corners. Anchor ties securely to structural framing. Ties shall be fastened to metal stud back-up and not be fastened to sheathing only.

C. Confirm with manufacturer of ties and anchors that tie spacing for cavity depth does not exceed slenderness ratio of wire.

D. For horizontal joint reinforcing, provide continuous joint reinforcing spaced not more than 16" o.c. vertically, except space reinforcing at 8" o.c. at tops of walls, and 8" o.c. immediately above and below openings and extend this reinforcing at least 2" beyond each jamb. Overlap joints in wire ladder reinforcing at least 6". Splice reinforcing bars as scheduled or detailed. Do not bridge expansion and control joints, if any. Provide preformed corners and tees.

3.05 LINTEL INSTALLATION

A. Install loose metal lintels where shown and elsewhere as needed. Coordinate with requirements of structural drawings.

B. Provide weep holes 24 in. o.c. above lintels in cavity wall construction.

C. Vertical leg of loose angle lintels shall be installed tight against sheathing material with flashing overlapping angle leg directing water above the lintel to the exterior.

3.06 FLASHING INSTALLATION AND COORDINATION

A. Prepare masonry surfaces to receive flashings smooth and free of projections. Place through-wall metal flashings on heavy bed of dampproofing mastic. Make sure that flashings are compatible with mastic used. Make sure that flashings are sealed and undamaged before covering with mortar.

B. Provide flashing at every obstruction to the downward flow of water and where shown on the drawings. Fabricate and install flashing to control and divert water to the exterior. Form at least 8" high flashing above lintels and similar conditions to extend the entire length of the lintel. All flashing terminations shall have end dams. Extend flashing a minimum of 4" beyond the end of lintel and form end dams a minimum of 2" in height.

1. Provide jam flashing at all items in masonry walls including curtainwall, doors and similar items.

C. Coordinate and install reglets where indicated and where needed.

3.07 FORM REMOVAL

A. Do not remove forms, shoring and bracing until concrete has sufficient strength to support its own weight, and construction and design loads which may be imposed upon it.

B. Reshore structural members due to design requirements or construction conditions to permit successive construction.

C. Do not damage concrete surfaces during form removal.

D. Store reusable forms for exposed architectural concrete to prevent damage to contact surfaces.

3.08 TOLERANCES

A. The following allowable installed tolerances are allowable variations from locations and dimensions indicated by the Contract Document and shall not be added to allowable tolerances indicated for other work.

1. Allowable Variation from True Plumb, Level and Line: ±1/8” in 20’-0”. 2. Allowable Variation from True Wall Thickness: ±1/8”.

2. Allowable Variation from True Plane of Adjacent Surfaces: ±1/16” in 10’0”.

3.09 REPAIRING, CLEANING AND PROTECTION

A. Remove and replace work that is loose, chipped, broken or otherwise damaged. Eliminate all evidence of repair. Enlarge voids and holes in mortar joints and point with mortar to exactly match sound adjacent mortar.

B. Clean exposed surfaces by dry brushing at the end of each day’s work. Comply with recommendations of NCMA TEK Bulletin No. 28. Remove and replace work that cannot be successfully cleaned. Demonstrate cleaning technique on sample panel and obtain Architect’s approval before beginning cleaning work.

C. Refer to Section 09900 – Painting for specified sealers.

END OF SECTION

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.01 WORK INCLUDED

A. Structural floor, wall, and roof framing.

B. Wall and roof sheathing.

C. Subfloor sheathing and overlay.

D. Soffits.

E. Wood blocking within walls as indicated on drawings, and, as required for specified work.

1.02 RELATED WORK

A. Section 03 31 13 – Heavyweight Structural Concrete: Setting anchors.

B. Section 06 17 53 – Shop Fabricated Wood Trusses

C. Section 07 21 16 – Blanket Insulation

D. Section 07 27 19 – Plastic Sheet Air Barriers

E. Section 07 46 46 – Mineral Fiber Cement Siding

F. Section 09 21 16 – Gypsum Board Assemblies

1.03 QUALITY ASSURANCE

A. Lumber Grading Agency: Certified by WCLIB.

B. Plywood Grading Agency: Certified by APA.

1.04 REGULATORY REQUIREMENTS

A. All lumber and sheathing materials must have grade stamp.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store and protect products under provisions of Section 01 66 00.

PART 2 PRODUCTS

2.01 LUMBER MATERIALS

A. Lumber Grading Rules: WWPA.

B. Lumber materials as indicated on Drawings.

2.02 PLYWOOD MATERIALS

A. Plywood materials as indicated on Drawings.

2.03 SHEATHING

A. Wall Sheathing:

1. Plywood: Per Structural documents.

2. Oriented-Strand Board: Per Structural documents.

3. Paper-Surfaced Gypsum: ASTM C79/C79MM, water-resistant core.

4. Glass-Mat Gypsum: ASTM C1177/C1177M.

2.04 ACCESSORIES

A. Fasteners: Size and type to suit condition.

B. Connectors: Sized to suit conditions; manufactured by Simpson.

C. Joist Hangers: Galvanized steel, sized to suit joists and framing conditions; manufactured by Simpson.

D. Anchors: Expansion bolt type for anchorage to solid masonry or concrete. Connection bolts shall be ASTM A-307, anchor bolts shall be ASTM A-307.

E. Subfloor Glue: Waterproof, air cure type, cartridge dispensed.

F. Drywall Screws: Bugle head, steel, power driven type length of three times thickness of sheathing.

2.05 WOOD TREATMENT

A. Wood Preservative (Pressure Treatment): AWPA Borate Treatment C2 using water borne preservative with 0.03 percent retainage.

PART 3 EXECUTION

3.01 FRAMING

A. Erect wood framing members level and plumb.

B. Place horizontal members laid flat, crown side-up.

END OF SECTION

SECTION 06 17 53

SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Prefabricated wood trusses for roof framing.

B. Bridging, bracing, and anchorage.

1.02 RELATED WORK

A. Section 06 10 53 – Miscellaneous Rough Carpentry

B. Section 07 21 16 – Blanket Insulation

1.03 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture of prefabricated wood trusses with three years minimum experience.

B. Design trusses under direct supervision of Professional Structural Engineer experienced in structural framing design of trusses registered in State of Washington.

C. Lumber Grading Agency: Certified by WWPA.

D. Truss Plates: In accordance with Truss Plate Institute, TPI-78.

1.04 REGULATORY REQUIREMENTS

A. Conform to International Building code 2006 edition for loads, seismic zoning, and other governing load criteria.

B. Conform to UL & TPI requirements to achieve rating indicated.

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 33 23. Supply structural engineering stamp with shop drawings.

B. Indicate framing system, sizes and spacing of trusses, loads and joist cambers, bearing and anchor details, bridging and bracing and framed openings. Submit design calculations.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01 66 00.

B. Store and protect products under provisions of Section 01 66 00.

C. Transport and store trusses in a properly supported manner so as not to side bend truss connections.

D. Protect trusses from moisture, warpage, and distortion during transit and when stored.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Lumbermans.

B. Northwest Building Components.

C. Valley Bestway.

D. CDA Building Supply.

E. The Truss Co. Inc.

F. Truss Components

G. Truss Tek

H. Interframe Components

I. Evergreen Lumber

J. Approved Alternate

2.02 MATERIALS

A. Lumber Grading Rules: WWPA.

B. Steel Connectors: ASTM A446 steel, Grade A; galvanized; die stamped with integral teeth, minimum 20 gauge.

2.03 FABRICATION

A. Verify dimensions and site conditions prior to fabrication.

B. Cut members accurately to length to achieve tight joint connections.

C. Jig trusses during fabrication to assure accurate configuration. Press connectors into lumber, both sides of joint simultaneously.

D. Build camber into truss.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify that supports and openings are ready to receive trusses.

B. Verify sufficient end bearing area.

C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Coordinate placement of bearing and support items.

3.03 INSTALLATION

A. Install trusses in accordance with manufacturer's instructions.

B. Place trusses true to line and level.

C. Provide temporary bracing to hold trusses in place until permanently secured.

D. Place permanent bridging, bracing, and anchors to maintain trusses straight and in correct position before inducing loads.

E. Do not field cut trusses.

F. Place headers and supports to frame openings required.

3.04 TOLERANCES

A. Framing Members: 1/4 inch maximum from true position.

END OF SECTION

SECTION 06 41 13

WOOD-VENEER-FACED ARCHITECTURAL CABINETS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Production manufactured casework including hardware.

B. Pre-finished surfaces.

C. Kitchen cabinets and bathroom vanities.

D. Countertops and Backsplashes.

1.02 RELATED WORK

A. Section 06 10 53 – Miscellaneous Rough Carpentry: Grounds and support framing.

B. Section 06 20 23 – Interior Finish Carpentry

C. Section 07 92 00 – Joint Sealants

1.03 SUBMITTALS

A. Submit product data and shop drawings under provisions of Section 01 33 23.

B. Include layouts, components, dimensions, profiles, finishes, and hardware.

C. Submit manufacturer's installation instructions under provisions of Section 01 33 26.

D. Submit samples under provisions of Section 01 33 23.

E. Submit two samples 12 x 24 inches in size illustrating finishes, colors, trim.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS CABINETS AND TOPS

A. Lanz cabinets.

B. Armstrong.

C. Select Euro Systems.

D. Central Cabinet Systems

E. Approved Alternate

2.02 MATERIALS

A. Cabinet Construction: Softwood lumber and plywood or particle board gables and backing.

B. Doors and Drawer Fronts: Full overlay - euro-style frameless.

C. Countertops and Ledges: Solid surface product with 4” backsplash. Eased edges.

2.03 HARDWARE

A. Shelf Standards and Clips, Drawer Guides, Spring-loaded Door Hinges, Catches, Door and Drawer Handles: Manufacturer's standard type, color approved by Architect/Owner.

2.04 ACCESSORIES

A. Adhesive: Type to suit application.

2.05 FABRICATION

A. Fabricate casework to ensure durable and rigid unit and to permit plumb and level site installation.

B. Align adjoining units for site assembly modules, to achieve tight hairline joints.

C. Prepare units with anchor devices to permit ease of site assembly.

D. Prepare countertops with joint devices to ensure hairline site joints.

E. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges.

F. All bath vanities shall have one drawer minimum.

G. All cabinets to be KCMA certified. The KCMA sticker is to be attached to all cabinets.

2.06 FINISHES

A. Sand work smooth and set exposed fasteners. Apply wood filler in exposed fastener indentations.

B. Finish all exposed exterior and interior surfaces.

C. Seal internal surfaces of cabinets with one coat of shellac.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify existing surfaces are ready to receive work of this section. Beginning of installation means acceptance of existing substrate.

3.02 INSTALLATION

A. Set and secure casework in place rigid, plumb, and level.

B. Use purpose designed fixture attachments for wall mounted components.

C. Permanently fix cabinet and counter bases to floor using appropriate angles and anchorages.

D. Carefully scribe casework which abuts other building materials, leaving gaps of 1/32 inch maximum.

E. Scribe strips not to exceed cover caps in excess of 1/2 inch.

F. Spread adhesive to smooth level surface, and firmly attach plastic laminate wainscot, and tub surrounds.

G. Remove all excess adhesive from surrounding walls and tub.

END OF SECTION

SECTION 07 13 26

SELF-ADHERING SHEET WATERPROOFING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Horizontal waterproofing at decks and breezeways.

B. Protective covering.

1.02 RELATED WORK

A. Section 31 23 23.13 - Backfill

B. Section 03 31 13 – Heavyweight Structural Concrete

C. Section 07 21 13 - Board Insulation: Perimeter insulation.

D. Section 07 62 00 - Sheet Metal Flashing and Trim: Counter flashings.

1.03 SYSTEM DESCRIPTION

A. Waterproofing System: Prevent moisture migration to interior.

1.04 QUALITY ASSURANCE

A. Applicator: Company specializing in bituminous waterproofing systems with 5 years minimum experience.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperatures above 40 degrees F for 24 hours before application and continuously until waterproofing membrane has cured.

B. Provide ventilation when waterproofing in an enclosed space.

1.06 WARRANTY

A. Provide five year warranty under provisions of Section 01 77 19.

B. Warranty: Include coverage of waterproofing failing to resist penetration of water.

C. Be responsible for removal and replacement of materials concealing waterproofing.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Protecto Wrap

B. Polyglass

C. EPRO

D. Approved Alternate

2.02 PRODUCTS

A. Protecto Wrap- Jiffy Seal 140/60

B. Polyglas- Polystick

C. Flexible/Metal Flashings: Per manufacturer’s recommendations.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify surfaces are solid, free of frozen matter, loose particles, cracks, pits, rough projections, and foreign matter detrimental to adhesion and application of waterproofing.

B. Do not apply waterproofing to damp, frozen, dirty, dusty, or deck surfaces unacceptable to manufacturer.

C. Verify items which penetrate surfaces to receive waterproofing are securely installed.

D. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

B. Apply mastic to seal penetrations, small cracks, and honeycomb in substrate.

3.03 APPLICATION

A. Conform to manufacturer's instructions.

B. Prime surfaces in accordance with manufacturer's instructions. Permit primer to dry.

C. Install cant strips in internal corners.

D. Extend membrane over cants and six inches above horizontal surfaces at membrane perimeter.

E. Use flexible or metal flashing on all horizontal/vertical intersections.

F. Terminate top edge of membrane under counterflashing, seal with mastic. Coordinate with metal flashing installation.

G. Seal protrusions through membrane with multiple plies, flood coating, mastic. Seal watertight.

3.04 FIELD QUALITY CONTROL

A. Provide manufacturer's representative for observation of the application of waterproofing. Manufacturer's representatives to fill out field reports on application of work.

3.05 PROTECTION

A. Protect finished membrane from damage.

END OF SECTION

SECTION 07 14 16

COLD FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Liquid below grade waterproofing at daylight basement foundations.

B. Surface dusting and protective covering.

1.02 RELATED WORK

A. Section 06 10 53 – Miscellaneous Rough Framing

B. Section 07 62 00 – Sheet Metal Flashing and Trim: Metal counter flashing work.

1.03 SYSTEM DESCRIPTION

A. Waterproofing System: Prevent moisture migration to interior.

1.04 WARRANTY

A. Provide ten year warranty under provisions of Section 01 77 19.

B. Warranty: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Deco 20

B. Tremco Watchdog H3

C. Approved Alternate

2.02 MEMBRANE MATERIAL

A. Waterproofing Membrane: ASTM C836; two component elastomeric compound; cold applied, quick setting.

2.03 ACCESSORIES

A. Protection Board: As recommended by manufacturer

B. Elastic Flashings: As recommended by membrane manufacturer.

C. Joint Cover Sheet: Elastic sheet material designed for and compatible with membrane.

D. Joint and Crack Sealant: As recommended by membrane manufacturer.

E. Back-up Material: PVC membrane or other suitable support material.

2.04 PROTECTIVE MATERIALS

A. Tack-free Surfacer: Stone dust.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify surfaces are solid, free of frozen matter, loose particles, cracks, pits, rough projections, and foreign matter detrimental to adhesion and application of waterproofing.

B. Do not apply waterproofing to damp, frozen, dirty, dusty, or deck surfaces unacceptable to manufacturer.

C. Verify items which penetrate surfaces to receive waterproofing are securely installed.

D. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

A. Clean and prepare surfaces to receive waterproofing, in accordance with manufacturer's instructions.

B. Apply mastic to seal penetrations, small cracks, and honeycomb in substrate.

C. Protect adjacent surfaces not designated to receive waterproofing.

D. Apply surface conditioner. Protect surface conditioner from rain or frost until dry.

E. Apply 12 inch wide strip of joint cover sheet over cracks, non-working joints, and expansion joints over 1/16 inch but not exceeding 1/2 inch in width.

F. At expansion joints from 1/2 to one inch in width, loop cover sheet down into joint between 1-1/4 and 1-3/4 inch. Extend sheet 6 inches on either side of expansion joint.

G. Verify that metal flashing is in place at all horizontal/vertical connections.

H. Verify that all decks slope 1/8 inch per foot from building. Puddling or ponding on decks is not allowed.

3.03 APPLICATION

A. Apply membrane in accordance with manufacturer's instructions. Seams, flashing and nail/screw heads shall not telegraph though membrane.

B. Refer to drawings for locations and details which apply for application of membrane

C. Continue membrane up vertical surfaces minimum 6 inches.

D. Seal items projecting through membrane.

E. Install membrane flashings and seal into membrane.

F. Reinforce membrane over static or moving joints.

3.04 FIELD QUALITY CONTROL

A. Provide manufacturer's representative for observation of the application of waterproofing. Manufacturer's representative to fill out field reports on application of work.

END OF SECTION

SECTION 07 21 13

BOARD INSULATION

PART 1 GENERAL

1.01 WORK INCLUDED

A. Board insulation at perimeter below grade walls and underside of floor slabs (24" verticle).

1.02 RELATED WORK

A. Section 07 13 26 – Self Adhering Sheet Waterproofing: Rigid insulation over membrane waterproofing.

1.03 SYSTEM DESCRIPTION

A. Materials of this Section shall provide a continuous thermal, barrier at building enclosure elements.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

A. Insulation: Type A: FS HH-I-524, Type 1 molded bead polystyrene; square edges of thickness as indicated.

B. Insulation: Type B: FS HH-I-530, Type 1, Style A closed cell polyisocyanurate; factory applied skin of aluminum foil on one face; square edges; thickness as indicated on Drawings.

2.02 ADHESIVE MATERIALS

A. Adhesive: Type recommended by insulation manufacturer for application.

2.03 ACCESSORIES

A. Nails or Staples: Type and size to suit application.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify substrate and adjacent materials and insulation boards are dry and ready to receive insulation.

B. Verify substrate surface is flat, free of honeycombs fins and irregularities.

C. Verify insulation boards are unbroken, free of damage, with face membrane undamaged.

3.02 INSTALLATION - FOUNDATION PERIMETER

A. Install boards on foundation wall perimeter. Place boards in a method to maximize contact bedding. Stagger side joints. Butt edges and ends tight to adjacent board and to protrusions.

3.03 INSTALLATION - UNDER CONCRETE SLABS

A. Prevent insulation from being displaced or damaged while placing slab.

3.04 SCHEDULE

A. Per Drawings

END OF SECTION

SECTION 07 21 16

BLANKET INSULATION

PART 1 GENERAL

1.01 WORK INCLUDED

A. Insulation in exterior wall, party wall, ceiling and roof construction.

B. Insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof assemblies.

1.02 RELATED WORK

A. Section 06 10 53 – Miscellaneous Rough Carpentry: Supportive Construction.

1.03 SYSTEM DESCRIPTION

A. Materials of this Section shall provide a thermal barrier at building enclosure elements and sound barrier for plumbing and party walls.

PART 2 PRODUCTS

2.01 MATERIALS

A. Batt/Blanket Insulation:

1. Provide commercial glass fiber insulation, unfaced.

2. Sound Insulation Blanket/Unrated: Provide commercial glass fiber insulation, unfaced. Provide full stud thickness unless indicated otherwise.

B. Blown-in Insulation:

1. Provide loose-fill fiber glass cellulose insulation.

C. Safing Insulation and Smoke Barrier:

1. Safing Insulation/Where Rating Required: U.S. Gypsum "Thermafiber" safing insulation in thicknesses, widths, and lengths needed to get hourly rating required per code. Provide galvanized steel safing clips.

2. Smoke Barrier: U.S. Gypsum "Thermafiber" Smoke Seal, flameproof, smoke-resistant.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify adjacent materials are dry and ready to receive installation.

B. Verify mechanical and electrical services within walls have been installed and tested.

3.02 INSTALLATION

A. Install insulation, in exterior walls, roof and ceiling spaces without gaps or voids in accordance with manufacturers' instructions.

B. Trim insulation neatly to fit spaces. Use batts free of damage.

C. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.

D. Install insulation with factory applied membrane facing warm side of building spaces. Lap ends and side flanges of membrane between framing members. Staple or nail in place at maximum 6 inches. Tape seal butt ends and lapped side flanges. Tape seal tears or cuts in membrane.

E. Blow in attic space insulation evenly, and without obstructing the gable end vents and vent dampers.

END OF SECTION

SECTION 07 27 19

PLASTIC SHEET AIR BARRIERS

PART 1 GENERAL

1.01 INCLUDED

A. Application of weather resistant air/moisture barrier (WRB) membrane behind exterior finish.

1.02 RELATED WORK

A. Section 06 10 53 – Miscellaneous Rough Carpentry

B. Section 07 46 46 – Mineral Fiber Cement Siding

C. Section 07 62 00 – Sheet Metal Flashing and Trim.

D. Section 08 14 23 – Wood Doors.

E. Section 08 53 13 – Vinyl Windows Windows.

1.03 DELIVERY, HANDLING AND STORAGE

A. Deliver and store materials in original wrappings and containers.

B. Protect from damage per manufacturer's instructions. Provide and maintain dry, weatherproof, storage.

1.04 QUALITY ASSURANCE

A. Subcontractor involved in the work of this section must be approved by WRB manufacturer.

PART 2 PRODUCTS

2.01 SHEATHING MEMBRANE

A. Green Guard Rain Drop 20 Mil Building Wrap

B. Approved Equal

C. Size: Manufacturer's standard sizes to minimize seams and joints in the installed assemblies.

2.02 MISCELLANEOUS MATERIALS

A. Sealing tape: Tape as required by wrap manufacturer.

B. Sealant: See Section 07 92 00 – Joint Sealants.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Examine the substrates to receive the work of this section. Report or correct any and all observed deficiencies which may not be corrected after the work or which

may adversely affect the performance or appearance of the work of this section.

B. Proceeding with the work indicates acceptance of all conditions affecting the work.

C. Sequence work to permit installation of materials in conjunction with related materials and seals.

3.02 SHEATHING MEMBRANE

A. Minimize the use of staples. Use staples only as required to secure the sheathing membrane until wood furring is installed. Where practical, install staples at locations that are to be covered by wood furring.

B. Install sheathing membrane horizontally beginning 2 inches below the lowest point of the framed wall assembly.

C. Install successive strips, proceeding upwards with each succeeding sheet overlapping the sheet below.

D. Cut sheathing membrane into suitable widths to allow for the proper integration and lapping of successive courses.

E. Horizontal laps per manufacturer's recommendation.

F. Vertical laps shall be made where required by overlapping sheets not less than 6 inches.

G. Repair small damaged areas of building wrap per manufacturer's recommendation:

1. Applying self-adhering bituminous membrane primer to the affected area as specified elsewhere in these specifications.

H. Ensure that lapping rules are followed at all locations and around all intersections of building elements and at all penetrations and openings.

I. Do not permit adjacent work to damage work of this section.

3.03 AIR-BARRIER CONTINUITY

A. Ensure continuity of air-barrier at all locations including but not limited to:

1. Windows, doors, and miscellaneous glazing.

2. Electrical components, mechanical services and all vents.

3. Joist spaces and intersecting walls.

4. Interface with roof membranes and foundation elements.

B. Ensure sheathing membranes and adjacent building elements are clean and free of any deleterious matter which may adversely affect the bond to associated tapes and self-adhered membranes.

C. Tape all horizontal and vertical laps of sheathing membrane. Apply tape to achieve continuous, positive, permanent adhesion to sheathing membrane with no wrinkles or "fish-mouths".

D. Tie-in sheathing membrane to adjacent building elements, penetrations and openings with self- adhered membrane as specified elsewhere in these specifications and as shown on

the drawings except as noted.

END OF SECTION

SECTION 07 46 46

MINERAL FIBER CEMENT SIDING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Installation of new fiber reinforced cement cladding system, trim and accessories as required by the Work. Includes Nichiha fiber cement faux stone.

B. Related Sections:

1. Section 09 91 00 – Painting.

1.02 SUBMITTALS

A. Submit 12 inch length samples of all types of fiber reinforced cement panel cladding and profile as indicated herein, as well as samples of all related accessories and fasteners.

B. Submit, from manufacturer, fastening patterns to meet or exceed that required to resist the specified wind load for Exposure “B” Basic Wind Speed of 85 mph.

1.03 DELIVERY, HANDLING AND STORAGE

A. Deliver and store materials in original wrappings and containers with manufacturer’s seals, labels and batch/serial numbers intact and legible.

B. Stack materials on edge or lay flat on a smooth, level surface. Protect edges and corners from chipping.

C. Store materials under cover and keep dry prior to handling.

D. In the event of materials damaged by the elements, improper handling or other causes, such material will be rejected and shall be replaced at not extra cost to the Owner. Remove rejected promptly from the site.

1.04 QUALITY ASSURANCE

A. Installer/Tradesmen involved in the work of this section must have a minimum of 3 years documented experience of having regularly undertaken the type of work as outlined herein.

PART 2 PRODUCTS

2.01 FIBER-CEMENT SIDING

A. Approved manufacturer: Nichiha

B. Materials to be pre-primed with field-applied finish coat.

C. Alternate to provide pre-finished siding.

D. Trim/Soffits/Fascia: Per plans.

PART 3 EXECUTION

3.01 ACCESSORIES

A. Install trim and siding using longest practical lengths, straight, true and plumb.

B. Use all proper accessories for outlets, penetrations, etc.

3.02 PANEL INSTALLATION

A. Workmanship shall be the best quality, executed by workers experienced and skilled in their respective duties for which they are employed.

B. Conceal fasteners whenever possible.

C. The fiber-cement siding and accessories shall be installed in accordance with the latest edition of manufacturer's printed application instructions.

D. At all openings and stops, a minimum 1/8" gap shall be provided for expansion and contraction as per manufacturer's instruction.

E. Seams:

1. Seams to be staggered per manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

A. After installation of siding, check installation entire surface for obvious flaws or defects. Replace and repair any problem areas as required or directed by the Consultant.

B. After the siding has been applied, clean as necessary to remove all fingerprints and soiled areas.

C. Under completion of the project, clean siding in accordance with manufacturer's printed instructions.

END OF SECTION

SECTION 07 54 00

THERMOPLASTIC-POLYOLEFIN ROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Mechanically fastened membrane roofing system.

2. Roof insulation

B. Related Sections include the following:

1. Division 05 Section "Steel Decking" for furnishing acoustical deck rib insulation.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 “Terminology Relating to Roofing and Waterproofing”; glossary of NRCA's "The NRCA Roofing and Waterproofing Manual"; and the Roof Consultants Institute “Glossary of Roofing Terms” for definition of terms related to roofing work in this Section.

B. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and Flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Jobsite Safety: Execute all operations and provide a safe work environment in accordance to OSHA standards and regulations. This requirement applies to all contractor personnel, associated subcontractors, workers in other trades, and jobsite visitors.

1. Follow all industry fire prevention guidelines for storage of materials, staging areas, roof access, and application means and methods.
2. Any applicable local fire codes supersede industry guidelines.

D. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.

1. Basic Wind Speed: 90 mph.

2. Exposure C

1.5 SUBMITTALS

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.

1. Flashings and membrane terminations.

2. Tapered insulation, including slopes.

3. Insulation fastening patterns.

4. Sheet layout with perimeter and corner defined.

C. Samples for Verification: No physical samples required

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

F. Qualification Data: For Installer and manufacturer.

G. Maintenance Data: For roofing system to include in maintenance manuals.

H. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

B. Manufacturer Qualifications: A qualified manufacturer that has UL listing and FMG approval for membrane roofing system identical to that used for this Project.

C. Test Reports:

1. Roof drain and leader test or submit plumber’s verification.

2. Roof deck fastener pullout test.

D. Source Limitations: Obtain all components from single source roofing manufacturer.

E. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A ASTM E 108, for application and roof slopes indicated.

2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

F. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative (if required), deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer'swritten instructions.

3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

5. Review structural loading limitations of roof deck during and after roofing.

6. Require that all complimentary trades be present at conference. Including, but not limited to; electrical, plumbing, HVAC, and framing contractors.

7. Review Flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

8. Review governing regulations and requirements for insurance and certificates if applicable.

9. Review temporary protection requirements for roofing system during and after installation.

10. Review roof observation and repair procedures after roofing installation.

G. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative (if required), deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer'swritten instructions.

3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

5. Review structural loading limitations of roof deck during and after roofing.

6. Review Flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system during and after installation.

9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 GUARANTEE

A. Provide manufacturer's system guarantee equal to Johns Manville's Peak Advantage No Dollar Limit Roofing System Guarantee.

1. Single-Source special warranty includes roofing membrane, Flashings, roofing membrane accessories, roof insulation, fasteners, substrate board, walkway products, manufacturer’s expansion joints, manufacturer’s edge metal products, and other single-source components of roofing system marketed by the manufacturer.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Installer’s Guarantee: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of roofing system such as roofing membrane, Flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: One years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Johns Manville – Basis of Design.

B. Carlisle

C. Firestone

D. Approved Equal

2.2 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced. Product: JM TPO

1. Thickness: 60 mils (1.5 mm), nominal. Color shall be white.

2.3 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane. Product: JM TPO

C. Sheet Flashing: Manufacturer's unreinforced sheet flashing of same material as sheet membrane. Product: JM TPO Detail Membrane

D. Bonding Adhesive: Manufacturer's standard solvent water-based bonding adhesive for membrane, and solvent-based bonding adhesive for Flashings. Product: JM TPO Membrane Adhesive (Solvent Based)

E. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, with anchors. Product: JM Termination Systems

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer. Product: High Load Pre-Assembled Fasteners and Extra High Load Fasteners and Plates

G. Expansion Joints: Provide factory fabricated weatherproof, exterior covers for expansion joint openings consisting of flexible rubber membrane, supported by a closed cell foam to form flexible bellows, with two metal flanges, adhesively and mechanically combined to the bellows by a patented bifurcation process. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee. Product:Expand-O-Flash

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories. Products: JM PVC Sealant JM TPO Pourable

Sealer A & B JM TPO Pipe Boots JM TPO Universal Corners JM TPO Edge Caulk JM TPO Edge Sealant JM TPO T-Joint Patch JM TPO Membrane Cleaner JM TPO Membrane Primer JM TPO Polyurethane Caulk JM TPO Sealing Mastic JM TPO Cover Tape JM TPO Detail Membrane JM TPO Peel & Stick 10" RPS JM TPO Peel & Stick 6" RTS JM TPO-Coated Metal

2.4 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads sourced from membrane roofing system manufacturer. Product: JM TPO Walkpad

2.5 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Product: ENRGY 3

1. Provide insulation package consisting of two layers each 2.5”.

2.6 TAPERED INSULATION

A. Tapered Insulation: ASTM C 1289, provide factory-tapered insulation boards fabricated to slope of Tapered ENRGY 3 1/4 inch per 12 inches unless otherwise indicated. Product:

2.7 COVER BOARD

A. High-density polyiso coverboard

1. Johns Manville Invinsa

2. Carlisle SecureShield HD

3. Firestone IsoGard HD

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and provided by roofing system manufacturer. Product: UltraFast Pre-Assembled Fasteners

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening substrate panel to roof deck. Product: UltraFast Pre-Assembled Fasteners

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.

2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSULATION INSTALLATION

A. Coordinate installing roof system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installing roof insulation.

C. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes greater than 45 degrees per manufacturer’s instruction.

D. Install tapered insulation under area of roofing to conform to slopes indicated.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

F. Install two or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.5 inches (38 mm) or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

G. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

H. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

I. Preliminarily Fastened Insulation: Install insulation with fasteners at rate required by roofing system manufacturer or applicable authority, which ever is more stringent.

3.4 COVER BOARD INSTALLATION

A. Install cover board with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards.

B. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

C. Preliminarily Fastened Insulation: Install insulation with fasteners at rate required by roofing system manufacturer or applicable authority, which ever is more stringent.

3.5 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane specification ST6RM over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

B. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

C. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

D. Always install membrane laps perpendicular to the steel deck flutes. “Picture Frame” installation method is not permitted.

E. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

F. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.

2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

a. Remove and repair any unsatisfactory sections before proceeding with Work.

3. Repair tears, voids, and lapped seams in roofing membrane that do not meet requirements.

G. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

H. Through-Membrane Attachment: Secure roofing membrane using fastening plates or metal battens and mechanically fasten roofing membrane to roof deck. Cover battens and fasteners with a continuous cover strip.

I. Install roofing membrane and auxiliary materials to tie in to existing roofing.

3.6 FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at

required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with sheet flashing.

D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

B. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 WORK INCLUDED

A. Reinforcing steel bars, welded steel wire fabric for cast-in-place concrete.

B. Support chairs and bar supports for supporting reinforcement.

1.02 RELATED WORK

A. Section 03 11 13 – Structural Cast-In-Place Concrete Forming

B. Section 03 31 13 – Heavyweight Structural Concrete

1.03 QUALITY ASSURANCE

A. Perform concrete reinforcement work in accordance with manual or ACI "Concrete Craftsman Series".

B. Conform to ACI 301 and 315.

1.04 INSPECTIONS AND TESTS

A. Conform to the requirements of Section 01 33 26, "Testing Laboratory Services." Submit testing results under provisions of 01 33 23.

B. All work shall be subject to inspection prior to placing any concrete.

C. Furnish mill test certificates identifying chemical and physical analysis of each heat of reinforcing steel delivered.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Steel: ASTM A615, yield grade as noted on drawings, billet-steel deformed bars, uncoated finish.

B. Welded Steel Wire Fabric: ANSI/ASTM A185 plain type; in flat sheets; uncoated finish.

2.02 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gauge annealed type.

B. Chairs, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

C. Chairs, Bar Supports, Spacers Adjacent to Architectural Concrete Surfaces: Plastic coated type; sized and shaped as required.

2.03 FABRICATION

A. Fabricate in accordance with ACI 315-83 & 318-83, providing concrete cover specified in Section 03 31 13.

B. Locate reinforcing splices not indicated on Drawings at points of minimum stress.

PART 3 EXECUTION

3.01 INSTALLATION

A. Before placing concrete, clean reinforcement of foreign particles or coatings.

B. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement.

C. Do not displace or damage vapor barrier required by Section 03 31 13.

END OF SECTION

SECTION 07 71 23

MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-coated Aluminum gutters and downspouts.

1.02 RELATED SECTIONS

A. Section 33 30 00 – Sanitary Sewerage Utilities

B. Section 07 62 00 - Sheet Metal Flashing and Trim.

C. Section 09 91 00 – Painting.

1.03 QUALITY ASSURANCE

A. Conform to SMACNA Manual Drawings for nominal sizing of components for rainfall intensity determined by a storm occurrence of 1 in 10 years.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aluminum Sheet: ASTM B209, shop pre-coated with coating of selected color.

2.02 COMPONENTS

A. Gutters: Pre-finished 5” K-style seamless.

B. Downspouts: Pre-finished 2” x 3” aluminum

C. Downspout Boots.

2.03 ACCESSORIES

A. Anchorage Devices: SMACNA requirements.

B. Gutter Supports: Spikes and ferrules.

C. Downspout Supports: Straps.

D. Downspout Boots.

2.04 FABRICATION

A. Form gutters and downspouts of profiles to SMACNA requirements.

B. Field measure site conditions prior to fabricating work.

C. Fabricate with required connection pieces.

D. Form sections square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

E. Hem exposed edges of metal.

F. Seal metal joints.

G. Fabricate gutter and downspout accessories; seal watertight.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install gutters, downspouts, and accessories for a complete water-tight system.

B. Join lengths with seams sealed watertight. Flash and seal gutters to downspouts and accessories.

C. Slope gutters towards downspouts to provide adequate drainage.

D. Seal metal joints watertight.

E. Connect downspouts to storm sewer system with boot. Seal connection watertight.

F. Locate downspouts per plan, and notify owner of areas of discrepancies.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparing sealant substrate surfaces.

B. Sealant and backing.

1.02 RELATED SECTIONS

A. Related sections to be included are all areas where sealants are used for thermal and moisture control.

1.03 QUALITY ASSURANCE

A. Rejection of installed Sealant: Workmanship not conforming to the best standards of the industry shall be sufficient grounds for the Architect to reject installed sealant and require its immediate removal and complete resealing at no additional cost to the owner.

B. Conform to Sealant and Waterproofers Institute requirements for installation.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Do not install solvent curing sealants in enclosed building spaces.

B. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

PART 2 PRODUCTS

2.01 SEALANTS

A. Type A - Polyurethane Sealant: FS TT-S-00230, Type II – non-sag, Class A; color to match adjacent surfaces; manufactured by Sikaflex or CoPoly Caulk.

B. Type B - Polysulphide or Polyurethane Sealant: FS TT-S-00227, Type II – non-sag, Class A; color to match adjacent surfaces; manufactured by Sonneborn.

C. Sealants not noted in this specification, but required, are to be approved by Architect before beginning of installation.

2.02 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: ANSI/ASTM D1565; round, open cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit

application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.

B. Beginning of installation means installer accepts existing surfaces.

3.02 PREPARATION

A. Clean and prime joints in accordance with manufacturer's instructions.

B. Remove loose materials and foreign matter which might impair adhesion of sealant.

C. Verify that joint backing and release tapes are compatible with sealant.

D. Protect elements surrounding the work of this Section from damage or disfiguration.

3.03 INSTALLATION

A. Install sealant in accordance with manufacturer's instructions.

B. Measure joint dimensions and size materials to achieve required width/depth ratios.

C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.

D. Install bond breaker where joint backing is not used.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Tool joints as detailed.

3.04 CLEANING AND REPAIRING

A. Clean work under provisions of Section 01 77 19.

B. Clean adjacent soiled surfaces.

C. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished installation under provisions of Section 01 51 00.

B. Protect sealants until cured.

END OF SECTION

SECTION 08 14 23

DOORS & FRAMES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Fire rated rolled steel doors, panels, frames and closers.

B. Rated wood doors, panels and frames.

C. Non-rated wood doors and frames.

D. Bypass, pocket and bi-fold doors.

1.02 RELATED WORK

A. Section 07 21 16 - Blanket Insulation: Insulation for door frame perimeter stuffing.

B. Section 08 71 00 - Door Hardware.

C. Section 09 91 00 – Painting.

1.03 QUALITY ASSURANCE

A. Conform to requirements of SDI-100 for steel doors and frames.

B. Conform to requirements of AWI Quality Standard Section 1300 and 1400 Premium Grade for wood doors.

C. Fire rated door, panel and frame construction to conform to UL 10B.

D. Installed frame and door assembly to conform to NFPA 80 for fire rated class indicated on Drawings.

1.04 REGULATORY REQUIREMENTS

A. Conform to 2006 Edition, International Building Code for fire rated frames and doors.

1.05 DELIVERY, STORAGE AND PROTECTION

A. Protect products under provisions of Section 01 66 00.

B. Protect doors and frames with resilient packaging.

1.06 WARRANTY

A. Provide one year manufacturer's warranty under provisions of Section 01 77 19.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Stanley.

B. Ceco.

C. Thermo Tru.

D. Lynden.

E. Masonite

F. Carrara

G. Jeld-Wen

H. Republic

I. Steelcraft

J. Curries

K. Approved Equal

2.02 DOOR TYPES (Unit Interior)

A. Interior Doors:

a. Wood: 1-3/8 inch thick, flush panel, solid core construction. Locations per plans.
b. Metal: 18 guage hollow metal construction. Locations per plans.

B. Interior Frames: Fully-welded hollow metal construction.

2.03 ACCESSORIES FOR DOORS WITH CLOSERS

A. Rubber Silencers Resilient rubber.

B. Closers: 50% of the door hinges are to be closer type, hinges are to be spring loaded, finish to match hardware, manufacturer to be approved by Architect/Owner.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install doors in accordance with manufacturer's instructions.

B. Machine cut relief for hinges and coring for handsets and cylinders.

3.02 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.03 ADJUSTING AND CLEANING

A. Adjust hardware for smooth and balanced door movement.

3.04 SCHEDULE

A. Refer to Drawings for location and size of doors.

END OF SECTION

SECTION 08 43 00

ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

C. Weatherstripping

D. Door Hardware.

E. Perimeter Sealant.

1.02 REFERENCE STANDARDS

A. AAMA CW-10- Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association; 2004.

B. AAMA 1503- Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; American Architectural Manufacturers Association; 2009.

C. AAMA 2605- Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2005.

D. ASCE 7- Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers; 2005.

E. ASTM A 36/A 36M- Standard Specification for Carbon Structural Steel; 2005.

F. ASTM A 123/A 123 M- Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.

G. ASTM B 221- Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2008.

H. ASTM B 221M- Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric);2007.

I. ASTM E 283- Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004.

J. ASTM E 330- Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2002.

K. ASTM E 331- Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

L. ASTM E 547- Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Differential; 2000 (Reapproved 2009).

M. ASTM E 1105- Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2000 (Reapproved 2008).

N. National Fenestration Rating Council
   1. NFRC 100- Procedures for Determining Fenestration Product U-factors; 2004, with 2005 addendum.
   2. NFRC 200 Procedure for Determining Solar Heat Gain Coefficient.

O. SSPC-Paint 20- Zinc-Rich Primers (Type I, “Inorganic,” and Type II, “Organic”); Society for Protective Coatings; 2002 (Ed. 2004).

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.04 SYSTEM DESCRIPTION

A. Thermal break storefront system, including compensating receptor, perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.

1.05 PERFORMANCE REQUIREMENTS

A. Design and size components to withstand the following load requirements without damage or permanent set, when tested in accordance with ASTM E 330, using loads 1.5 times the design wind loads and 10 second duration of maximum load.

B. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.

C. Water Leakage: none, when measured in accordance with ASTM E 547 with a test pressure difference of 6.00 lbf/sq ft.

D. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

E. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and inner sheet of infill panel and heel bead of glaxing compound.

F. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

1.06 SUBMITTALS

A. See Section 01300- Submittals, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

D. Test Reports:
   1. Furnish test reports from accredited independent testing laboratory certifying that identical or larger window units meet requirements specified.
      a. Air Infiltration, Water penetration, and StructuralPerformance: AAMA/WDMA/CSA 101/I.S.2/A440.
      b. Thermal performance:NFRC 100 and NFRC 200.

E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, dimensional limitations.

F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

G. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

H. Report of laboratory testing for water leakage showing compliance with performance requirements.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in which the Project is located.

B. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum three years of documented experience.

1.08 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this Section.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.10 PROJECT CONDITIONS

A. Coordinate the work with installation of firestopping components or materials.

1.11 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.12 WARRANTY

A. See Section 01700- Contract Closeout, for additional warranty requirements.

B. Provide ten year manufacturer warranty against failure of glass seal on insulating glass units,

including interpane dusting or misting. Include provision for replacement of failed units.

C. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Kawneer Company, Inc; Product TriFab 451T.

B. Other Acceptable Manufacturers
1. Arcadia.
2. Vistawall.
3. Approved Equal.

2.02 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
1. Unitized, shop assembly.
2. Glazing Position: Front-set.
3. Vertical Mullion Dimensions: 2 inches wide by 4- ½ inches deep.
4. Finish: Superior performance organic coating.

B. Performance Requirements:
1. Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E 330, using loads
1.5 times the design wind loads and 10 second duration of maximum load.
a. Design Wind Loads: Comply with requirements of Building Code.
1) Positive Design Wind Load: 30 lbf/sq. ft.
2) Negative Design Wind Load: 30 lbf/sq. ft.
b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
3. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at a reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E-283.
4. Condensation Resistance Factor: CRF of 50 when measured in accordance with AAMA 1503.1.
5. Thermal Resistance of Assembly for fixed framed members: NFRC certified U value of 0.34. Thermal Resistance of Assembly for storefront doors: NFRC certified U value of 0.35
6. Water Leakage: None, when measured in accordance with ASTM E 331 at specified pressure differential.
7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
8. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and inner sheet of infill panel and heel bead of glazing compound.
9. Expansion/Contraction: Provide for expansion and contraction and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Glazing Location: Front.
   2. Glazing stops: Flush.
   3. Cross-Section: As indicated on drawings.
   4. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.

B. Doors: Glazed aluminum.
   1. Thickness: 1- ¾ inches.
   2. Top Rail: 3 1/2 inches wide.
   3. Vertical Stiles: 3 1/2 inches wide.
   4. Bottom Rail: 6 1/2 inches wide.
   5. Glazing Stops: Square.
   6. Finish: Same as storefront.

C. Head Compensating Receptor: Manufacturers standard unit for application.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B 221 (ASTM B 221 M).

B. Structural Stel Sections: ASTM A 36/A 36M; galvanized in accordance with requirements of ASTM A 123/A 123M.

C. Fasteners: Stainless Steel.

D. Exposed Flashings: 0.032 inch thick aluminum sheet; finish to match framing members.

E. Concealed Flashings: 0.018 thick stainless steel.

F. Perimeter Sealant: Type as specified in Joint Sealants Section.

G. Glass: As specified in Glazing Section.

H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

I. Glazing Accessories: As specified in Glazing Section.

J. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.05 FINISHES

A. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system; color as scheduled.

B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 HARDWARE

A. Door Hardware: Storefront manufacturer’s standard type to suit application.
   1. Finish on Hand-Contacted Items: Polished chrome.
   2. Include for each door weatherstripping, sill sweep strip, threshold, pivots, narrow stile handle latch, closer, and card access control.

2.07 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminuous paint.

E. Arrange fasteners and attachments to conceal from view.

F. Reinforce components internally for door hardware.

G. Reinforce framing members for imposed loads.

H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Coordinate attachment and seal of perimeter air and vapor barrier materials.

I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

J. Set thresholds in bed of mastic and secure.

K. Install hardware using templates provided.

L. Install glass and infill panels in accordance with the Glazing Section, using glazing method required to achieve performance criteria.

M. Install perimeter sealant in accordance with Joint Sealants Section.

N. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft. non-cumulative or 1/16 inches per 10 ft., whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

A. See Section 01400- Quality Control, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.

B. Notify Manufacturer, Contractor and Owner, in writing, prior to conducting field testing.

C. Number of Tests: Minimum three (3) of each sections of storefront and doors or as required to achieve compliance with manufacturer's published performance ratings.
1. First Test: Take at initial installation.
2. Second Test: Take at 50% completion.
3. Third Test: Take at 80% completion.

D. Provide set-up, test chamber and items needed for testing.
1. Remove interior finishes to allow for observations during testing.
2. Replace interior finishes after conclusion of testing.
3. If any window fails, test additional windows at Contractor's expense.

E. Test Chamber Requirements:
1. Chamber location to be selected to encompass as many typical details as possible, such as swing and sliding doors, operable vent, in-slab/fire vent hoods, fixed light, and tie-ins to adjacent systems.
2. Constructed of steel studs and plywood or drywall (interior grade acceptable).
   a. Steel studs, top and bottom track, stud spacing and fastening to be constructed as typical exterior walls.
   b. Sheathing installed on exterior side of chamber.
   c. Access hatch (approx. 2 x 3 feet) to allow entrance and exit into chamber to be operable and sealed for air leakage.
3. Fire caulk or fire tape board joints to adjacent concrete slabs and columns and/or exterior walls.
   a. Chamber to be sealed to exterior beyond edge of test section.
4. Water supply requirement to test chamber location:
   a. 21 gallons per minute at 15 psi.
   b. Below 10 stories, two separate ¾ inch hoses attached individually to city supply from a 100 psi 1" branch is sufficient.
   c. Connecting larger hose (greater than 1-1/2 inch) and splitting to (2) two ¾ inch hoses at test may also be sufficient.
   d. Length of hose excedding 250 feet: Plastic piping to be used to minimize pressure loss due to higher friction of rubber hose.
5. Electricity: 110V, 20 amp breaker, 1 dedicated circuit per floor.

F. Testing Agency: Owner to engage qualified independent testing agency to perform testing indicated.
   1. Water Penetration: Test areas of installed system at locations randomly selected by Owner.
   2. Test installed storefront for water penetration in accordance with ASTM E 1105, prodedure B with a cyclic test pressure difference of 6.00 lbf/sq ft. Test shall include a minimum of 4 cycles, each lasting a minimum of 5 minutes.
      a. First Test: Take at initial installation.
      b. Second Test: Take at 50% completion.
      c. Third Test: Take at 80% completion.
   3. Locations: Where approved by Owner. Each test to include most typical details including interface with cladding types and typical penetration types.

3.05 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Rmove excess sealant by method acceptable to sealant manufacturer.

3.07 PROTECTION

A. Protect installed products from damage during subsequent construction.

B. Remove, dispose and recycle debris from project site.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.01 WORK INCLUDED

A. Hardware for all doors.

B. Thresholds.

C. Gasketting.

1.02 RELATED WORK

A. Section 06 20 23 - Interior Finish Carpentry.

B. Section 08 14 23 – Clad Wood Doors

1.03 COORDINATION

A. Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for door hardware.

1.04 QUALITY ASSURANCE

A. Manufacturers: Companies specializing in manufacturing door hardware with minimum three years experience.

B. Hardware Supplier: Company specializing in supplying commercial door hardware with three years documented experience.

1.05 SUBMITTALS

A. Indicate locations and mounting heights of each type of hardware.

B. Provide product data on specified hardware.

C. Submit samples under provisions of Section 01 33 23.

D. Submit samples of hardware illustrating style, color, and finish.

E. Samples: May be incorporated into the Work.

F. Submit manufacturer's parts lists, templates, and installation instructions under provisions of Section 01 33 26.

G. Submit manufacturer's certificate under provisions of Section 01 33 26 that fire rated hardware meets or exceeds specified requirements.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01 77 19.

B. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and protect products to site under provisions of Section 01 66 00.

B. Deliver keys to Owner.

C. Protect hardware from theft by cataloging and storing in secure area.

1.08 WARRANTY

A. Provide one year warranty under provisions of Section 01 77 19.

B. Warranty: Include coverage of door closers.

1.09 MAINTENANCE MATERIALS

A. Provide special wrenches and tools applicable to each different or special hardware component.

B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS – LOCKS/ HARDWARE

A. Weslock.

B. Schlage.

C. Faultless.

D. Kwikset.

2.02 HARDWARE

A. Hinges, pivots, latch sets, push/pulls, cylinder locks, mortise locks, exit devices, closers, gasketting, bifolding door hardware, pocket door hardware and protection plates: Size and type to suit application, finish to be selected, submit to Architect/Owner.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify that doors and frames are ready to receive work and dimensions are as instructed by the manufacturer.

B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions.

B. Use the templates provided by hardware item manufacturer.

C. Conform to ANSI A117.1 for positioning requirements for the handicapped.

3.03 SCHEDULE

A. All doors to have lever type hardware that meets ADA.

B. Accessory Buildings (rec. bldgs., storage maintenance buildings, etc): Provide full locksets, including passage and deadbolt.

C. Refer to Drawings for all additional information, including type of hardware which is required, and type of rooms to establish type.

END OF SECTION

SECTION 09 21 16

DOOR HARDWARE

PART 1 GENERAL

1.01 WORK INCLUDED

A. Gypsum board.

B. Taped and sanded joint treatment.

1.02 RELATED WORK

A. Section 06 10 53 – Miscellaneous Rough Carpentry.

B. Section 07 21 16 - Blanket Installation: Thermal insulation.

C. Section 08 14 23 – Clad Wood Doors.

D. Section 09 91 00 - Painting.

1.03 REGULATORY REQUIREMENTS

A. Conform to Noted Edition of UBC for fire rated assemblies.

1.04 SUBMITTALS

A. Submit one 36" x 36" panel illustrating texture. Acceptance means all other work will be of the same quality.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - GYPSUM BOARD SYSTEM

A. National Gypsum Co.

B. Other acceptable manufacturers offering equivalent products:

1. U.S. Gypsum Co.

2. Kaiser Gypsum Co.

3. Bestwell Gypsum Co.

4. Approved Equal

2.02 FRAMING MATERIALS

A. Furring, Framing and Accessories: ANSI/ASTM C645.

B. Fasteners: ANSI/ASTM C514.

C. Adhesive: ANSI/ASTM C557.

2.03 GYPSUM BOARD MATERIALS

A. Standard Gypsum Wall Board: ANSI/ASTM C36; 5/8 inch thick, maximum permissible length; ends square cut, tapered edges, butt joints.

B. Fire Rated Wall Gypsum Board: ANSI/ASTM C36; fire resistive type, UL rated; 5/8 & 1/2 inch thick, type X, maximum permissible length; ends square cut, tapered edges, butt joints.

C. Moisture Resistant Gypsum Wall Board: ANSI/ASTM C630; 5/8 & 1/2 inch thick, maximum permissible length; ends square cut, tapered edges. Use for all lavatory, exterior soffits and other locations where dampness may occur.

D. Exterior gypsum ceiling board (soffit board): ASTM C931, 5/8" thick pipe code, UL rated.

2.04 ACCESSORIES

A. Corner Beads: Metal.

B. Edge Trim: GA 201 and GA 216; Type LC exposed reveal bead.

C. Joint Materials: ANSI/ASTM C475; reinforcing tape, joint compound, adhesive, water, and fasteners.

D. Screws: 1-1/4" Type W, Type A for attaching gypsum wallboard to framing. Contractor may add a credit option in contract for nailing.

E. Nails: Kooler Nails

2.05 PRIMER

A. Primer/Vapor Barrier Primer: Provide alternate price for a vapor barrier primer at all exterior walls ceilings and standard primer at all interior walls and ceilings.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify that site conditions are ready to receive work.

B. Assure that wood is thoroughly dry and that 50 degrees F temperature will be maintained before and after work.

C. Beginning of installation means acceptance of existing surfaces.

3.02 SHAFT WALL INSTALLATION

A. Shaftwall Framing: In accordance with manufacturer's installation instructions, and current applicable edition of Uniform Building Code.

3.03 ACOUSTICAL ACCESSORIES INSTALLATION

A. Install resilient channels as indicated on Drawings. Locate joints over framing members.

B. Place acoustical insulation in partitions tight within spaces, around cut openings,

behind and around electrical, mechanical or plumbing items within or behind partitions, and tight to items passing through partitions.

3.04 GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with GA 201 and GA 216.

B. Apply board to ceilings before applying to walls. Apply boards with long edges at right angles to framing members. Use full size sheets of maximum practical lengths where possible. Place boards in moderate contact; do not force into place. Stagger vertical joints; arrange joints on opposite sides of partition so as to occur on different studs.

C. Use screws when fastening gypsum board to wood furring or framing. Provide solid blocking behind all joints not on framing members, except for ceiling framing where wall board is covered by acoustical tile.

D. Space screws not to exceed 12" on center on ceilings, 16" on center on sidewalls, per manufacturers recommendations. Where studs are placed 24" on center, sidewall screw spacing shall not exceed 12" on center.

E. Double Layer Applications: Secure second layer to first with fasteners.

F. Erect exterior gypsum soffit board perpendicular to supports, with staggered end joints over supports.

G. Treat cut edges and holes in moisture resistant gypsum board with sealant.

H. 90 degree corners use galvanized steel with perforated flanges except where adjacent to aluminum or other metal trim where galvanic reaction may occur. Use plastic corner bead in these areas. Use largest practical length.

I. Other corners use Multi-Flex continuous Metal Tape Bead by Gold Bond.

3.05 JOINT TREATMENT

A. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

B. Reinforce all corners.

C. Fill all exposed screw heads, nails and staples.

D. Fill all cracks at electrical outlets and similar fireproofing.

E. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch.

F. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.

3.06 TEXTURING/PRIMER

A. Texture shall be light orange peel. Primer is to be applied prior to texturing.

3.07 WORKMANSHIP

A. Make cutouts to minimum size necessary for fixture placement. Installer responsible for patching all overcuts for outlet boxes, light fixtures, etc. where standard trim does not cover.

3.08 TOLERANCES

A. Maximum Variation from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 50 00

ACOUSTIC CEILING TILE

PART 1 GENERAL

A. Submittals

1. Submit a minimum of three samples of the following:

a. Acoustical ceiling panels: 6" x 6" minimum

b. Suspension system components: 12" in length

B. Quality Assurance

1. To the greatest extent possible, materials, including exposed wall moldings, suspensions systems, and accessories, shall be products of a single manufacturer or items standard with manufacturer of acoustical ceiling panel units.

C. Materials

1. Acoustical tiles and suspension system as scheduled in drawings. Provide manufacturer standard components as shown in details.

D. Installation

1. Grid System:

a. Install grid system in compliance with ASTM C636, manufacturer's instructions, and as supplemented in this section.

b. Install grid system in a true, even plane and in straight courses as indicated on Drawings and accepted shop drawings.

c. Coordinate and fit ceiling components to grilles, lighting fixtures, and other related items. In determining location and spacing of hangers and primary runners, take into consideration weight of grilles, light fixtures, etc., that are to be installed in conjunction with acoustical ceilings.

d. Provide stabilizer bars, clips, splices, and edge moldings needed for a complete installation.

e. Hang grid system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

f. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers and related carrying channels to span extra distance.

g. Do not support components on main runners or cross runners if weight causes total dead load to exceed maximum deflection limitations. Support fixture loads by supplementary hangers located within 6" (150 mm) of each corner; or support components independently.

h. Do not eccentrically load system, or produce rotation of runners.

2. Moldings and Trim

a. Install wall moldings at intersection of suspended ceiling and vertical surfaces, using longest practical lengths. Provide moldings at junctions with other interruptions and as needed to cover edges of acoustical ceiling panels.

b. Attach moldings and trims with screws spaced not more than 16" (400 mm) on center and within 3" (75 mm) of ends of each piece being installed.

c. Moldings and trim shall be level with suspension system and within tolerances specified for suspension system.

d. Miter corners and align butt joints where wall moldings intersect to form tight, hairline joints.

e. Face riveting of moldings and trim shall not be acceptable.

3. Tolerances

a. Deflection of grid components shall not exceed 1/360 of span.

b. Variation from Flat and Level Surface: 1/8" (3 mm) in 10 feet (3000 mm) maximum.

c. Variation from Plumb of Grid Members: 2 degrees maximum; caused by eccentric loads.

E. Adjusting and Cleaning

1. Follow grid system manufacturer's recommendations for methods and materials to clean and touch-up exposed components.

2. Replace components which are discolored or damaged in any way, in a manner which results in grid system showing no evidence of replacement work

END OF SECTION

SECTION 09 65 16

RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient flooring.

1.02 RELATED SECTIONS

A. Section 03 35 00 - Concrete Finishing.

B. Section 03 54 13 - Gypsum Cement Underlay: Floor substrate surface.

1.03 REGULATORY REQUIREMENTS

A. Conform to current applicable UBC code for flame/ fuel/smoke rating requirements in accordance with ASTM E84.

1.04 SUBMITTALS

A. Provide product data on specified products, describing physical and performance characteris

B. Submit samples and manufacturer's installation instructions under provisions of Section 01 33 23.

C. Provide floor layout shop drawings showing direction of planks and patters of tiles.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit cleaning and maintenance data under provisions of Section 01 77 19.

B. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Store materials for three days prior to installation in area of installation to achieve temperature stability.

B. Maintain ambient temperature required by adhesive manufacturer three days prior to, during, and 24 hours after installation of materials.

1.07 EXTRA MATERIALS

A. Provide 5 boxes of flooring, of each color, specified under provisions of Section 01 77 19.

PART 2 PRODUCTS

2.01 MANUFACTURERS - RESILIENT FLOORING

A. Shaw

B. Mannington

C. Armstrong

D. Congoleum

E. Johnsonite- Tub Moldings

F. Other Acceptable Manufactuers: Domco, Tarkett.

2.02 ACCESSORIES

A. Subfloor Filler: Type recommended by flooring material manufacturer.

B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

C. Sealer and Wax: Types recommended by flooring manufacturer.

D. Tub Moulding: Type recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are smooth and flat with maximum variation of 1/8 inch in 10 ft and are ready to receive Work.

B. Verify concrete and/or gypcrete floors are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization, or dusting.

C. Beginning of installation means acceptance of existing substrate and site conditions.

3.02 PREPARATION

A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Apply, trowel, and float filler to leave a smooth, flat, hard surface.

C. Prohibit traffic from area until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Install in accordance with manufacturers' instructions.

B. Spread only enough adhesive to permit installation of materials before initial set.

C. Set flooring in place, press with heavy roller to attain full adhesion.

D. Lay flooring with joints and seams parallel to building lines to produce minimum number of seams.

E. Terminate flooring at vinyl plank side of door openings where adjacent floor finish is dissimilar.

F. Install edge strips at unprotected or exposed edges, and where flooring terminates.

G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances

to produce tight joints.

H. Install flooring in pan type floor access covers. Maintain floor pattern.

3.04 PROTECTION

A. Prohibit traffic on floor finish for 24 hours after installation.

3.05 CLEANING

A. Remove excess adhesive from floor and wall surfaces without damage.

B. Clean, seal, and wax floor surfaces in accordance with manufacturer's instructions.

3.06 SCHEDULE

-Per plans.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Surface preparation.

B. Surface finish schedule.

C. Schedule.

1.02 RELATED WORK

A. All sections which require the application of paint, stain, lacquer or varnish for either surface preparation, surface finish, or surface marking.

1.03 DEFINITIONS

A. Conform to ANSI/ASTM D16 for interpretation of terms used in this Section.

1.04 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with three years experience.

B. Applicator: Company specializing in commercial painting and finishing with three years documented experience.

1.05 REGULATORY REQUIREMENTS

A. Conform to current edition of Uniform Fire Code for flame/fuel/smoke rating requirements for finishes.

1.06 SUBMITTALS

A. Submit product data under provisions of Section 01 33 23.

B. Provide product data on special coatings.

C. Submit samples under provisions of Section 01 33 23.

D. Submit two samples 12 x 12 inch in size illustrating range of colors and textures available for each surface finishing product scheduled, for selection.

E. Submit manufacturer's application instructions under provisions of Section 01 33 26.

1.07 FIELD SAMPLES

A. Provide samples under provisions of Section 01 33 23.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during, and 48

hours after application of finishes, unless required otherwise by manufacturer's instructions.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.09 EXTRA STOCK

A. Provide a five gallon container of each color, primer and surface texture to Owner.

B. Label each container with color, texture, model numbers and room locations, in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - PAINT

A. Parker.

B. Sherwin Williams.

C. Pittsburgh.

D. Olympic.

E. Columbia.

F. Rodda

G. Benjamin Moore

2.02 ACCEPTABLE MANUFACTURERS - PRIMER-SEALERS

A. Parker.

B. Sherwin.

C. Columbia.

D. Pittsburgh.

E. Olympic.

F. Rodda

G. Benjamin Moore

2.03 MATERIALS

A. Spray Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a

homogeneous coating.

B. Brush coatings: Good flow and brushing properties; capable of drying or curing free of streaks or sags.

C. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

2.04 FINISHES

A. Refer to schedule at end of Section for surface finish and color schedule.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Beginning of installation means acceptance of existing surfaces.

3.02 PREPARATION

A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.

B. Correct minor defects and clean surfaces which affect work of this Section.

C. Shellac and seal marks which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

F. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.

G. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

H. Gypsum Board Surfaces: Latex fill minor defects. Spot prime defects after repair.

I. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Uncoated Steel and Iron Surfaces: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

K. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

L. Interior Wood Items Scheduled to Receive Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

M. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections.

N. Wood and Metal Doors Scheduled for Painting: Seal top, sides and bottom edges with primer.

O. Prefinished or embossed material shall have all nail holes and cracks filled with a matching putty.

3.03 PROTECTION

A. Protect elements surrounding the work of this Section from damage or disfiguration.

B. Repair damage to other surfaces caused by work of this Section.

C. Furnish drop cloths, shields, and protective methods to prevent spray or drippings from disfiguring other surfaces.

D. Remove empty paint containers from site and dispose in authorized disposal facility.

3.04 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish.

D. Allow applied coat to dry before next coat is applied.

E. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

F. Prime back surfaces of interior and exterior woodwork with primer paint.

G. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.05 CLEANING

A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.

B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.

C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.06 DEFECTIVE WORK

A. Where work is deemed to be defective by Architect/Owner, the contractor shall

refinish the surface as required until the desired result is obtained. If defective work is judged to be a product-based problem by the painting contractor, he shall consult the manufacturer's representative to obtain a cure and remedy. All work to be done at no additional expense to owner.

3.07 FINISHING SCHEDULE

A. Contractor shall obtain color schedule from Architect/Owner prior to paint application. Work scheduled herein is in addition to shop coats specified in other sections.

B. Exterior hollow metal doors and frames shall receive two coats alkyd semi-gloss enamel over prime coat or factory-finished items.

C. All exterior and interior metal work and mechanical work exposed to view shall receive two (2) coats alkyd semi-gloss enamel over prime coat or factory-finish items. This includes chimney wind screens and interior electrical panels.

D. Exterior wood trim to receive two coats of paint.

E. Pre-primed interior wood trim, doors, door frames, shelves, and all other wood items to receive one coat of semi-gloss alkyd paint.

F. Interior and Exterior Drywall Units:

1. All gypsum walls to receive one coat of primer and one eggshell finish coat. Provide and alternate price for a vapor barrier primer to be applied prior to texture.

3.08 TOUCH UP

A. Touch up as required to achieve uniform look on all painted surfaces.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Signage for buildings.

B. Signage for unit entry doors.

C. Signage for stairwells.

D. Signage for barrier free site access.

E. Signage for common areas and offices.

F. Signage for safety regulations in and around pool area.

G. Signage for site entry.

H. Signage for barrier free parking.

I. Miscellaneous signage for code compliance and as shown on plans.

J. Project sign per General Notes.

1.02 RELATED WORK

A. Division 26 -- Electrical

1.03 SUBMITTALS

A. Submit samples under provisions of Section 01 33 23.

B. Submit two samples illustrating full size sample sign, of type, style and color specified including method of attachment.

C. Include installation template and hardware.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01 66 00.

B. Store and protect products under provisions of Section 01 66 00.

C. Package signs, labeled in name groups.

D. Store adhesive tape at ambient room temperatures.

END OF SECTION

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Toilet and bath accessories - apartment units.

B. Toilet and bath accessories - recreation bldg(s) and common areas.

C. Attachment hardware.

1.02 RELATED SECTIONS

A. Section 06 10 53 – Miscellaneous Rough Carpentry: Blocking for bathroom accessories.

B. Section 06 41 13 – Wood Veneer Faced Architectural Cabinets

1.03 SUBMITTALS

A. Submit product data under provisions of Section 01 33 23.

B. Provide product data on accessories describing size, finish, details of function, attachment methods.

C. Submit manufacturer's installation instructions under provisions of Section 01 33 23.

1.04 REGULATORY REQUIREMENTS

A. Conform to Barrier Free code requirements.

1.05 SYSTEM DESCRIPTION

A. Apartment units - Provide and install the following items, unless specified otherwise:

1. Toilet paper holders.

2. Towel bars- Three 2-prong robe hooks per bathroom. One for hand towels and two for bath towels.

3. Mirror - 42 inch tall to match width of entire vanity. Verify horizontal and vertical dimensions with owner prior to fabrication.

4. Type A Grab bars in barrier free units only.

B. Accessory Mirrors - Provide and install mirrors in locations as shown on Drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer for apartment unit accessories to be Pamex, finish chrome, style to be approved by Architect/Owner.

B. Acceptable Manufacurers to be Taymor, or Bobrick Washroom Equipment, Inc.

C. Substitutions: Under provisions of Section 01 66 00.

2.02 MATERIALS

A. Mirror: FS DD-G-451, Type 1, Class 1, quality q 2, 1/4" thick with silver coating, copper protective coating, and non-metallic paint coating complying with FS DD-M-411.

B. Tubing: ASTM A269, stainless steel.

C. Adhesive: Contact type, waterproof.

D. Fasteners, Screws, and Bolts: Hot dip galvanized , size and type to suit application. No plastic clips.

E. To support mirrors, use concealed plastic, glue, or metal clips only. Large plastic clips with exposed screws are not acceptable.

2.03 FABRICATION

A. Except where otherwise indicated, fabricated units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinges. Provided concealed anchorage wherever possible.

2.04 FACTORY FINISHING

A. Galvanizing: ANSI/ASTM A123.

B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

C. Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats baked enamel.

D. Chrome/Nickel Plating: ANSI/ASTM B456, Type SC 2 satin finish.

E. Stainless Steel: No. 4 satin luster finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are ready to receive work and dimensions are as indicated on Drawings.

B. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site at appropriate time for building-in.

B. Provide templates and rough-in measurements as required.

C. Verify exact location of accessories for installation.

3.03 INSTALLATION

A. Install fixtures, accessories and items in accordance with manufacturers' instructions.

B. Install plumb and level, securely and rigidly anchored to substrate.

END OF SECTION

SECTION 10 44 16

FIRE EXTINGUISHERS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Fire extinguishers.

B. Cabinets.

C. Accessories.

1.02 RELATED WORK

A. Section 06 10 53 – Miscellaneous Rough Carpentry: Roughed-in wall openings.

1.03 QUALITY ASSURANCE

A. Conform to NFPA 10 requirements for extinguishers and fire blankets.

1.04 SUBMITTALS

A. Scope: Coordinate with local fire marshal to determine number and location of fire extinguishers.

PART 2 PRODUCTS

2.01 EXTINGUISHERS

A. Dry Chemical Type: steel tank, with pressure gage, size and classification as required.

2.02 CABINETS

A. Cabinet: Formed sheet steel, 18 gauge, primed, recessed type, size to accommodate accessories.

B. Trim: Flat, primed steel.

C. Door: Primed steel, 18 gauge thick, reinforced for flatness and rigidity; lock with break glass access.

D. Glass: 1/8 inch thick float glass.

E. Mounting Hardware: Appropriate to cabinet.

2.03 FABRICATION

A. Form body of cabinet with tight inside corners and seams.

B. Predrill holes for anchorage.

C. Form perimeter trim and door stiles by welding, filling, and grinding smooth.

D. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch.

2.04 FINISHES

A. Cabinet Trim and Door: Red enamel, color as selected by Architect/Owner.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify rough openings for cabinet are correctly sized and located.

B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install cabinets plumb and level in wall openings in accordance with applicable codes.

B. Secure rigidly in place, in accordance with manufacturer's instructions.

END OF SECTION

SECTION 11 31 00

RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Laundry Room

1.02 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish all wiring, circuit breakers and shut offs installed under Division 16 - Electrical Materials and Distribution.

B. Furnish plumbing requirements for appliances installed under Division 15 - Plumbing Piping.

C. Furnish vent piping for dryer vents installed under Division 15 - Mechanical Venting and Ductwork: Dryer Venting.

1.03 RELATED WORK

A. Section 21 13 00 – Closet and Utility Shelving.

1.04 SUBMITTALS

A. Submit product data and manufacturer's installation instructions under provisions of Section 01 33 23.

B. Submit operating and maintenance instructions for each item of residential equipment. Under provision of Section 01 33 26.

C. Submit manufacturer's standard written warranty for each item of residential equipment under provisions of Section 01 77 19.

1.05 QUALITY ASSURANCE

A. Provide residential equipment with UL Standard Labels.

1.06 DELIVERY STORAGE AND HANDLING

A. Deliver appliances in unopened boxes, stating brand name, once installed and model number.

B. Uncrate appliances and dispose of packaging material.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate work with Section 09 65 16 - Resilient Flooring.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. By owner

2.02 FINISH:

A. See plans

2.03 PERFORMANCE REQUIREMENT: Appliance dimensions are listed for general compliance, subcontractor is reposnible for reviewing drawings to ensure product fits designed dimensions.

APPLIANCES

Owner furnished Owner installed washer and dryer

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

B. Install plumb, level and secure.

3.02 PROTECTION

A. Protect installed appliances from scratches, dents and theft until substantial completion.

3.03 TESTING

A. Test all appliances to insure they are in a first class working order.

3.04 CLEAN-UP

A. Remove all containers and related waste from job site at end of installation.

B. Clean appliances surfaces by methods approved by manufacturer.

END OF SECTION

SECTION 12 31 00

CLOSET AND UTILITY SHELVING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Wire Closet Shelves at Unit Locations:

a. Laundry Room

1.02 SUBMITTALS

A. Submit Product Data: Mark each copy to identify applicable products, characteristics, models, options and other supplemental data to clearly communicate information specific to this project.

B. Color Chart: Each product specified.

PART 2 PRODUCTS

2.01 WIRE CLOSET SHELVES

A. Approved Manufacturers:

1. Schulte Corporation
2. Shelf Tech
3. Rubbermaid
4. Lee and Rowan
5. Closet Maid

B. Design:

1. Wire Shelves: Full width of closet with rods spaced at 1" centers.
2. Shelf Depth: 16 inches (any closets not deep enough to receive 12”).

C. Components:

1. Rods: Cold-drawn steel wire conforming to ASTM A29, Grade C1008.

a. Front Rods: 0.306 inch diameter

b. Back Rods: 0.243 inch diameter

2. Protective Coating: White epoxy enamel.
3. Mounting Hardware: Manufacturer's standard components.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install wire shelving per plans.

END OF SECTION

SECTION 21 13 00

FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 GENERAL

A. Provide labor and materials necessary for a complete fire sprinkler system. Conform to Specification Section 23 00 00, General Conditions, Supplementary Conditions, the modifications thereto and Division 1 - General Requirements for all work in this section.

B. Design, fabricate, install, test and secure all necessary written stamped approvals of a complete automatic fire protection sprinkler system acceptable to the governing Fire Marshal, and in accordance with the standards set forth in this section. Provide and install a complete fire protection system including connection to the water main outside the building, riser, piping, controls, and accessories for a complete system. Contractor shall obtain and pay for all permits required by local authorities.

C. In addition to conforming with all pertinent codes and regulations, conform with the requirements of NFPA 13, NFPA 13R, other applicable sections of NFPA, and IBC.

D. In case the specifications conflict with code or local requirements, the code or local requirements govern.

1.02 DESIGN REQUIREMENTS

A. Provide sprinkler systems designed in accordance with NFPA 13R to protect the apartments. The design and installation shall be in accordance with all local requirements.

B. Provide standpipes and hose cabinets as required by IBC and local requirements.

C. Determine flows and pressures of available water supply and adjust the design accordingly.

D. Coordinate sprinkler system installation with structure, ductwork, plumbing, lighting, and conduit to preclude interferences. Coordinate all electrical connection requirements with the electrical contractor and the alarm contractor as required.

1.03 SUBMITTALS

A. Shop drawings shall be stamped by a licensed individual (minimum of NICET Level III or registered fire protection engineer in the state of Washington). Completion of shop drawings shall be done so that the fire marshal can review the fire sprinkler drawings with the fire alarm shop drawings. Coordinate with the alarm contractor as necessary.

1. Layout drawing of complete overhead sprinkler system indicating relationship of all other overhead items including ceiling air diffusers and grilles, ductwork, lighting fixtures, and beams. Conform to symmetrical spacing, align in straight rows, and integrate with locations of lights and other ceiling devices. Drawing scale shall be the same as the architectural floor plans.

2. Include complete details and sections as required to clearly define and clarify the design, including a materials list describing all proposed materials by manufacturer's name and catalog number.

3. Plot plan shall indicate location of all underground connections, valves, piping, and related items, and all structures within 15 feet of the buildings. Drawing scale shall be the same as the architectural plot plan.

1.04 MANUAL

A. Upon completion of the installation, and as a condition of its acceptance, compile an 8-1/2" x 11" sprinkler system manual. Provide two copies of the manual to the Architect.

B. Contents of manual shall be as follows:

1. A complete list of all components of the system with manufacturer's names, catalog numbers and all data required for ordering replacement parts.

2. One copy of the record drawings.

3. All information required to affect or secure emergency repairs or service.

4. One copy of written warranty.

1.05 RECORD DRAWINGS

A. During progress of the work of this section, maintain an accurate record of all changes made in the design of the fire sprinkler system. Upon completion of the installation, and as a condition of its acceptance, insert one set of record drawing prints into each copy of the sprinkler manual.

PART 2 PRODUCTS

2.01 GENERAL

A. All materials, equipment, valves and devices installed and/or furnished under this Section shall be new and shall be UL listed and approved and/or FM listed and approved. All materials shall be the latest design of the manufacturer. All materials shall meet the requirements of the local authorities.

2.02 FIRE DEPARTMENT CONNECTION

A. Fire department connection shall be all brass, or bronze, labeled "Auto-spkr", UL approved, national standard thread fire department hose connection. Locate where approved by the fire department.

2.03 VALVES

A. All gate valves in fire protection system shall be class 150, UL or FM listed, 285 psi at 100 degrees F. Provide tamper switch, flow switch, drain valve and sight glass for each OS & Y and butterfly valves.

2.04 SPRINKLER HEADS

A. Sprinkler heads shall have white finish, UL or FM listed standard type conforming

to section 3-16 of NFPA 13. Sprinkler heads to be installed in the vicinity of heating equipment shall be of the temperature ratings required by NFPA 13. Provide for high temperature, corrosion resistant, or fast response heads in locations where special occupancies indicate the need. Provide fast response heads to conform with ADA requirements if limited exits exist, such as second floors that are available to the handicapped.

B. Sprinkler heads in areas with gypsum wall board ceilings shall be white finished semi-recessed pendant type with adjustable off-white escutcheon plate. Sprinkler heads in mechanical spaces shall generally be upright type and shall be high temperature where located near heat-producing equipment.

2.05 PIPING

A. Above grade use Schedule 40 standard black steel pipe, ASTM A-53, with 150-lb. cast iron screwed fittings. CPVC or Schedule 10 may be used where allowed by local jurisdiction.

PART 3 EXECUTION

3.01 GENERAL

A. Run all sprinkler piping concealed in all occupied areas. Provide all hangers, supports, beam clamps, earthquake bracing, sleeves through walls and floors and openings for the fire sprinkler system in accordance with NFPA 13R. Provide firestopping through fire rated penetrations as required by local jurisdiction.

B. Sprinkler lines shall be routed in a satisfactory manner which will eliminate the necessity of cutting, burning or otherwise damaging any structural member that would result in weakening the structure. All overhead sprinkler main lines must be supported from exterior walls or beams with steel hangers. Sprinkler mains to be as close to bottom of beams as possible. Piping shall not be run over the top of electrical panels or switchgear.

C. Provide and install near each riser a cabinet containing a minimum of six extra heads of each type used for this project, including a special head wrench. The drain valve shall be so indicated with a suitable sign. Instruction charts describing operation and proper maintenance shall be provided and posted near the risers by the Sprinkler Contractor. Valve charts to be provided per Specification.

D. Design shall be coordinated with the Architect to achieve maximum utility of building spaces and the best practical appearance. Provide sprinkler guards on all heads lower than 7'6" to finished floor. All heads in ceiling panels shall be located as close to the center of the panel as possible. Return bend piping takeoffs shall be used as necessary to get heads centered in panels.

E. Installation of valves, gauges and equipment shall be conveniently and accessibly located with reference to the finished building for repairs, removal and service. Access doors in finished ceilings and walls will be provided by the general contractor. Coordinate access door locations with the general contractor to access these components where concealed.

F. After completion, perform a hydrostatic leakage test witnessed by representative of the Fire Marshall. Submit NFPA test report.

END OF SECTION

SECTION 220500 – GENERAL REQUIREMENTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 22 Section “Project Closeout for Plumbing”.
2. Division 22 Section “Common Materials and Methods for Plumbing”.
3. Division 22 Section “Hangers and Supports for Plumbing Piping and Equipment”.
4. Division 22 Section “Identification for Plumbing Piping and Equipment”.

1.2 SCOPE OF WORK – GENERAL

A. This section specifies general requirements for plumbing installations and includes requirements common to more than one section of Division 22. It expands and supplements the requirements specified in sections of Division 01.

B. Provide materials, labor, transportation, tools, permits, fees, inspections, utilities and incidentals necessary for the complete installation of plumbing work indicated and described in the Contract Documents.

C. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required for work indicated or specified under this section of work or work specified in other sections, provide material and equipment which is usually furnished with such systems in order to complete the installation, whether mentioned or not.

1.3 SEQUENCE OF WORK

A. Conduct work in sequence to provide least possible interference to the activities of the Owner, and to permit orderly transfer of activities and equipment to completed areas.

B. Work shall be substantially complete by the dates listed in Division 01 Section “Summary”.

1.4 ALTERNATES

A. Refer to Division 01 Section “Alternates” for description of alternates. Review Contract Documents for additional information.

1.5 DEFINITIONS

A. Provide: Furnish and install complete and ready for intended use.

B. Indicated: Indicated on drawings.

C. Noted: Noted on Drawings or in Specifications.

D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

H. 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.

1.6 CODES AND STANDARDS

A. Code Compliance: Comply with most current adopted edition of following:

1. International Building Code (IBC), Standards and Amendments.
2. International Mechanical Code (IMC), Standards and Amendments.
3. International Fire Code (IFC), Standards and Amendments.
4. Uniform Plumbing Code (UPC), Standards and Amendments.
5. International Fuel Gas Code (IFGC).
6. National Fire Protection Association (NFPA).
7. National Electrical Code (NEC); NFPA 70.
8. Applicable State and local codes, laws and ordinances.

1.7 SAFETY OF PERSONS AND PROPERTY

A. Comply with applicable laws, ordinances, rules and regulations of any public authority for the safety of persons and property, including requirements of the Washington Industrial Safety and Health Administration (WISHA) and/or the Occupational Safety and Health Act (OSHA) and Division 01, General and Supplementary Conditions.

1.8 PERMITS AND FEES

A. Obtain and pay for required permits and fees necessary to fully complete work included in the Contract Documents.

1.9 INTENT AND INTERPRETATION

A. Drawings and Specifications supplement each other and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.

B. Drawings are partly diagrammatic and do not necessarily show exact location of new piping and existing utilities, unless specifically dimensioned.

C. Riser and other diagrams are schematic only and do not necessarily show the physical arrangement of equipment. They shall not be used for obtaining quantities or lineal runs of piping.

D. Fixtures or other pieces of equipment shall be centered on windows, wall spaces, or other items, unless specifically dimensioned otherwise.

E. Location of piping shall be checked to determine that it clears openings and structural members; that it may be properly concealed; and that it clears cabinets, lights and equipment having fixed locations.

F. Mechanical drawings shall serve as working drawings for Division 22 work. Refer to Architectural, Structural, Civil, Landscape and Electrical drawings for additional detail affecting

the installation of work. Architectural drawings shall take precedence over the Mechanical drawings if any dimensional discrepancies exist.

G. Approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details in regard to location. Exact locations are to be determined by actual measurements at the building. Not all pipe and duct offsets are indicated on the drawings.

1.10 SUBMITTAL OF EQUIPMENT FOR APPROVAL

A. Refer to Division 01 Section "Submittal Procedures" for submittal definitions, requirements and procedures. Additional requirements are listed below.

B. Shop drawings, catalog information, and material schedules shall be submitted for approval on materials and equipment prior to ordering.

C. Submittals not meeting the following requirements will be returned for revision:

1. Provide a cover page for each item or group of items (schedule group, single fixture plus trim group, etc.). Cover page shall provide a 3" x 5" space for Engineer's review stamp
2. Each cover page must be clearly identified with the project name, specification number and paragraph number.
3. Submittal package must be accompanied by an itemized index listing specification section, paragraph number, item and manufacturer; larger projects will be index tabbed by specification section with index for each section.

1.11 SCHEDULE OF VALUES

A. Furnish to the Engineer, a breakdown of the Contract for work in Division 22 within 30 days of Notice to Proceed.

B. The breakdown shall list cost for materials and labor as follows:

1. Miscellaneous Overhead Expenses
2. Plumbing Rough-in:
    a. Underground Piping
    b. Aboveground Piping
    c. Pipe Insulation
3. Plumbing Finish:
    a. Fixtures
    b. Plumbing Equipment
    c. Final Connection
4. Testing, Adjusting and Balancing
5. Commissioning Support
6. Project Closeout:
    a. O & M Manuals
    b. Record Documents

1.12 GUARANTEE

A. Guarantee satisfactory operation of material and equipment installed under Division 22. Repair or replace any defective materials, equipment, or workmanship which may show itself within one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. Where more than one manufacturer is listed, provide products of only one manufacturer for each type of product.

B. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Outdated “new” equipment is not acceptable.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Fuel-fired equipment shall be listed by a nationally recognized testing agency.

E. Furnish pressure vessels and relief valves in accordance with applicable Boiler and Unfired Pressure Vessel Laws.

2.2 EQUIPMENT AND MATERIAL SUBSTITUTIONS

A. Throughout these Contract Documents, various materials, equipment, apparatus, etc., are specified by manufacturer, brand name, type or catalog number. Such designation is to establish standards of desired quality and construction and shall be the basis of the bid.

B. Where more than one manufacturer is listed, and only one manufacturer's catalog number is indicated, that standard of quality and construction shall be maintained by materials supplied by other manufacturer(s).

C. Substitutions of equipment or materials shall be made only with written prior approval. Prior approval requests must be received at least ten (10) days prior to bid date unless otherwise instructed. Refer to Division 01 Section “Product Substitutions” for procedures in requesting substitutions. The Owner or Owner’s representative shall review all substitution requests for final approval.

D. Substitution request must include manufacturer, specific model number, special features, physical dimensions, and capacities of proposed equipment. Verify requirements before submitting for approval.

E. The Contractor shall bear full responsibility for substituted equipment and materials, including, but not limited to:

1. Costs.
2. Available space requirements
3. Effect on other trades
4. Changes in electrical requirements
5. Changes in structural requirements.

PART 3 - EXECUTION

3.1 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

3.2 COORDINATION

A. Refer to Division 01 Section “Project Coordination”.

B. Coordinate available space for equipment and systems with other trades. Refer to Architectural, Structural and Electrical Drawings for additional building details necessary for coordination.

C. Cutting, patching, wiring, finishing or any other work required for relocation of work installed due to interferences between work of the various trades will be at no additional cost to the Owner.

3.3 MANUFACTURER'S INSTRUCTIONS

A. Furnish proper equipment and/or materials required for installation as intended by the manufacturer, for all work described under Division 22. If needed for proper installation or operation, request advice and supervisory assistance from the representative of the specific manufacturer. Manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated. Promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and obtain the Architect's instructions before proceeding with the work.

3.4 LAYING OUT WORK

A. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Exact locations of such items shall be determined from the Construction Drawings. Verify physical dimensions of each item of mechanical equipment, ductwork system and piping system, to fit available space and promptly notify the Architect prior to roughing-in if conflicts appear. Coordinate equipment to available space and access routes through construction. Offsets or transitions in ductwork or piping systems required for proper system operation and/or installation, whether indicated on drawings or not, shall be provided at no additional cost to Owner.

3.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.6 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate location of concealed equipment and devices requiring access with location of access panels and doors. Allow ample space for removal of parts that require replacement or servicing.

3.7 TEMPORARY USE OF NEW EQUIPMENT

A. New equipment shall not be used for temporary plumbing unless authorized in writing by the Owner.

END OF SECTION 220500

SECTION 220505 – PROJECT CLOSEOUT FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 01 Section “Submittal Procedures”.
2. Division 01 Section “Closeout Procedures”.

1.2 SCOPE OF WORK - GENERAL

A. This section specifies procedural requirements for plumbing installations project closeout, including but not limited to:

1. Project Record Document submittal.
2. Operation and Maintenance Manual submittal.
3. Operation and Maintenance Instruction and Training.
4. Plumbing Equipment and Systems Start-Up.
5. Lubrication.
6. Final Cleaning.
7. Training Session Agenda.

1.3 PROJECT RECORD DOCUMENTS

A. Record differences between plumbing work as installed and as shown in Contract Drawings. Notations made on drawings shall be neat and legible. Comply with Division 01 Section requirements.

B. Mark drawings to indicate revisions to piping, size and location both exterior and interior; actual equipment locations; concealed equipment and control devices; mains and branches of piping systems, with valves and control devices located and numbered; actual inverts and locations of underground piping.

C. Revise equipment and fixture schedules on the Drawings to indicate actual installed manufacturer and model numbers.

D. Mark specifications to indicate change orders; actual equipment and materials used.

E. The Commissioning Authority may review record drawings once monthly for completeness.

1.4 OPERATION AND MAINTENANCE MANUALS

A. Prepare and submit Operation and Maintenance (O&M) Manuals for plumbing systems provided. Comply with Division 01 Section requirements.

B. Manual binder shall have permanent lettering of a contrasting color. Information to be included on the binder is as follows:

1. The front cover shall be lettered as follows:

PLUMBING

OPERATION AND MAINTENANCE

MANUAL

(PROJECT NAME)

(CITY AND STATE)

(YEAR)

OWNER:	(NAME)
ARCHITECT:	(NAME
MECHANICAL ENGINEER:	L&S ENGINEERING ASSOCIATES, INC.
GENERAL CONTRACTOR:	(NAME)
PLUMBING CONTRACTOR:	(NAME)

2. The spine shall be lettered as follows:

PLUMBING O & M MANUAL (Year)
(Project Name)

C. Provide master index at beginning of Manual showing sections and items included. Use plastic tab indexes for sections of Manual.

D. Cover section: List name, address, and phone number of Project Architect, General Contractor, Mechanical Engineer, Plumbing Contractor and all Plumbing Sub-Contractors. Provide a list of equipment suppliers with address and phone number.

E. Provide a separate section for each Section of the Specifications. Provide index for each section listing equipment included. Include all items specified.

F. Include descriptive literature (manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined. Data sheets shall be originals or clean copies of originals. Copies of faxes are not acceptable.

G. One draft copy of the manual shall be submitted to both the Engineer and Commissioning Authority for review, comment and approval, as applicable, at least 15 days prior to substantial completion or training, whichever is first. After approval, submit 3 copies of manual to Architect for approval unless otherwise directed by Division 01 Section requirements. Information to be included in manual:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping shut-down, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.
5. Schematic control diagrams for each automatic control system. Mark correct operating setting for each control instrument on these diagrams.
6. Valve schedule indicating the valve symbol (tag number), valve location by room number and description, valve purpose and system served, and valve size. Provide 1 corresponding set of full size plumbing prints showing these valve locations for cross-reference. A second complete set of valve schedules (8 1/2 in. x 11 in.) encased in clear plastic laminate and fitted in an aluminum holding frame shall be furnished to the Owner.
7. Test records and certifications.
8. Equipment start-up reports.
9. Warranty information and letters of guarantee.
10. Instruction period checklist for each equipment item.

H. Complete O&M Manual shall be available for use by Owner's representatives during instruction and training sessions.

1.5 OPERATION AND MAINTENANCE INSTRUCTION AND TRAINING

A. Instruct Owner's Representative(s) in the Operation and Maintenance procedures described in Operation and Maintenance Manual. Comply with Division 01 Section requirements.

B. Enlist services of qualified personnel, including each sub-trade and factory trained specialists for each major piece of equipment, to attend training sessions and provide operation and maintenance instructions.

C. The Commissioning Authority is responsible for preparing the final list of equipment requiring training for the Owner’s personnel. Additional training sessions may be required by the owner based on staffing requirements. Training sessions shall be scheduled with the Commissioning Authority at least two weeks in advance. Prior to scheduling, the contractor must submit a lesson plan to the Commissioning Authority with topics to be covered during training, a list of persons recommended to attend, and any documents or other audio visual aids that will be used in the training sessions.

D. Sign in sheets shall be used for all attendees, including manufacturer’s, vendor’s and contractor’s personnel. Obtain written sign off on all training sessions from the Commissioning Authority and Owner.

E. Allow a minimum of 4 hours instructional time per equipment category. Refer to individual Division 22 sections for additional instruction/training requirements."

F. All plumbing systems shall be properly functioning prior to instruction period.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PLUMBING EQUIPMENT AND SYSTEMS START-UP

A. Provide the services of a factory-authorized service representative to test and inspect unit installation, provide start-up service and demonstrate and train Owner's maintenance personnel.

B. Include certification of factory-authorized representative status as part of equipment submittal from manufacturer. Include copies of any installation and start-up instructions, manufacturer's checklists and other forms used in start-up as part of the equipment submittal. These instructions and checklists will be utilized by the Commissioning Authority in developing start-up and functional performance testing procedures in accordance with Division 01 Section "Commissioning Requirements", and Division 22 Section "Commissioning of Plumbing". Upon successful completion of equipment start-up, a copy of all manufacturer's forms will be given to the Commissioning Authority for enclosure in the records.

C. Include written start-up reports with test data for equipment in Operation and Maintenance Manual.

D. All construction debris, including electrical wiring debris shall be removed from units prior to equipment start up. Areas surrounding and served by equipment being started must be free of construction debris, sheetrock dust and any materials that may adversely affect the equipment.

3.2 LUBRICATION

A. Lubricate all pieces of equipment in accordance with Manufacturer's written instructions prior to project closeout. Include a listing of all equipment with the date of final lubrication in Operation and Maintenance manual.

3.3 FINAL CLEANING

A. Refer to Division 01 general requirements for final cleaning.

B. At time of final cleanup, clean all fixtures and equipment and leave in condition for use intended. Vacuum cabinet interiors of control panels, etc. to remove all construction debris including electrical wiring debris.

3.4 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development,

testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

PART 4 - APPENDIX TO SECTION 220505

4.1 GOALS OF THE TRAINING SESSION

A. Inform maintenance staff of minimum requirements for maintaining equipment installed on this project. Minimum training required to satisfy this goal is listed in Suggested Training Agenda. Additional requirements may apply as appropriate to equipment installed.

B. In addition to the general goal stated above, the Owner has the following specific goals which the training session must satisfy:

1. Train janitorial staff how to replace filters and strainers.
2. Train maintenance staff regarding standard operating parameters of equipment.
3. Train maintenance staff regarding the potential failure modes of equipment and appropriate actions to take should such failures occur.
4. Train maintenance staff how to test status of water treatment.
5. Train Administrative staff how to adjust temperature settings, where appropriate.

C. Personnel who will be attending the training session are varied. Contractor should design the training session as appropriate to audience as listed below:

1. Maintenance Staff
   a. Attending: Head of Maintenance, Assistant Head of Maintenance, Maintenance Mechanic(s).
   b. These personnel have several years experience in maintaining systems similar to those used in this project. General training session should be provided as a refresher course in system maintenance requirements.
   c. Beyond the understanding general system requirements, individuals should be able to identify specific maintenance requirements of particular equipment used on this project.
   d. At end of the training session, the maintenance staff should be able to prepare a maintenance schedule, based on information provided in this training program.
2. Janitorial Staff
   a. Attending: Lead janitor, assistant lead janitor, line janitor(s).
   b. These personnel have little experience in maintaining systems of the kind used on this project.
   c. Training for these individuals should focus on the basic, day to day maintenance required to keep system in normal operating condition.
   d. At the end of training session, these individuals should be able to respond to comfort complaints and emergencies by taking corrective action or by contacting appropriate maintenance personnel.
3. Administrative Staff
   a. Attending: School Principal, Assistant Principal, Secretaries, other staff.
   b. These personnel have little or no experience operating systems of the kind used on this project.
   c. Training for these individuals should consist of instruction regarding normal operating procedures; what systems should be expected to do; what systems should not be expected to do.

d. At the end of training session, these individuals should be able to respond to comfort complaints and emergencies by making minor adjustments or by contacting appropriate maintenance personnel.

4.2 SAMPLE TRAINING AGENDA

A. This agenda shown on the following pages represents the minimum training required. Contractor shall prepare a specific agenda for this project as appropriate for equipment provided.

B. Final agenda shall provide the names of the contractors and manufacturer's representatives responsible for training in the locations identified as [Contractor] and [Mfr's Rep.].

C. In space labeled "Acknowledged" in the agenda, the Owner will indicate those areas for which training was received and accepted as adequate to satisfy training requirements.

SAMPLE TRAINING AGENDA

Date: _____
Time: _____
Location: _____
Goals of the training: _____
For the Owner to know the maintenance requirements of the installed plumbing systems.

Time	Topic	Presented by	Acknowledged
1 hour	System Overview		
	- Plumbing system Overview	[Contractor]	_____
4 hours	Specific Equipment Maintenance Requirements - Plumbing		
	- Water Heaters	[Mfr's Rep]	_____
	- Hot Water Circulation Pumps	[Contractor]	_____
	- Water Softeners	[Mfr's Rep]	_____
	- Thermostatic Mixing Valves	[Mfr's Rep]	_____
	- Water Hammer Arresters	[Contractor]	_____
	- Backflow Preventer Assemblies	[Contractor]	_____
	- Valves, general	[Contractor]	_____
	- Flushometer Valves	[Contractor]	_____
	- Plumbing Fixtures	[Contractor]	_____
	- Trap Primers	[Contractor]	_____

Attendees: (list names or attach a separate sign-in sheet)

_____
_____
_____
_____
_____

Training was provided for the attendees listed, on the agenda items acknowledged above.

Signed _____ Date _____
Owner's Representative

END OF SECTION 220505

SECTION 22 05 07 – PLUMBING DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to work of this section.

1.2 SUMMARY

A. Include all labor, equipment, and materials necessary to complete demolition of existing plumbing systems as shown on the drawings and described herein.

B. Mechanical Services to areas occupied by Owner shall be maintained.

C. Related Sections include the following:

1. Division 01 Section, “Summary” for phasing requirements.
2. Division 01 Section, “Execution”.
3. Division 02 Section, “Selective Demolition” for general demolition requirements and procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

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

PART 2 - SALVAGE

2.1 MATERIALS OWNERSHIP

A. Except for items or materials to be reused, salvaged, reinstalled or otherwise indicated to remain owner’s property, demolished materials shall become Contractor’s property and removed from Project site.

B. Transport and legally dispose of off-site, all materials resulting from demolition not being salvaged.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Condition and Premises: The Owner assumes no responsibility for condition of areas to be demolished. General conditions existing at time of inspection for bidding purposes will be maintained by Owner.

B. Partial Removal: Items of salvageable value to Contractor indicated to be removed may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed. Storage or sale of removed items on site will not be permitted.

C. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.

D. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.

E. Existing Utility Services: Maintain existing utilities indicated to remain, keep in service and protect against damage during demolition operations.

F. Cut and/or patch and repair all existing floor, wall and roof penetrations not being re-used. Comply with Division 01 Section requirements.

G. All roof penetrations that are re-used shall be inspected and made air and water tight.

H. Not all piping or equipment items are shown on drawings. Other demolition may be required.

I. Any existing piping that is to be reused or left in existing position shall have the opening of such covered and protected during demolition and construction until final connections can be made.

J. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment. Equipment removal shall include removal of all connecting piping, etc., either to a point below floor behind wall surface, etc.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

K. If pipe, insulation, or equipment to remain is damaged in appearance during construction, or is rendered unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

END OF SECTION 22 05 07

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to plumbing systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. Equipment installation requirements common to equipment sections.
8. Painting.
9. Supports and anchorages.
10. Access doors.
11. Through-penetration fire stop systems.
12. Excavation and backfill.
13. Cutting and patching.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PVC: Polyvinyl chloride plastic.
3. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.
5. Access Doors.
6. Through-Penetration Fire Stop Systems.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

E. “Lead-Free” Compliance: All components, products, and assemblies used in potable domestic water systems shall have a lead content less than 0.25%, defined as “lead-free”.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers listed.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free; 95.6% tin/4% copper/0.4% silver solder; 440-500 deg.F melting range.

F. Brazing Filler Metals: AWS A5.8, BCuP-5, copper-phosphorus alloys, 15% silver, 1190-1480 deg.F melting range.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

I. PVC to ABS Piping Transition: ASTM D 3138.

2.4 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:
   a. Precision Plumbing Products, Inc.
   b. Sioux Chief Manufacturing Co., Inc.
   c. Victaulic Co. of America.

2.5 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:
   a. Advance Products & Systems, LLC.
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 22 gage minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. PVC Pipe: ASTM D 1785, Schedule 40.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.8 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.9 ACCESS DOORS

A. Description: Access doors, non-rated and fire-rated for ceiling and wall surfaces.

B. Manufacturers:

1. Acudor Products, Inc.
2. Cesco Products.
3. Elmdor/Stoneman; Div. Of Acorn Engineering Co.
4. Karp Associates.

5. Milcor .

C. Flush, Insulated, Fire-Rated Access Doors and Trimless Frames: Fabricated from steel sheet.

1. Locations: Gypsum board wall and ceiling surfaces.
2. Fire-Resistance Rating: One and a half hours, “B” label.
3. Temperature Rise Rating; 250 degrees at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
5. Frame: Minimum 0.060 inch thick sheet metal with drywall bead.
6. Hinges: Continuous piano hinge.
7. Automatic Closer: Spring type.
8. Lock and Latching: Prep for 1-1/8” mortised cylinder lock to accept Sargent keyed cylinder core provided by Division 08 supplier.

D. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Gypsum board wall and ceiling surfaces.
2. Door: Minimum 0.060 inch thick sheet metal, set flush with exposed face flange of frames.
3. Frame: Minimum 0.060 inch thick sheet metal with 1 inch wide surface-mounted trim.
4. Hinges: Continuous piano hinge.
5. Lock and Latching: Prep for 1-1/8” mortised cylinder lock to accept Sargent keyed cylinder core provided by Division 08 supplier.

E. Flush Access Doors and Trimless Frames: Fabricated from steel sheet.

1. Locations: Gypsum board wall and ceiling surfaces.
2. Door: Minimum 0.060 inch thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060 inch thick sheet metal with drywall bead.
4. Hinges: Continuous piano hinge.
5. Lock and Latching: Prep for 1-1/8” mortised cylinder lock to accept Sargent keyed cylinder core provided by Division 08 supplier.

2.10 THROUGH-PENETRATION FIRE STOP SYSTEMS

A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
3. Fire-resistance-rated floor assemblies.
4. Fire-resistance-rated roof assemblies.

B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor

areas:
Penetrations located outside wall cavities.

1. Penetrations located outside fire-resistive shaft enclosures.
2. Penetrations located in construction containing fire-protection-rated openings.
3. Penetrating items larger than 4-inch diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

D. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.

E. Related sections include the following:

1. Division 07 Section “Firestopping”.
2. Division 22 Sections specifying piping penetrations.

F. Submittals:

1. Product Data: For each type of through-penetration firestop system product indicated.
2. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.
3. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

G. Manufacturers:

1. Bio-Fireshield
2. Firestop Systems Inc.
3. Hilti Construction Chemicals, Inc.
4. International Protective Coatings Corp.
5. RectorSeal Corporation .
6. 3M Fire Protection Products.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. 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.

C. Drawing plans, schematics, and diagrams indicate required minimum pipe sizes. Where commercially manufactured pipe is not available in size indicated for intended pipe material, use next larger pipe size.

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. Do not run piping directly over electrical panels or switchgear.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

H. Install piping to permit valve servicing.

I. Install piping at indicated slopes.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

L. Install piping to allow application of insulation.

M. Cap or seal temporary openings in piping during construction. Remove caps or seals for final connections.

N. Select system components with pressure rating equal to or greater than system operating pressure.

O. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:
    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    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 Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge andset screw or spring clips.
    f. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.

P. Sleeves are not required for core-drilled holes.

Q. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions where specifically indicated and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.
    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint.

R. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

S. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

T. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

U. Fire-Barrier Penetrations:

1. Use metallic piping only for fire-barrier penetrations. Transition from system pipe material to penetration material as required.
2. Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

V. Verify final equipment locations for roughing-in.

W. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. 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.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using AWS A5.8, BAg1, 15% silver alloy brazing filler metal.

F. 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.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each threaded valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect galvanized or black steel piping to copper piping and fittings. Where a union type connection is required, provide a brass union.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of mechanical systems, equipment, and components is specified in Division 09 Section "Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.7 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.8 ACCESS DOORS

A. Provide access doors wherever required to service valves, dampers, fire dampers, motor or any other items of equipment where concealed, unless specifically indicated on the drawings to be furnished under other Section(s).

B. Size and locate access doors for service and maintenance of equipment items to allow adequate access for required service.

C. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

D. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

E. Adjust doors and hardware after installation for proper operation.

F. Label access doors.

3.9 THROUGH-PENETRATION FIRESTOP SYSTEMS

A. Examination:

1. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation:

1. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer:
2. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Through-Penetration Firestop System Installation:

1. General: Install through-penetration firestop systems in accordance with manufacturer's written installation instructions and published drawings for products and applications indicated.
2. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

D. Cleaning and Protection:

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

3.10 EXCAVATION AND BACKFILL

A. Provide necessary excavation, shoring, and backfilling required for proper installation of mechanical work.

B. During excavation, stockpile material satisfactory for backfilling in an orderly manner at a distance from the banks of the trench equal to half the depth of the excavation, but in no instance closer than 2 feet. Remove excavated material not required or not satisfactory for backfill from the site and dispose of properly. Grading shall be done as necessary to prevent surface water from flowing into the excavation. Remove accumulated water to maintain stability of the bottom and sides of excavation.

C. Excavate trenches to depth required to establish indicated slope and invert elevations and to support bottom of piping or conduit on undisturbed soil. Trenches shall be of uniform width, sufficient to provide ample working room and a minimum of 12 inches of clearance on both sides of pipe or conduit.

D. Grade bottoms of trenches to provide uniform bearing and support for bottom quadrant of each section of pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing.

E. Remove stones of 2 inches or greater in any dimension, or as recommended by pipe manufacturer, whichever is smaller, to avoid point bearing. Where unyielding material is encountered in the bottom of trench, remove such material 6 inches below required grade and replaced with materials described below for bedding.

F. Bedding and initial backfill material: Clean, sand-gravel mixture free from organic matter and conforming to the following gradation when tested in accordance with ASTM D 2940.

U.S. Standard Sieve Size	Percent Passing
1 inch	100
No. 200	0-10

G. Backfill: Satisfactory soil materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP, free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

H. Place bedding and initial backfill material to a depth of 6 inches over the top of piping. Bring material up evenly on both sides of pipe for full length of pipe.

I. Backfill to the required grade in layers not exceeding 4 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines otherwise specified. Compact top 12 inches below subgrade and each layer of backfill at 95 percent maximum dry density (ASTM D 1557) under structures, building slabs, steps, pavements and walkways. Compact the top 6 inches below subgrade and each layer of backfill at 90 percent maximum dry density (ASTM D 1557) under lawn or unpaved areas.

J. Do not cover underground lines until installation has been approved by the inspector having jurisdiction and Owner's Representative.

K. Cut trenches within 5 feet of footings or under footings only after approval of the Architect.

L. Provide bracing and shoring where depth of excavation or character of ground render it necessary for personnel protection. Comply with local and state safety laws and regulations.

M. Remove bracing and shoring materials before backfilling except where necessary to insure against caving.

N. Provide securely constructed barricades around excavation.

O. Exercise extreme care while excavating in the area of utilities, carefully check for location of possible utilities, whether shown on the drawings or not, and establish location of cutoff valves for ready shut-off of service in case of emergency. Assume complete responsibility for all damage to any utilities caused in excavating as well as damage to personnel and property caused by said damaged utilities whether shown on drawings or not.

3.11 CUTTING AND PATCHING

A. Comply with Division 01 Section “Cutting and Patching” for general requirements for cutting and patching.

B. Cutting shall be performed with masonry saws, core drills or similar equipment to provide neat and uniform openings.

C. Patching shall match adjacent surfaces in materials and finish. Do not endanger or damage installed work through procedures and processes of cutting and patching.

D. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations. will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover work to provide for installation of ill-timed work.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Remove samples of installed work as specified for testing.

5. Install equipment and materials in existing structures.
6. Upon written instructions from the Architect, uncover and restore work to provide for observation of concealed work.

G. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by new work.

H. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

I. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.12 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 220509

SECTION 220519 – METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following meters and gages for plumbing piping:

1. Thermometers.
2. Gages.
3. Test plugs.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

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

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 listed.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers:

1. Marsh Bellofram.
2. MILJOCO Corporation.
3. Tel-Tru.
4. Trerice, H. O. Co.
5. Weiss Instruments, Inc.
6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
7. Winters Instruments.

B. Case: Die-cast aluminum, 9 inches long.

C. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Window: Glass.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

G. Stem: Metal, for thermowell installation and of length to suit installation.

H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem.

1. Material: Brass, for use in copper piping.
2. Material: Steel, for use in steel piping.
3. Extension-Neck Length: Nominal thickness of 2 inches, but not less than thickness of insulation. Omit extension neck for sockets for piping not insulated.
4. Insertion Length: To extend to center of pipe, minimum insertion length 2-1/2 inches.

2.4 PRESSURE GAGES

A. Manufacturers:

1. AMETEK, Inc.; U.S. Gauge Div.
2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
3. Marsh Bellofram.
4. MILJOCO Corporation.
5. Tel-Tru.
6. Trerice, H. O. Co.
7. Weiss Instruments, Inc.
8. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
9. WIKA Instrument Corporation.
10. Winters Instruments.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Dry type, cast aluminum, 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass.
8. Ring: Stainless steel.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.

10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.
2. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.5 TEST PLUGS

A. Manufacturers:

1. Flow Design, Inc.
2. MG Piping Products Co.
3. Peterson Equipment Co., Inc.
4. Sisco Manufacturing Co.
5. Trerice, H. O. Co.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: Two self-sealing rubber valves.

1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be chlorosulfonated synthetic rubber.
2. Insert material for air or water service at minus 30 to plus 275 deg F shall be EPDM.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install liquid-in-glass thermometers in the following locations:

1. Outlet of each water heater.
2. Where indicated on Drawings.

B. Provide the following temperature ranges for thermometers:

1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.
2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install dry-case-type pressure gages in the following locations:

1. Discharge of each pressure-reducing valve.
2. Building water-service entrance.
3. Where indicated on Drawings.

3.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install thermowells with socket extending a minimum of 2 inches into fluid or to center of pipe and in vertical position in piping tees where thermometers are indicated. Install utilizing thermal conductive paste or other approved material.

C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

D. Install needle-valve and snubber fitting in piping for each pressure gage for fluids.

E. Provide test plugs at the following locations whether indicated on plans or not:

1. Adjacent to all gauges, temperature or pressure sensors, and thermometers. If instruments/ sensors are grouped, one test plug will suffice if provided in a common location.
2. Adjacent to the supply and discharge of all pumps and manual flow control devices.
3. Adjacent to each temperature control sensor thermowell.

F. Restricting devices (pressure reducing valves, etc.) shall not be placed between test plugs and device being tested.

G. Install flow indicators, in accessible positions for easy viewing, in piping systems.

3.4 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

3.5 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.6 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 220519

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following general-duty valves for plumbing piping:

1. Ball valves.
2. Butterfly valves.
3. Swing check valves.
4. Gate valves.

B. Related Sections include the following:

1. Division 22 piping Sections for specialty valves applicable to those Sections only.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:

1. WOG: Non-shock Water-Oil-Gas working pressure rating, psig.
2. SWP: Steam working pressure rating, psig.
3. EPDM: Ethylene-propylene-diene terpolymer rubber.
4. PTFE: Polytetrafluoroethylene plastic.
5. OS&Y: Outside stem and yoke.
6. TFE: Tetrafluoroethylene plastic.
7. MSS: Manufacturer's Standardization Society of the Valve and Fittings Industry.
8. PPS: Polyphenylene sulfide.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances.

B. Maintenance Data: For each type of valve indicated to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for building services piping valves.

B. ASME Compliance for Bronze Valves: ASME B16.24.

C. "Lead-Free" Compliance: All components, products, and assemblies used in potable domestic water systems shall have a lead content less than 0.25%, defined as "lead-free".

D. MSS Compliance:

1. SP-67: Butterfly valves.
2. SP-70: Cast Iron Gate Valves, Flanged and Threaded Ends.
3. SP-80: Bronze Gate, Globe, Angle and Check Valves.
4. SP-110: Ball Valves, Threaded and Solder Joint Ends.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Conbraco/Apollo Industries
2. Hammond Valve
3. Milwaukee Valve Company
4. NIBCO, Inc.
5. Stockham
6. Red-White Valve Corp.

2.2 VALVES, GENERAL

A. Valve Type/Manufacturer: Valves of same type shall be of same manufacturer.

B. Refer to Part 3 "Valve Applications" Article for applications of valves.

C. Bronze Valves: NPS 2 and smaller with threaded or solder-joint ends, unless otherwise indicated.

D. Iron Valves: NPS 2-1/2 and larger with flanged ends or grooved ends, unless otherwise indicated.

E. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Flanges: ASME B16.10 for iron valves; ASME B16.24 for bronze valves.

G. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

H. Valve Actuators:

1. Handwheel: For valves other than quarter-turn types.
2. Lever Handle: For quarter-turn valves NPS 6 and smaller.

I. Extended Valve Stems: On insulated valves.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, General: MSS SP-110.

B. Two-Piece Ball Valves: Bronze body with full port, hard chrome-plated solid brass or bronze ball, reinforced TFE seats and PTFE packing, adjustable packing nut, blowout-proof brass stem,

threaded or solder-joint ends; 150 SWP/600 WOG, lead content less than 0.25% for potable water systems.

2.4 BRONZE CHECK VALVES

A. Bronze Check Valves, General: MSS SP-80.

B. Horizontal Swing Check Valves: Bronze body, threaded cap, bronze or TFE disc, integral bronze seats, threaded or solder-joint ends; minimum 125 SWP/200 WOG, lead content less than 0.25% for potable water systems.

2.5 CAST-IRON GATE VALVES

A. Cast-Iron Gate Valves, General: MSS SP-70.

B. Gate Valves: Cast iron body, bolted bonnet, OS&Y, rising stem, bronze trim, cast iron handwheel, solid wedge, non-asbestos packing, gland follower, flanged ends; 125 SWP/200 WOG.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

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

B. 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.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. 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.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball valves; Gate valve for main water service.
2. Throttling Service: Ball valves.

B. If valves with specified SWP or WOG ratings are not available, the same types of valves with higher SWP or WOG ratings may be substituted.

C. DOMESTIC POTABLE WATER PIPING: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: 600 WOG, full port, bronze body, lead content less than 0.25%.
2. Swing Check Valves, NPS 2 and Smaller: 125 SWP/200 WOG, bronze body, lead content less than 0.25% for potable water systems.
3. Gate Valves, NPS 2-1/2 and Larger: 125 SWP/200 WOG, bronze trim, iron body.

D. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or solder-joint ends.
2. For Copper Tubing NPS 2-1/2 and Larger: Flanged ends.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

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.

F. Install union adjacent to each threaded end valve on the downstream side, and at final connection to each piece of equipment.

3.4 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for basic piping joint construction.

3.5 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.

3.6 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 220523

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes hangers and supports for plumbing piping and equipment.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pipe Hangers:
    a. Anvil International, Inc.
    b. Globe Pipe Hanger Products, Inc.
    c. Erico/Michigan Hanger Co., Inc.
    d. PHD Manufacturing, Inc.
    e. Thomas & Betts
    f. Tolco Inc.
    g. Unistrut Corp.
2. Channel Support Systems:
    a. Erico/Michigan Hanger Co., Inc.; O-Strut Div.
    b. Thomas & Betts Corp.
    c. Tolco Inc.
    d. Unistrut Corp.

3. Thermal-Hanger Shield Inserts:
   a. Erico/Michigan Hanger Co., Inc.
   b. PHS Industries, Inc.
   c. Pipe Shields, Inc.
   d. Rilco Manufacturing Co., Inc.
   e. Value Engineered Products, Inc.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

1. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.
2. Nonmetallic Coatings: Plastic coating, jacket or liner.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
2. Nonmetallic Coatings: Plastic coating, jacket or liner.

C. Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.

1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
2. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
4. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
5. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

A. Mechanical-Anchor Fasteners: Insert-wedge type zinc-coated steel, for use in hardened Portland cement with pull-out, tension and shear capacities appropriate for supported loads and building materials where used.

B. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

C. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification 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. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
4. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
5. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30.
6. 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 and with U-bolt to retain pipe.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification 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.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification 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. 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.
10. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification 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 by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

D. 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. Make allowance for pipe insulation as required.

E. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

F. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

G. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.9.
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 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.
5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting.

B. Galvanized Surfaces: Clean welds, bolted connections and abraded area and apply galvanizing repair paint.

3.7 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 220529

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following plumbing identification materials and their installation:

1. Equipment markers.
2. Access panel and door markers.
3. Pipe markers.
4. Valve tags.
5. Valve schedules.
6. Ceiling grid markers.

1.3 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. Valve numbering scheme.

D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Terminology: Match schedules as closely as possible.
2. Data:
   a. Name and plan number.
   b. Equipment service.
3. Size: 2-1/2 by 4 inches for equipment.

B. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide two, 1/8-inch holes for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
3. Pipes with OD, Including Insulation, Less Than 6 Inches: Either full-band pipe markers extending 360 degrees around pipe at each location or strip-type pipe markers.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with approved numbering scheme . Provide 5/32-inch hole for fastener.

1. Material: 0.032-inch- thick brass
2. Material: 3/32-inch- thick laminated plastic with 2 black surfaces and white inner layer.
3. Valve-Tag Fasteners: Brass wire-link or beaded chain.
4. Size: 1-1/2 inch diameter (minimum).

B. Isolation Valves: Provide a reflective sticker or tape on all isolation valve tags to facilitate locating isolation valves (not required within mechanical room).

2.4 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: Single-thickness glass.

2.5 CEILING GRID MARKERS

A. Description: ½-inch diameter, reflective, color coded with self-adhesive.

PART 3 - EXECUTION

3.1 GENERAL

A. All identification shall use the room numbers assigned by the Owner. Obtain a list of room numbers from the Owner's Representative prior to preparing identification.

3.2 EQUIPMENT IDENTIFICATION

A. Install equipment markers with permanent adhesive on or near each major item of plumbing equipment.

1. Letter Size: Minimum 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances.
2. Locate markers where accessible and visible from ground or floor level. Include markers for the following general categories of equipment:
   a. Meters, and similar units.
   b. Pumps and similar motor-driven units.
   c. Tanks and pressure vessels.
   d. Water-treatment systems, and similar equipment.

B. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pre-tensioned pipe markers. Use size to ensure a tight fit.
2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe for strip-type pipe markers.

3. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; mechanical rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 25 feet along each run. Reduce intervals in areas of congested piping and equipment.
7. Piping above removable acoustical ceilings.

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; plumbing fixture supply stops; 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.

3.5 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.6 CEILING GRID MARKERS

A. Install ceiling grid markers on the T-bar grid directly below the location of valves to be identified.

B. Install ceiling grid markers at all locations of the following above accessible ceilings:

1. Plumbing valves: Blue

3.7 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.8 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

3.9 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 220553

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes insulation systems for plumbing piping.

1.3 DEFINITIONS

A. ASJ: All-service jacket.

B. FSK: Foil, scrim, kraft paper.

C. PVC: Polyvinyl chloride.

D. SSL: Self-sealing lap.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. For adhesives, sealants and mastics: Documentation including printed statement of VOC content.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application.

1.8 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 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 INSULATION MATERIALS

A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Thermal conductivity (k-value) not greater than 0.27 at 75 deg F mean temperature.

1. Products:
   a. Aeroflex USA Inc.
   b. Armacell LLC
   c. K-Flex USA.

D. Mineral-Fiber, Preformed Pipe Insulation:

1. Products:
   a. Fibrex Insulations Inc.; Coreplus 1200.
   b. Johns Manville; Micro-Lok.
   c. Knauf Insulation; 1000 deg. Pipe Insulation.
   d. Manson Insulation Inc.; Alley-K.
   e. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Thermal conductivity (k-value) not greater than 0.23 at 75 deg F mean temperature. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

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. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

B. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96, 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, 59 percent by volume and 71 percent by weight.
4. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 200 deg F.
3. Solids Content: 63 percent by volume and 73 percent by weight.
4. Color: White.

2.5 SEALANTS

A. Joint 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:
   a. White for ASJ and PVC.
   b. Aluminum for FSK and metal jackets.

B. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.7 REMOVABLE INSULATING FABRIC FITTING COVERS

A. For Systems Requiring Vapor Barrier: Minimum 2-inch thick thermal insulating wool (TIW, Type 1) blanket insulation fully enclosed in minimum 17 oz./sq. yd. glass fiber fabric impregnated with silicone rubber; stainless steel fasteners and 18 gage stainless steel lacing wire.

B. For Systems Not Requiring Vapor Barrier: Minimum 2-inch thick thermal insulating wool (TIW, Type 1) blanket insulation fully enclosed in minimum 17 oz./sq. yd. glass fiber fabric; stainless steel fasteners and 18 gage stainless steel lacing wire.

2.8 REUSABLE VALVE WRAPS

A. Flexible, reusable insulation system for valves, calibrated balancing valves, automatic flow control valves, strainers, and similar piping components.

B. Complete with a flexible outer cover constructed of DuPont Tychem QC fabric which shall resist punctures and is impermeable to water; hook and loop closures; 1-inch thick glass fiber blanket insert.

C. "NO SWEAT" Reusable Valve Wraps: www.valvewraps.com; 1-800-416-4610.

2.9 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; 20 mils thick; roll stock ready for shop or field cutting and forming.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. 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 and mechanical joints.
4. Factory-fabricated tank heads and tank side panels.

2.10 TAPES

A. ASJ Tape: White vapor-barrier tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

B. PVC Tape: White vapor-barrier tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

2.11 SECUREMENTS

A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

B. Wire: 0.062-inch soft-annealed, stainless steel.

C. Bands: Stainless-steel or aluminum with wing seals.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or barriers, jackets, and thicknesses required for each item of equipment, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 to 6 inches o.c.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. Do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Below-Grade 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 Non-Rated Interior Wall and Partition Penetrations): 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. Firestopping and fire-resistive joint sealers are specified in Division 07 Section "Fire-Resistive Joint Systems" and 22 Section “Common Materials and Methods for Plumbing”.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies according to Division 07 Section "Fire-Resistive Joint Systems" and Division 22 Section “Common Materials and Methods for Plumbing”.

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install reusable valve wrap or preformed valve covers manufactured of same material as pipe insulation when available.
2. Install insulation to flanges as specified for flange insulation application.
3. 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.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 4 to 6 inches o.c.
3. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-barrier integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation. Where preformed fitting insulation is not commercially available, use 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.
3. Insulate tee fittings with preformed fitting insulation. Where preformed fitting insulation is not commercially available, use 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 reusable valve wrap or preformed fitting insulation. Where preformed fitting insulation is not commercially available, use 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.
5. Insulate strainers using reusable valve wrap or preformed fitting insulation. Where preformed fitting insulation is not commercially available, use 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. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. 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. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
8. Install reusable valve wrap or removable insulating fabric fitting covers on valves, elbows, tees, and flanges, strainers or other irregularly-shaped fittings or components where fitted PVC covers are not practical or available.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Fire-suppression piping.
2. Drainage piping located in crawl spaces.
3. Below-grade piping.
4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. If more than one material is listed for a piping system, selection from materials listed is Contractor’s option.

B. Service: Domestic Hot and Recirculated Hot Water.

1. Operating Temperature: 60 to 140 deg F.
2. Insulation Material: Mineral-Fiber or Flexible Elastomeric.
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. Pipe, 1-1/4 inch and less: 1.0 inch

b. Pipe, 1-1/2 inch and greater: 1.5 inch

4. Field-Applied Jacket: PVC for piping exposed in public spaces to 9 feet above floor level.
5. Vapor Barrier Required: No.

C. Service: Domestic Cold Water.

1. Operating Temperature: 35 to 60 deg F.
2. Insulation Material: Mineral-Fiber or Flexible Elastomeric.
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. Pipe, 1-1/4 inch and less: 1.0 inch
   b. Pipe, > 1-1/2 inch: 1.5 inch
4. Field-Applied Jacket: PVC for piping exposed in public spaces to 9 feet above floor level.
5. Vapor Barrier Required: Yes.

D. Service: Storm Drainage (Rainwater) and Overflow Conductors.

1. Operating Temperature: 32 to 100 deg F.
2. Insulation Material: Mineral-Fiber.
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. All pipe sizes: 1.0 inch
4. Field-Applied Jacket: PVC for piping exposed in public spaces to 9 feet above floor level.
5. Vapor Barrier Required: Yes.

E. Service: Roof Drain Bodies.

1. Operating Temperature: 32 to 100 deg F.
2. Insulation Material: Mineral-Fiber.
3. Insulation Thickness: 1.0 inch
4. Vapor Barrier Required: Yes.

3.10 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 220700

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes domestic water piping and water meters inside the building.

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and fittings.
2. Division 22 Section "Domestic Water Piping Specialties" for water distribution piping specialties.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Service Piping: 160 psig.
2. Domestic Water Distribution Piping: 125 psig.

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings and water meters.

B. Water Samples: Specified in "Cleaning" Article in Part 3.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

C. “Lead-Free” Compliance: All components, products, and assemblies used in potable domestic water systems shall have a lead content less than 0.25%, defined as “lead-free”.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

C. Transition Couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 PEX TUBE AND FITTINGS (1-INCH AND SMALLER)

A. PEX Distribution System: ASTM F 877, SDR 9 tubing.

1. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.
2. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.

2.3 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

B. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings.
2. Copper Pressure-Seal Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper fittings with EPDM O-rings, inboard bead design, compression crimp on both sides of the seal bead, minimum 200-psig working-pressure rating at 250 deg F.
    a. Manufacturers:
        1) NIBCO
        2) Viega
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

2.4 VALVES

A. Refer to Division 22 Section "General Duty Valves for Plumbing Piping" for general-duty valves.

B. Refer to Division 22 Section "Domestic Water Piping Specialties" for balancing and drain valves.

2.5 WATER METER

A. Manufacturer:

1. Badger Meter, Inc. (no substitutions)

B. Compound-Type Water Meter: Cast bronze housing, NSF/ANSI Standard 61, AWWA C702, compound totalization meter with dual chambers, 150-psig minimum working-pressure rating, Class 150 flanged end connections, magnetic drive with registration in cubic feet.

C. Plate Strainer: Dual flange, cast bronze, removable 316 stainless steel screen, drain plug, 150-psig minimum working-pressure rating.

D. Remote Registration System: Encoder-type with piezoelectric, solid-state switch signal transmitting assembly, low-voltage connecting wiring, and remote register assembly.

E. Schedule: Badger Meter Model “Recordall Compound” Series, size 2”-RTR, 0.25-200 GPM operating range, 170 GPM maximum continuous flow, 5.4 psig pressure loss at maximum continuous flow; with 2” plate strainer.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

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 may be used on aboveground piping, unless otherwise indicated.

C. Underground Domestic Water Service Piping: Use the following piping materials for each size range:

1. NPS 2 and Smaller: Soft copper tube, Type K; copper pressure fittings; and brazed joints.
2. NPS 3 and NPS 4: Hard copper tube, Type K; copper pressure fittings; and brazed joints.

D. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:

1. NPS 1 and Smaller: PEX tube; fittings for PEX tube; crimped joints.
2. NPS 4 and Smaller: Hard copper tube, Type L; copper pressure fittings and soldered joints.
3. NPS 4 and Smaller: Hard copper tube, Type L; copper pressure-seal fittings and joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Ball valves.
2. Throttling Duty: Ball valves.
3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

3.4 PIPING INSTALLATION

A. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for basic piping installation.

B. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.

C. Install copper tubing according to CDA's "Copper Tube Handbook."

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each domestic water service.

E. Install aboveground domestic water piping level without pitch and plumb.

F. Install PEX piping with loop at each change of direction of more than 90 degrees.

G. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

H. Perform the following steps 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. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.

I. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

J. Check plumbing specialties and verify proper settings, adjustments, and operation.

K. Energize pumps and verify proper operation.

3.5 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for basic piping joint construction.

B. PEX Piping Joints: Join according to ASTM F 1807.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, 95-5 tin antimony solder; and ASTM B 828 procedure, unless otherwise indicated.

D. Pressure-Seal Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.6 WATER METER INSTALLATION

A. Rough-in domestic water piping for water meter installation and install water meter according to manufacturer’s instructions.

B. Install water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter. Valves for bypass shall be lockable type.

C. Install remote registration system according to standards of Owner.

D. Coordinate meter installation with City of Selah requirements.

3.7 VALVE INSTALLATION

A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment.

B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops.

C. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.

E. Do not install valves over electrical outlets or electrical equipment.

F. Valves shall be installed so they are easily accessible for maintenance.

3.8 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing:

1. NPS 1-1/2 and Smaller: 6 feet.
2. NPS 2 and Larger: 10 feet.

E. Install supports for vertical copper tubing every 10 feet.

F. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing:

1. NPS 1 and Smaller: 32 inches.

G. Install hangers or supports for vertical PEX piping at base and each floor with mid-floor guides.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.9 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow 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 service piping with shutoff valve, and extend and connect to the following:

1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code.
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union or flange for each connection.

3.10 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

B. Test domestic water piping 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 domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. 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 to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

3.11 ADJUSTING

A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

3.12 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to the following:
    c. 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.
    d. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    e. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities. Provide one copy of cleaning report and acceptance report from a certified laboratory or Health Department upon completion of cleaning and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.13 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development,

testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 221116

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Backflow preventers
2. Balancing valves
3. Compact Circulators (Recirculation Pumps)
4. Thermostatic water mixing valve assembly
5. Strainers
6. Outlet boxes
7. Key-operation hydrants
8. Trap seal primer valves
9. Drain valves
10. Downspout Boot
11. Miscellaneous piping specialties

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, and pressure gages.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 125 psig.

1.4 SUBMITTALS

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

B. Maintenance Data: For domestic water piping specialties to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water piping specialties.

C. “Lead-Free” Compliance: All components, products, and assemblies used in potable domestic water systems shall have a lead content less than 0.25%, defined as “lead-free”.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Operating Key Handles: Equal to 100 percent of amount installed for each key-operated hose bibb and hydrant installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers listed.

2.2 BACKFLOW PREVENTERS

A. Manufacturers:

1. Ames Co., Inc.
2. Conbraco Industries, Inc.
3. Watts Industries, Inc.
4. Zurn Industries, Inc.; Wilkins Div

B. General: ASSE standard, backflow preventers.

1. NPS 2 and Smaller: Bronze body with threaded ends.
2. NPS 2-1/2 and Larger: Bronze, cast-iron, or stainless-steel body with flanged ends.
3. Interior Components: Corrosion-resistant materials.
4. Strainer: On inlet.

C. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

D. Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.

1. NPS 2 and Smaller: Quarter-turn, full-port ball valves.
2. NPS 2-1/2 and Larger: Outside screw and yoke (OS&Y) gate valves.
3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

E. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves. Stainless steel construction for water supply serving carbonated water beverage systems.

1. NPS 2 and Smaller: Quarter-turn, full-port ball valves.
2. NPS 2-1/2 and Larger: Quarter-turn, full-port ball valves.
3. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

2.3 BALANCING VALVES

A. Manufacturers:

1. Armstrong Pumps, Inc.
2. Flow Design, Inc.
3. Bell & Gossett
4. Hays Fluid Control Div.
5. Taco, Inc.
6. Tour & Andersson, Inc.
7. Watts Industries, Inc.
8. Red White

B. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator.

1. NPS 2 and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends

2.4 COMPACT CIRCULATORS (RECIRCULATION PUMPS)

A. Manufacturers:

1. Armstrong Pumps, Inc.
2. Grundfos Pumps Corp.
3. Bell & Gossett
4. Taco, Inc.

B. Description: Horizontal, in-line, replaceable-cartridge-design circulator; rated for 125-psig minimum working pressure and minimum continuous water temperature of 225 deg F. Bronze or stainless steel body.

1. Pump and Motor Assembly: On common shaft in hermetically sealed unit without stuffing box or mechanical seal, and with manufacturer's standard cooling and lubrication system.
2. Impeller: Corrosion-resistant material.
3. End Connections for NPS 2 and Smaller: Threaded. Pumps available only with flanged ends may be furnished with threaded companion flanges.
4. Motor: Single speed, unless otherwise indicated.

2.5 THERMOSTATIC WATER MIXING VALVES

A. Manufacturers:

1. Lawler Manufacturing Company, Inc.
2. Leonard Valve Company.
3. Mark Controls Corp.; Powers Process Controls.
4. Symmons Industries, Inc.
5. Watts Industries, Inc.
6. Acorn Controls

B. General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and thermometer.

1. Type: Bimetal thermostat, operation and pressure rating 125 psig minimum.

C. Manifolded, Thermostatic Water Mixing-Valve Assemblies: Factory-fabricated unit consisting of single combination thermostatic water mixing valve.

1. Arrangement: One combination large-flow, small-flow thermostatic water mixing valve with flow-control valve. Include thermometers, factory- or field-installed inlet and outlet valves, check valves, balancing valves, recirculation pump and other indicated options.
2. Include piping, valves, and unions.
3. Piping Component Finish: Rough bronze.

2.6 STRAINERS

A. Manufacturers:

1. Conbraco Industries, Inc.
2. Mueller Steam Specialty
3. Spirax Sarco, Inc.
4. Victaulic Company of America.
5. Watts Industries, Inc.

B. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens .

1. Pressure Rating: 125-psig minimum steam working pressure, unless otherwise indicated.
2. NPS 2 and Smaller: Bronze body, with female threaded ends; 20 mesh, 0.033-inch openings.
3. NPS 2-1/2 and Larger: Cast-iron body, ANSI 125 flanged ends; 20 mesh, 0.033-inch openings for steam and water service to NPS 3; 0.045-inch perforations for steam service NPS 4 to NPS 6; 0.062-inch perforations for steam service NPS 8 and larger; 0.125-inch perforations for water service NPS 4 and larger.
4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
   a. Drain: Factory- or field-installed, hose-end drain valve.

2.7 OUTLET BOXES

A. Manufacturers:

1. Acorn Engineering Company.
2. Guy Gray Manufacturing Co., Inc.

B. General: Recessed-mounting outlet boxes with supply fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections.

C. "Lead-Free" Compliance: All components, products, and assemblies used in potable domestic water systems shall have a lead content less than 0.25%, defined as "lead-free".

D. Clothes Washer Outlet Boxes: With hot- and cold-water hose connections, drain, and the following:

1. Box and Faceplate: White epoxy or powder-coated steel.
2. Shutoff Fitting: Combination, single lever.
3. Drain: NPS 2 slip-nut drain kit.
4. Schedule (Referenced Manufacturer: Guy Gray Manufacturing Co.):
   a. Symbol "CWR": Guy Gray Model WB200, for 2-inch drain.

2.8 KEY-OPERATION HYDRANTS

A. Manufacturers:

1. Acorn Engineering
2. Smith, Jay R. Mfg. Co.
3. Woodford Manufacturing Co.
4. Zurn Industries, Inc.

B. General: ASSE 1019, key-operation hydrant with pressure rating of 125 psig.

1. Inlet: NPS ¾ threaded joint.
2. Outlet: ASME B1.20.7, garden-hose threads.

C. Hose Bibb: Surface mount with wall flange; 18 gage, type polished chrome finish exterior, , cartridge-operated type bronze valves with vandal-resistant lockshields, removable loose key wheel handles and screwdriver operated stops; integral atmospheric backflow preventer, 3/4 inch solder water inlets, 3/4 inch male hose thread outlet.

1. Schedule (Referenced Manufacturer: Woodford):
   a. Symbol "HB": Woodford #24 PC

D. Non-freeze Concealed-Outlet Wall Hydrants: ASSE 1019, self-drainable with integral non-removable hose-connection vacuum breaker or backflow preventer, casing and operating rod to match wall thickness, stainless steel box with full cover opening, “Water“ on cover, “T” handle key, quarter-turn operation.

1. Schedule (Referenced Manufacturer: Smith, Jay R. Mfg. Co.):
   a. Symbol “NFWH”: Smith, J.R.; Fig. 5509-QT-W

2.9 TRAP SEAL PRIMER VALVES

A. Vacuum Breaker Type Trap Seal Primer Valves: ASSE 1044, Chrome-plated, cast-brass, NPS 1-1/2, flushometer valve vacuum breaker with NPS 3/8 outlet tubing.

1. Manufacturers:
   a. Smith, Jay R. Mfg. Co.

B. Electronic Trap Priming Assembly: Low voltage, solenoid valve with cord, NPS ½ inlet, 1-inch diameter 1-inch air gap with alignment legs, NPS ½ outlet, constructed of type K copper tubing. Precision Plumbing Products Model SP-500-24V “SOLO-PRIME” electronic trap priming assembly.

1. Manufacturer:
   a. Precision Plumbing Products, Inc.
   b. Sioux Chief Mfg. Co.

2.10 DRAIN VALVES

A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 ball valve, rated for 400-psig minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.

1. Inlet: Threaded or solder joint.
2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.

B. Stop-and-Waste Drain Valves: MSS SP-110, ball valve, rated for 200-psig minimum CWP or MSS SP-80, Class 125, gate valve; ASTM B 62 bronze body, with NPS 1/8 side drain outlet and cap.

2.11 DOWNSPOUT BOOT

A. Downspout Boot: Cast iron transition, connecting sheet metal exposed downspout to below grade cast iron soil piping. Securement strap as part of the casting, with 5/16” holes. Contractor to coordinate sizes with drawings. Paint to match building (see architectural specifications).

1. Manufacturer:
   a. Jay R. Smith 1786-24

2.12 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

1. Manufacturers:
   a. Amtrol, Inc.

b. Josam Co.
c. Precision Plumbing Products, Inc.
d. Sioux Chief Mfg. Co.
e. Watts Industries, Inc.
f. Zurn Industries, Inc.; Wilkins Div.

B. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig; integral or field-installed, nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.

1. Finish for Equipment Rooms: Rough bronze, chrome or nickel plated.
2. Finish for Service Areas: Rough bronze, Chrome or nickel plated.
3. Finish for Finished Rooms: Chrome or nickel plated.
4. Operation for Equipment Rooms: Wheel handle or operating key.
5. Operation for Service Areas: Wheel handle.
6. Operation for Finished Rooms: Wheel handle.
7. Include operating key with each operating-key hose bibb.
8. Include integral wall flange with each chrome- or nickel-plated hose bibb.

C. Water Hose Reel: Open stainless-steel hose reel, NSF approved, high flow spray valve with swivel, spring rewind, 125 psig maximum operating pressure, permanently lubricated bearings, stainless steel wall bracket, 15 feet of 3/8-inch I.D. hose with stainless-steel front trigger water gun outlet.

1. Schedule:
   a. Symbol “HS” (for Kitchen): T&S Brass #B-7112-08H-MV-2522-24

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers where indicated; in same room as connected equipment or system where possible if not specifically indicated.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Backflow preventers installed more than 5 feet above floor or ground level shall have a permanent platform under for maintenance personnel to stand on.
4. Do not install bypass piping around backflow preventers.
5. Test each backflow prevention assembly by a Washington State Department of Health (DOH) certified tester at the time of installation. Furnish written report of test to Owner

and authority having jurisdiction. Provide one copy to the Commissioning Authority for enclosure with commissioning report.

C. Install calibrated balancing valves of size specified at indicated locations. Transition from system piping size to balancing valve as required.

D. Install strainers on supply side of each control valve, water regulator, and solenoid valve.

E. Install plumbing pumps according to manufacturer's written instructions and with access for periodic maintenance, including removing motors, impellers, couplings, and accessories.

F. Install thermostatic water mixing valves and required specialties in accordance with manufacturer’s instructions. Provide heat trap of recommended depth in hot water inlet piping where required by mixing valve location, check valves and adjusting valves as required. Adjust mixing valves in accordance with manufacturer’s instructions. Furnish written report to include in Operation and Maintenance Manual.

G. Trap seal primers are not generally indicated on the Drawings. Trap seal primers shall be drainage-type used with flushometer valves. At locations remote from a flushometer valve fixture, or where indicated on the drawings, trap seal primers shall be electronic trap priming assemblies. See Division 23 Section “HVAC Instrumentation and Controls” for control of priming assemblies.

H. Locate trap seal primers in accessible locations. Where located in finished area, conceal in wall and provide access door. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain, floor-sink, or open-hub drain or other drain body, trap, or inlet fitting. Adjust valve for proper flow.

1. Outlet Piping: Soft copper tube, Type K; or crosslinked polyethylene (PEX) tubing and compression adapter fittings.

I. Size and install water hammer arresters in accordance with manufacturer’s recommendations and instructions. Install arresters at quick-closing valves, solenoid valves, and at each plumbing fixture or battery of fixtures in domestic water systems. Provide accessible shutoff valve for isolation of each water hammer arrester installation. Arrestors shall be accessible for servicing or replacement. Refer to Division 22 Section “Common Materials and Methods for Plumbing”

J. Install individual shutoff ball valve in each water supply to water piping specialties. Install shutoff valves in accessible locations. Refer to Division 22 Section "General Duty Valves for Plumbing Piping" for general-duty valves.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Install shutoff valve and strainer on suction side of circulator pumps, and check valve and balancing valve on discharge side of pumps. Install valves same size as connected piping.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each thermostatic water mixing valve, backflow preventer and specialty valve.

1. Refer to Division 22 Section "Identification for Plumbing Piping and Equipment" for nameplates and signs.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each backflow preventer according to authorities having jurisdiction and the device's reference standard.

3.5 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 221119

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes natural gas piping, specialties, and accessories within the building and to locations indicated. Products include the following:

1. Pipe, tube, fittings, and joining materials.
2. Protective pipe and fitting coating.
3. Specialty valves.
4. Line Pressure regulators.
5. Sub-metering meters.

1.3 PROJECT CONDITIONS

A. Gas System Pressures: Two pressure ranges. Primary pressure is at least 2.0 psig but not more than 5.0 psig, and is reduced to secondary pressure of 0.5 psig (14 inches w.c.) or less.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data.
2. Line Pressure regulators. Include pressure rating, capacity, and settings.
3. Service meters. Include pressure rating and capacity of selected models.

B. Operation and Maintenance Data: For natural gas specialties and accessories to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

B. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ANSI Standard: Comply with ANSI Z223.1, "National Natural Gas Code."

D. FM Standard: Provide components listed in FM's "Fire Protection Approval Guide" if specified to be FM approved.

E. IAS Standard: Provide components listed in IAS's "Directory of A. G. A. and C. G. A Certified Appliances and Accessories" if specified to be IAS listed.

F. UL Standard: Provide components listed in UL's "Gas and Oil Equipment Directory" if specified to be UL listed.

1.6 CODES AND STANDARDS

A. Code Compliance: Comply with most current adopted edition of following:

1. International Natural Gas Code (IFGC).

1.7 COORDINATION

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Gas Valves, NPS 2 and Smaller:
   a. Hammond Valve
   b. Jomar International, Ltd.
   c. Kitz Corp. of America.
   d. Milwaukee Valve Co., Inc.
   e. Mueller Co.; Mueller Gas Products Div.
   f. Nibco, Inc.
   g. Watts Industries, Inc.; Water Products Div.
2. Plug Valves, NPS 2-1/2 and Larger:
   a. Flow Control Equipment, Inc.
   b. Milliken Valve Co., Inc.
   c. Nordstrom Valves, Inc.
   d. Olson Technologies, Inc.; Homestead Valve Div.
   e. Walworth Co.
3. Line Pressure Regulators:
   a. American Meter Company.
   b. Fisher Control Valves and Regulators; Division of Emerson Process Management.
   c. Invensys.
   d. Maxitrol Company.
   e. Sensus.
4. Sub-Metering Meters:
   a. Elster/American Meter Co.
   b. Badger Meter, Inc.; Utility Products Div.
   c. Invensys.
   d. National Meter Industries, Inc.
   e. Schlumberger Limited; Gas Div.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PIPES, TUBES, FITTINGS, AND JOINING MATERIALS

A. Steel Pipe: ASTM A 53; Type E ; Grade B; Schedule 40; black.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
3. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
4. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
5. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
6. Joint Compound and Tape: Suitable for natural gas.
7. Steel Flanges and Flanged Fittings: ASME B16.5.
8. Gasket Material: Thickness, material, and type suitable for natural gas.

B. Transition Fittings: Type, material, and end connections to match piping being joined.

2.4 SPECIALTY VALVES

A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Gas Stops, NPS 2 and Smaller: Bronze body with AGA stamp, ball type with chrome-plated brass ball and lever handle; 2-psig minimum pressure rating.

C. Gas Valves, NPS 2 and Smaller: ASME B16.33 and CSA International-listed bronze body and 125-psig pressure rating.

D. Plug Valves, NPS 2-1/2 and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig pressure rating.

2.5 LINE PRESSURE REGULATORS

A. Description: Single-stage, lock-up design, suitable for natural gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent. Regulator seat shall seal the regulator orifice when the connected appliance or equipment is off and there is no demand for gas.

1. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
2. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
3. Line Pressure Regulators: ANSI Z21.80 with 2-psig- minimum inlet pressure rating.

B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

2.6 SUB-METERING METERS

A. Sub-metering Meters: Positive-displacement type suitable for natural gas service. Include one-piece, die-cast aluminum case; oil impregnated, self-lubricated bearings; molded duramic diaphragams; graphite-filled, phenolic valves; temperature compensation; corrosion-resistant internal components,; 5 psig maximum inlet pressure; automatic meter reader compatibility; and flow registered in cubic feet with meter pulsing index.

1. Meter Pulsing Index: Index mounted, reed switch pulser providing one contact closure per cubic foot of gas consumption for use with data collection system. Contact rating of 10W, 200 VDC.
2. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Type: ANSI B109.1, diaphragm.

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.

1. 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 section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.

3.3 SERVICE ENTRANCE PIPING

A. Extend natural gas piping and connect to natural gas distribution for service entrance to building.

3.4 PIPING APPLICATIONS

A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.

B. Natural Gas Piping: Use any of the following piping materials for each size range:

1. NPS 1/2 and Smaller: Steel pipe, malleable-iron threaded fittings, and threaded joints.
2. NPS 3/4 and NPS 1: Steel pipe, malleable-iron threaded fittings, and threaded joints.
3. NPS 1-1/4 to NPS 2: Steel pipe, malleable-iron threaded fittings, and threaded joints.
4. NPS 2-1/2 and Larger: Steel pipe, steel welding fittings, and welded joints.

3.5 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig or Less: Gas stop.

B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig: Gas stop or gas valve.

C. Piping Line Valves, NPS 2 and Smaller: Gas valve.

D. Piping Line Valves, NPS 2-1/2 and Larger: Plug valve.

E. Valves at Service Meter, NPS 2 and Smaller: Gas valve.

F. Valves at Service Meter, NPS 2-1/2 and Larger: Plug valve.

3.6 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 23 Section "Common Materials and Methods for HVAC".

B. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.

1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums.
2. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.
   a. Exception: Tubing passing through partitions or walls.
3. In Walls: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in masonry walls, subject to approval of authorities having jurisdiction.
4. Prohibited Locations: Do not install gas piping in or through circulating air ducts, chimneys or gas vents (flues), ventilating ducts, or elevator shafts.
   a. Exception: Accessible above-ceiling space specified above.

C. Drips and Sediment Traps: Install drips at points where condensate may collect. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

D. Install natural gas piping at uniform grade of 0.1 percent slope upward toward risers.

E. Use bell reducer or eccentric reducer fittings to make reductions in pipe sizes. Install eccentric reducer fittings with level side down.

F. Connect branch piping from top or side of horizontal piping.

G. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

H. Install shutoff valve on inlet of each line pressure regulator.

I. Install flanges on valves, specialties, and equipment having NPS 2-1/2 and larger connections.

J. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

3.7 JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 22 Section "Common Materials and Methods for Plumbing".

B. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.8 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

B. Install hangers for horizontal steel piping with the following maximum spacing:

1. NPS 1/2: Maximum span, 6 feet.
2. NPS ¾ and 1: Maximum span, 8 feet.
3. NPS 1-1/4 and Larger: Maximum span, 10 feet.

3.9 CONNECTIONS

A. Drawings indicate general arrangement of natural gas piping, fittings, and specialties.

B. Install piping adjacent to appliances to allow service and maintenance.

C. Connect piping to appliances with shutoff valve, unions and appliance gas connector. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

3.10 SUB-METERING METER INSTALLATION

A. Install sub-metering meters downstream from service pressure regulators.

B. Install gas valve upstream from each service meter.

3.11 SEISMIC RESTRAINTS

A. Application: Gas piping 2-1/2-inches and larger.

B. Selection and installation of seismic restraint devices shall be in accordance with the most recent edition of the IBC and ASCE-7 (American Society of Civil Engineers), “Minimum Design Loads for Buildings and Other Structures”.

C. Install vibration-isolation and seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for components.

3.12 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each pressure regulator, and specialty valve.

1. Nameplates, pipe identification, and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.13 PAINTING

A. Paint all piping visible at the building exterior.

1. Types:
   a. Industrial corrosion and rust inhibiting primer; one (1) coat.
   b. Industrial silicone alkyd high gloss enamel; two (2) coats.
   c. Color: Industrial Gray.
2. Application:
   a. Roll, brush, or spray. Use appropriate protection of other adjacent finishes, building entrances, and pedestrian traffic ways. Do not paint indoors.
   b. Primer to be used prior to or immediately following installation. Clean, prepare, and touch-up disturbed areas as necessary.

3.14 FIELD QUALITY CONTROL

A. Test, inspect, and purge piping according to NFPA 54 and requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Verify capacities and pressure ratings of pressure regulators, valves, and specialties.

D. Verify correct pressure settings for pressure regulators.

E. Verify that specified piping tests are complete.

3.15 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

3.16 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 221235

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.

B. Related Sections include the following:

1. Division 22 Section "Sanitary Waste Piping Specialties" for soil, waste, and vent piping systems specialties.

1.3 DEFINITIONS

A. The following are industry abbreviations for plastic piping materials:

1. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS (See Part 3 for application)

A. Pipe and Fittings: CISPI 301, ASTM A 888 or ASTM A 74, Service class. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be of domestic manufacturer only.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.

1. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.
   a. NPS 1-1/2 to NPS 4: 3-inch- wide shield with 4 bands.
   b. NPS 5 to NPS 10: 4-inch- wide shield with 6 bands.
   c. ANACO Husky SD 2000, Mission Rubber Co. Heavyweight (HW), or approved equal.

2.3 STAINLESS-STEEL DRAINAGE PIPE AND FITTINGS FOR GREASE WASTE APPLICATIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. BLÜCHER; A Watts brand.
2. Josam Company.

B. Description: Comply with requirements of ASME A112.3.1, drainage pattern.

C. Material: Type 316L stainless steel.

D. Pipe Construction: Seamless.

E. Joints: Socket and spigot ends, push-fit with EPDM gasketed sockets.

2.4 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, Schedule 40, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Aboveground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:

1. NPS 1-1/2 to NPS 6: Hubless, cast-iron soil pipe and fittings, heavy-duty stainless steel couplings. Required for sound sensitive areas, Libraries, Classrooms, Assembly areas etc.

2. NPS 1-1/2 to NPS 6: Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints not allowed in return air plenums.
3. NPS 1-1/2 to NPS 6: Copper DWV tube, copper drainage fittings, and soldered joints.
4. NPS 2 to NPS 6: Stainless-steel pipe and fittings, gasketed joints.
5. Food Service/Kitchen waste piping: Stainless-steel or copper tube only.

C. Underground, Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:

1. NPS 2 to NPS 6: Hubless, cast-iron soil pipe and fittings, heavy-duty stainless steel couplings.
2. NPS 2 to NPS 6: Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. NPS 2 to NPS 6: Stainless-steel pipe and fittings, gasketed joints.
4. Food Service/Kitchen waste piping: Cast-iron or stainless-steel only.

3.3 PIPING INSTALLATION

A. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for basic piping installation.

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for wall penetration systems.

D. 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."

E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

F. Install vent piping free from drops or sags, graded and connected as to drip back by gravity to the drainage pipe it serves.

G. 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.

1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

J. Do not use PVC plastic piping in return air plenums.

K. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

L. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

M. Prime and paint (chrome or silver finish) all exposed copper waste drainage piping in Food Service/Kitchen fixture applications.

3.4 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for basic piping joint construction.

B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Hubless Joints: Make with rubber gasket and sleeve or clamp.

C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

D. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

3.5 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing:

1. NPS 1-1/2 to NPS 12: At every other joint, unless over 4 feet, then support each joint.

E. Install supports for vertical cast-iron soil piping at base and each floor, a maximum of 15 feet.

F. Install hangers for copper or stainless-steel tubing with the following maximum horizontal spacing:

1. NPS 1-1/2 and Smaller: 6 feet.
2. NPS 2 and Larger: 10 feet.

G. Install supports for vertical copper or stainless-steel tubing at base and each floor, a maximum of 10 feet.

H. Install hangers for PVC piping with the following maximum horizontal spacing:

1. NPS 1-1/2 to NPS 12: 4 feet.

I. Install supports for vertical PVC piping at base and each floor with mid-floor guides.

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union or flange for each connection.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. 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.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 221316

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sanitary waste drainage piping specialties:

1. Dishwasher air-gap fittings
2. Miscellaneous piping specialties
3. Flashing materials
4. Cleanouts
5. Floor drains
6. Floor sinks
7. Grease Interceptor

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, and pressure gages.

1.3 DEFINITIONS

A. The following are industry abbreviations for plastic piping materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Sanitary Waste and Vent Piping: 10-foot head of water.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics.

B. Maintenance Data: For drainage piping specialties to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic piping components. Include marking "NSF-DWV" on plastic drain, waste, and vent piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers listed.

2.2 DISHWASHER AIR-GAP FITTINGS

A. Symbol DW Description: ASSE 1021, fitting suitable for use with domestic dishwashers and for deck mounting; with plastic body, chrome-plated brass cover; and capacity of at least 5 gpm; and inlet pressure of at least 5 psig at temperature of at least 140 deg F.

2.3 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

A. Roof Piping and Conduit Flashings: One-piece, 18” x 18” 24 gage galvanized steel base with friction-seal, elastomeric sealing collar.

B. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

C. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semi-open top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

2.4 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-lb/sq. ft., 0.0625-inch thickness.

B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

C. Fasteners: Metal compatible with material and substrate being fastened.

2.5 CLEANOUTS

A. Manufacturers:

1. MIFAB
2. Sioux Chief Mfg. Co.
3. Smith, Jay R. Mfg. Co.

4. Tyler Pipe, Wade Div.
5. Watts Industries, Inc., Drainage Products Div.
6. Zurn Industries, Inc.

B. Cleanouts, General: Comply with ASME A112.36.2M.

1. Body or Ferrule Material: Cast iron.
2. Clamping Device: Required.
3. Outlet Connection: Spigot or no-hub.
4. Closure: Brass plug with tapered threads.
5. Adjustable Housing Material: Cast iron with threads.
6. Frame and Cover Material and Finish: Nickel-bronze.
7. Frame and Cover Shape: Round.
8. Top Loading Classification: Light Duty for finished interior floor service; Heavy Traffic Duty for exterior service.

C. Cleanout Schedule (Reference Manufacturer: Smith, Jay R. Mfg. Co):

1.	Finished Floor:	Smith, Jay R.; Fig. 4023S or Fig. 4033L.
2.	Carpeted Floor:	Smith, Jay R.; Fig. 4023S-X or Fig. 4033L-X.
3.	Terrazzo Floor:	Smith, Jay R.; Fig. 4183S or Fig. 4193L.
4.	Wall:	Smith, Jay R.; Fig. 4422T.
5.	Exterior:	Smith, Jay R.; Fig. 4253S or Fig. 4263L.

2.6 FLOOR DRAINS

A. Manufacturers:

1. MIFAB
2. Sioux Chief Mfg. Co.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe, Wade Div.
5. Watts Industries, Inc., Drainage Products Div.
6. Zurn Industries, Inc.

B. Floor Drains, General: Comply with ASME A112.21.1M.

1. Body Material: Cast iron.
2. Clamping Device: Required.
3. Outlet: Bottom.
4. Top of Body and Strainer Material: Nickel bronze or cast iron as scheduled.
5. Trap Material: Cast iron.
6. Trap Pattern: Standard P-trap.
7. Trap Features: Trap seal primer valve drain connection.

C. Floor Drain Schedule (Reference manufacturer: Smith, Jay R. Mfg. Co):

1. Symbol “FD-1” (standard finished floor drain with square adjustable strainer head): Smith, Jay R.; Fig. 2005Y-B.
2. Symbol “FD-2” (standard finished floor drain with round adjustable strainer head): Smith, Jay R.; Fig. 2005Y-A.
3. Symbol “FD-3” (standard finished floor drain with 7-inch diameter round, anti-flood design adjustable strainer head): Smith, Jay R.; Fig. 2005Y-A-F37
4. Symbol “FD-4” (medium-duty utility floor drain with 8-1/2 inch diameter round top and slotted sediment bucket): Smith, Jay R.; Fig. 2110Y-B.

2.7 FLOOR SINKS

A. Manufacturers:

1. MIFAB
2. Sioux Chief Mfg. Co.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe, Wade Div.
5. Watts Industries, Inc., Drainage Products Div.
6. Zurn Industries, Inc.

B. Floor Sinks, General:

1. Body Material: 16 gauge minimum, Type 304 fabricated stainless steel.
2. Outlet: Bottom.
3. Top Grate Material: Stainless steel.
4. Top Grate Configuration: As scheduled.
5. Dome Bottom Strainer Material: Stainless steel with stainless steel body.
6. Trap Material: Cast iron.
7. Trap Pattern: Standard P-trap.

C. Floor Sink Schedule (Reference Manufacturer: Smith, Jay R. Mfg. Co):

1. Symbol “FS-1” (stainless steel, 12 inches square, 8 inches deep, with 1/2 grate): Smith, Jay R.; Fig. 3003-12.
2. Symbol “FS-1” (stainless steel, 12 inches square, 8 inches deep, less grate): Smith, Jay R; Fig. 3003-10.

2.8 GREASE INTERCEPTOR

A. Manufacturer:

1. Canplas Endura
2. Mifab
3. Schier Products

B. Description: Lifetime guaranteed and made of seamless, rotationally-molded high density polyethylene (HDPE) with minimum 3/8” uniform wall thickness. Interceptor shall be furnished for below grade installation. Interceptor shall be built in accordance to ASME A112.14.3 (type C), with field adjustable riser system, built-in flow control, built in test caps and three outlet options. Cover shall provide water/gas tight seal and have minimum 16,000 lbs load capacity.

C. Hydromechanical grease interceptor to be third party certified and IAPMO listed

D. Grease Interceptor Schedule:

1. Symbol “GI-1”: Schier Products Model GB-2, 50 GPM flow rate, 127 lbs. grease capacity and 20 gallon liquid capacity, anchor kit, tele-glide risers as required, clamping collar, adapter, pumpout port kit and gas/water tight composite cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install expansion joints on vertical risers, stacks, and conductors if indicated.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.
5. Locate at upper terminal of all horizontal drain lines that exceed 5 feet from drainage mains. Cleanouts not required for horizontal drain lines less than 5 feet from drainage mains, unless serving sinks or urinals.
6. Locate above each urinal.
7. Locate below each sink and mop sink.
8. Locate as required by the applicable Plumbing Code.

D. Install cleanouts with top flush with finished floor, for floor cleanouts for piping below floors.

E. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

F. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

G. Install wall cleanouts with horizontal clearance for access:

1. 2-inch diameter piping or less: 12-inches minimum.
2. Piping larger than 2-inches diameter: 18-inches minimum.

H. Install cleanouts for underfloor piping with minimum 18-inches vertical clearance and 30-inches horizontal clearance for access.

I. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

J. 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. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

K. Install floor sinks where indicated. Set rim and grate of floor sinks raised 3/8- to ½-inch above finished floor, unless otherwise indicated.

1. Install floor sink flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
2. Install individual traps for floor sinks connected to sanitary building drain, unless otherwise indicated.

L. Install interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
2. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

M. Install traps on piping specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

N. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect drainage piping specialties to piping specified in other Division 22 Sections.

D. Interceptor Connections: Connect piping, flow-control fittings, and accessories.

1. Solids Interceptors: Connect inlet and outlet.
2. Grease Interceptors: Connect inlet and outlet.

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: Solder joints of lead sheets 4-lb/sq. ft., 0.0625-inch thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors 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 in solid coating of bituminous cement.

D. Install flashing for piping and conduit passing through roofs with counterflashing or commercially made flashings.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.5 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 221319

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following gas-fired water heaters:

1. Instantaneous, tankless, gas water heaters.
2. Water heater accessories.

1.3 SUBMITTALS

A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For water heaters to include in operation and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

C. “Lead-Free” Compliance: All components, products, and assemblies used in potable domestic water systems shall have a lead content less than 0.25%, defined as “lead-free”.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gas-fired 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 Period(s): From date of Substantial Completion:
   a. Commercial Instantaneous, Gas Water Heaters:
      1) Heat Exchanger: **8** years.
      2) Controls and Other Components: 5 years.

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.

B. Description: Comply with ANSI Z21.10.3/CSA 4.3, except storage is not required.

1. Manufacturers:
   a. Rinnai
   b. Controlled Energy Corporation.
   c. NORITZ America Corporation.
   d. Paloma Industries, Inc.
   e. Takagi Industrial Co. USA, Inc.
   f.
2. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
   a. Tappings: ASME B1.20.1 pipe thread.
   b. Pressure Rating: 150 psig.
   c. Heat Exchanger: Copper tubing.
   d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
   e. Burner: For use with tankless water heaters and for natural-gas fuel.
   f. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
   g. Temperature Control: Adjustable thermostat.
   h. Jacket: Metal with enameled finish or plastic.
3. Support: Bracket for wall mounting.
      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
   c. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
   d. Jacket: Steel with enameled finish.
   e. Burner: For use with atmospheric water heaters and for natural-gas fuel.
   f. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
4. Special Requirements: NSF 5 construction.

C. Commercial, High-Efficiency, Instantaneous Tankless Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.

1. Description: Manufacturer's proprietary design to provide at least 97 percent combustion efficiency at optimum operating conditions. Following features and attributes may be modified or omitted if water heater otherwise complies with requirements for performance.
2. Storage-Tank Construction: ASME-code steel where scheduled or indicated with 150-psig minimum 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.

3. Energy Management System Interface: Normally closed dry contacts for enabling and disabling water heater.

4. Hot-Water Storage Tank: Connected with piping to circulating pump and water heater.
   a. Construction: According to ASME Boiler and Pressure Vessel Code: Section VIII, steel with 150-psig working-pressure rating.
   b. 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.
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
   e. Jacket: Steel with enameled finish.
   f. Anode Rods: Factory installed, magnesium.
   g. Drain Valve: Corrosion-resistant metal complying with ASSE 1005, factory installed.
   h. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately

2.2 COMPRESSION TANKS

A. 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.

1. Manufacturers:
   a. AMTROL Inc.
   b. Armstrong Pumps, Inc.
   c. Honeywell Sparco.
   d. Smith, A. O.; Aqua-Air Div.
   e. State Industries, Inc.
   f. Taco, Inc.
   g. Watts Regulator Co.
   h. Wessels Co.

2. Construction:
   a. Non-ASME-code steel as scheduled with 150-psig working-pressure rating.
   b. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   d. Air-Charging Valve: Factory installed.

2.3 WATER HEATER ACCESSORIES

A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.

B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.

C. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.

D. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.

1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.

E. Pressure Relief Valves: Include pressure setting less than working-pressure rating of water heater.

1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.

F. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.

G. .

H. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.

I. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test water heater storage tanks before shipment to minimum of one and one-half times pressure rating.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install commercial water heaters on concrete bases.

1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.

B. Install 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.

C. Install seismic restraints for water heaters. Anchor to substrate.

D. Install gas water heaters according to NFPA 54.

E. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.

F. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.

G. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.

H. 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.

I. Install pressure relief valves in water piping for 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 or mop sink.

J. 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 water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.

K. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing" for thermometers.

L. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves and to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

M. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.

N. Fill water heaters with water.

O. Charge compression tanks with air.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

C. Ground equipment according to Division 26 Section "Grounding and Bonding."

D. Connect wiring according to Division 26 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gas-fired, domestic water heaters.

END OF SECTION 22 34 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes plumbing fixtures, emergency plumbing fixtures, drinking fountains, water coolers and related components.

B. Related Sections include the following:

1. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, wall hydrants, thermostatic water mixing valves, and specialty fixtures not in this Section.
2. Division 22 Section "Sanitary Waste Piping Specialties" for floor drains, floor sinks, roof drains and interceptors.

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.4 SUBMITTALS

A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

1. Include summary table of plumbing fixtures, in order scheduled, listing fixture identification symbol, fixture and all related trim and accessories with manufacturers and model numbers.
2. Include single product data for accessories (p-traps, stops, supplies, ADA protective shielding guards, etc.) common to multiple fixtures. Identify which fixture symbols each accessory applies to. Do not duplicate product data for common accessories.

B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For plumbing fixtures to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements of the International Building Code (IBC) and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.

C. ANSI Standard: Comply with ANSI Z358.1, “Emergency Eyewash and Shower Equipment,”

D. NSF Standard: Comply with NSF 61, “Drinking Water System Components- Heath Effects,” for fixture materials that will be in contact with potable water.

E. Water Conservation: Comply with requirements of the Uniform Plumbing Code (UPC) as amended by Washington State Building Code Council (Chapter 51-56 WAC) for maximum water usage by plumbing fixtures.

F. ARI Standard: Comply with ARI 1010, “Self-Contained, Mechanically Refrigerated Drinking-Water Coolers, for water coolers and with ARI’s “Directory of Certified Drinking Water Coolers” for type and style classifications.

G. “Lead-Free” Compliance: All components, products, and assemblies used in potable domestic water systems shall have a lead content less than 0.25%, defined as “lead-free”.

H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Hand Sinks: NSF 2 construction.
3. Plastic Laundry Trays: ANSI Z124.6.
4. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
5. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
6. Vitreous-China Fixtures: ASME A112.19.2M.
7. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
8. Water-Closet, Flushometer Tank Trim: ASSE 1037.

I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucet Hose: ASTM D 3901.
5. Faucets: ASME A112.18.1M.
6. Hose-Connection Vacuum Breakers: ASSE 1011.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
9. NSF Materials: NSF 61.
10. Pipe Threads: ASME B1.20.1.

11. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
12. Supply and Drain Fittings: ASME A112.18.1M.

J. Comply with the following applicable standards and other requirements specified for bathtub and shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Faucets: ASME A112.18.1M.
4. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
5. Hose-Coupling Threads: ASME B1.20.7.
6. Manual-Control Antiscald Faucets: ASTM F 444.
7. Pipe Threads: ASME B1.20.1.
8. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
9. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
10. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

K. Comply with the following applicable standards and other requirements specified for miscellaneous fittings and accessories:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1M.
    a. Stops: Chrome-plated, quarter-turn ball or compression type; 1/2 inch nominal compression or threaded inlet, loose-key.
    b. Supplies: Chrome-plated; flexible tubing riser with ground joint connection to fixture and wall escutcheon.
3. Manual-Operation Flushometers: ASSE 1037.
4. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
5. Tubular Brass Drainage Fittings and Piping: ASME A112.18.2M; 17 gauge minimum; semi-cast p-traps with cleanout, 1-1/2” minimum.

L. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Grab Bars: ASTM F 446.
2. Hose-Coupling Threads: ASME B1.20.7.
3. Hot-Water Dispensers: ASSE 1023 and UL 499.
4. Off-Floor Fixture Supports: ASME A112.6.1M.
5. Pipe Threads: ASME B1.20.1.
6. Plastic Toilet Seats: ANSI Z124.5.
7. Supply and Drain Piping Protective Shielding Guards: ICC A117.1.
    a. Manufactured, molded anti-microbial protective pipe covers for covering hot and cold water supplies, stops, p-trap and drain piping; flush, snap-in tamper-resistant fasteners; white color; ADA compliant.

1.6 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lavatories, Water Closets, Urinals:
   a. American Standard.
   b. Kohler Co.
   c. Sloan
   d. Zurn Industries, Inc.
2. Mop Basins:
   a. Acorn Engineering Co.
   b. Florestone Products Co.
   c. Stern-Williams Co.
3. Sink Faucets:
   a. American Standard.
   b. Chicago Faucet Co.
   c. Delta Commercial Faucets.
   d. Elkay Mfg. Co.
   e. Kohler Co.
   f. Moen Commercial.
   g. Sloan Valve Company.
   h. T&S Brass & Bronze.
4. Flushometer Valves (Manual & Sensor):
   a. American Standard.
   b. Sloan Valve Company
   c. TOTO USA, Inc.
   d. Zurn Industries, Inc.
5. Water Closet Seats:
   a. American Standard.
   b. Bemis Mfg. Co.
   c. Beneke Corp.
   d. Centoco Mfg. Co.
   e. Church Seats
   f. Kohler Co.
   g. Olsonite Corp.
   h. Zurn Industries, Inc.
6. Fixture Supports and Carriers:
   a. Josam Co.
   b. J.R. Smith Mfg. Co.
   c. MIFAB.
   d. Tyler Pipe/Wade Div.
   e. Watts Drainage
   f. Zurn Industries, Inc.
7. Specialty Institutional (Handwash Stations) Fixtures:
   a. Acorn Engineering Co.
   b. Bradley Corporation

8. Water Coolers/ Bottle Fillers:
   a. Elkay Mfg. Co.

2.2 PLUMBING FIXTURE SCHEDULE

A. General: Basis-of-Design manufacturers and model numbers listed are for reference only for intended level of quality and required features.

B. Fixture Mounting Heights: Refer to Architectural interior elevations for fixture mounting heights.

C. Install protective shielding guards on hot and cold water supplies, stops, p-trap and drain piping for lavatories, sinks and other plumbing fixtures designated as “accessible”.

D. For water closets with manual flushometer valves, install with flushometer valve handle for use from the wide side of the water closet area

Fixtures:.

"TAL" Tank Water Closet: Gerber 21-928 bowl with 28-990 tank ADA height elongated toilet, 1.28 gallons per flush. Speedway supply with stops with plastic seat and cover. Left hand flush lever.

"TAR" Tank Water Closet: Gerber 21-928 bowl with 28-990-97 tank ADA height elongated toilet, 1.28 gallons per flush. Speedway supply with stops with plastic seat and cover. Right hand flush lever.

“LWA”: Caitlin L2016-4 with Flagstone Model 47711 L single lever faucet with pop-up drain and 1.0 gallon per minute aerator/restrictor, with p-trap, Speedway supplies with stops, and single lever faucet with pop-up drain and 1.0 gallon per minute aerator/restrictor equal AM Conservation Part No. 3010.12. Provide ADA insulation package at "LWA"

"SHA" Shower: Acorn 538ADA with wall-mounted showerhead and hand-held shower with quick-disconnect, 24” slide bar with hi-low mounting brackets, on-off pushbutton, vacuum breaker and flow control, diverter valve with ligature resistant tri-lever handle, recessed soap dish, two wall stainless steel grab bar and phenolic folding seat.

"CWR" Washing Machine Outlet Box: Symmons W-602, with wall box, 2” drain and single lever valve, provided for residential washing machine.

"MFT" Mop Sink: Acorn Model TDF-36 single compartment, floor mount, Terrazzo, complete with chrome faucet, 36”hose with wall hanger, stainless steel wall guards and dome strainer.

E. CDB Water Cooler/Bottle Filling Station (Accessible, Two-Level, Vandal Resistant): Wall-mount coolers, stainless steel, contoured basins with vandal-resistant safety bubblers, water filter, front pushbutton operation and bottom cover plates, enclosed adjustable thermostat, removable stainless steel cooler panel, wall mounting frame, cooling unit capacity of 8 gph of 50 deg.F drinking water based on 80 deg.F inlet water and 90 deg.F ambient air. Type HFC-134A refrigerant with 1/5 hp hermetic compressor, 370 watts, 5.0 FLA, 120 volt, 1 phase. Bottle filling station shall include an electronic sensor for no-touch activation with an automatic 20-second shutoff timer, bottle counter, 1.1 gpm flow rate with laminar flow outlet, filtration system, and anti-microbial protected plastic components. Furnish with manufactured dual level mounting

frame to match unit. Provide 1-1/2" p-trap with cleanout and stop. Mounting heights as indicated on Architectural interior elevations.

1. Fixture:
   a. Elkay #LVRCTL8WSK
   b. Elkay #MF200

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

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

3.2 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-hanging fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball valve if stops are not specified with fixture. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves.

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

K. Install protective shielding guards on hot and cold water supplies, stops, p-trap and drain piping for fixtures designated as accessible.

L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

M. Rough-in and install plumbing piping at heights to allow access to flushometer valve head below grab bars for maintenance.

N. Install toilet seats on water closets.

O. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

P. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

Q. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

R. Install shower, flow-control fittings with specified maximum flow rates in shower arms.

S. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

T. Install disposer in outlet of sinks indicated to have disposer.

U. Install hot-water dispensers in back top surface of sink or in counter with spout over sink.

V. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for escutcheons.

W. Set shower receptors and service basins in leveling bed of cement grout. Refer to Division 22 Section "Common Materials and Methods for Plumbing" for grout.

X. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect cold water supply piping to plumbed emergency plumbing fixtures without integral, water-tempering system.

D. Connect hot and cold water supply piping to hot and cold tempering equipment. Connect tempered water piping to emergency plumbing fixtures.

E. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary drainage and vent piping.

F. Connect drain piping from fixtures to sanitary drainage and vent piping.

G. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

H. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

I. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.

C. Adjust water flow at emergency fixtures to produce required flow and stream for all connected fixtures.

D. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

3.8 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned per Section 019113 – General Commissioning Requirements and Section 220800, Commissioning of Plumbing. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 224000

SECTION 23 05 00 – GENERAL REQUIREMENTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK – GENERAL

A. This section specifies general requirements for HVAC installations and includes requirements common to more than one section of Division 23. It expands and supplements the requirements specified in sections of Division 01.

B. Provide materials, labor, transportation, tools, permits, fees, inspections, utilities and incidentals necessary for the complete installation of HVAC work indicated and described in the Contract Documents.

C. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required for work indicated or specified under this section of work or work specified in other sections, provide material and equipment which is usually furnished with such systems in order to complete the installation, whether mentioned or not.

1.3 SEQUENCE OF WORK

A. Conduct work in sequence to provide least possible interference to the activities of the Owner, and to permit orderly transfer of activities and equipment to completed areas.

B. Work shall be substantially complete by the dates listed in Division 01 Section “Summary”.

1.4 ALTERNATES

A. Refer to Division 01 Section “Alternates” for description of alternates. Review Contract Documents for additional information.

1.5 DEFINITIONS

A. Provide: Furnish and install complete and ready for intended use.

B. Indicated: Indicated on drawings.

C. Noted: Noted on Drawings or in Specifications.

D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

H. 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.

1.6 CODES AND STANDARDS

A. Code Compliance: Comply with most current adopted edition of following:

1. International Building Code (IBC), Standards and Amendments.
2. International Mechanical Code (IMC), Standards and Amendments.
3. International Fire Code (IFC), Standards and Amendments.
4. Uniform Plumbing Code (UPC), Standards and Amendments.
5. International Fuel Gas Code (IFGC).
6. National Fire Protection Association (NFPA).
7. National Electrical Code (NEC); NFPA 70.
8. Applicable State and local codes, laws and ordinances.

1.7 SAFETY OF PERSONS AND PROPERTY

A. Comply with applicable laws, ordinances, rules and regulations of any public authority for the safety of persons and property, including requirements of the Washington Industrial Safety and Health Administration (WISHA) and/or the Occupational Safety and Health Act (OSHA) and Division 01, General and Supplementary Conditions.

1.8 PERMITS AND FEES

A. Obtain and pay for required permits and fees necessary to fully complete work included in the Contract Documents.

B. Submit applications, pay application fees and obtain approval of Spokane Regional Clean Air Agency (SRCAA) “Notice of Construction and Application for Approval” for all applicable equipment.

1.9 INTENT AND INTERPRETATION

A. Drawings and Specifications supplement each other and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.

B. Drawings are partly diagrammatic and do not necessarily show exact location of new work and existing utilities, unless specifically dimensioned.

C. Riser and other diagrams are schematic only and do not necessarily show the physical arrangement of equipment. They shall not be used for obtaining quantities or lineal runs of piping.

D. Grilles, fixtures or other pieces of equipment shall be centered on windows, wall spaces, or other items, unless specifically dimensioned otherwise.

E. Location of piping and ductwork shall be checked to determine that it clears openings and structural members; that it may be properly concealed; and that it clears cabinets, lights and equipment having fixed locations.

F. Mechanical drawings shall serve as working drawings for Division 23 work. Refer to Architectural, Structural, Civil, Landscape and Electrical drawings for additional detail affecting the installation of work. Architectural drawings shall take precedence over the Mechanical drawings if any dimensional discrepancies exist.

G. Approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details in regard to location. Exact locations are to be determined by actual measurements at the building. Not all pipe and duct offsets are indicated on the drawings.

1.10 SUBMITTAL OF EQUIPMENT FOR APPROVAL

A. Refer to Division 01 requirements for submittal definitions, requirements and procedures. Additional requirements are listed below.

B. Shop drawings, catalog information, and material schedules shall be submitted for approval on materials and equipment prior to ordering.

C. Submittals not meeting the following requirements will be returned for revision:

1. Provide a cover page for each item or group of items (schedule group, single fixture plus trim group, etc.). Cover page shall provide a 3" x 5" space for Engineer's review stamp
2. Each cover page must be clearly identified with the project name, specification number and paragraph number.
3. Submittal package must be accompanied by an itemized index listing specification section, paragraph number, item and manufacturer; larger projects will be index tabbed by specification section with index for each section.

1.11 SCHEDULE OF VALUES

A. Furnish to the Engineer, a breakdown of the Contract for work in Division 23 within 30 days of Notice to Proceed.

B. The breakdown shall list cost for materials and labor as follows:

1. Miscellaneous Overhead Expenses
2. HVAC Ductwork:
   a. Ductwork
   b. Insulation
3. HVAC Equipment:
   a. Air Moving
   b. Equipment Connections
4. HVAC Finish
5. HVAC Instrumentation and Controls:
   a. Submittal Engineering
   b. Rough-in
   c. Final
6. Testing, Adjusting and Balancing
7. Commissioning Support
8. Project Closeout:
   a. O & M Manuals
   b. Record Documents
   c. Owner Training

1.12 GUARANTEE

A. Guarantee satisfactory operation of material and equipment installed under Division 23. Repair or replace any defective materials, equipment, or workmanship which may show itself within one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. Where more than one manufacturer is listed, provide products of only one manufacturer for each type of product.

B. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Outdated "new" equipment is not acceptable.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Fuel-fired equipment shall be listed by a nationally recognized testing agency.

E. Furnish pressure vessels and relief valves in accordance with applicable Boiler and Unfired Pressure Vessel Laws.

2.2 EQUIPMENT AND MATERIAL SUBSTITUTIONS

A. Throughout these Contract Documents, various materials, equipment, apparatus, etc., are specified by manufacturer, brand name, type or catalog number. Such designation is to establish standards of desired quality and construction and shall be the basis of the bid.

B. Where more than one manufacturer is listed, and only one manufacturer's catalog number is indicated, that standard of quality and construction shall be maintained by materials supplied by other manufacturer(s).

C. Substitutions of equipment or materials shall be made only with written prior approval. Prior approval requests must be received at least ten (10) days prior to bid date unless otherwise instructed. Refer to Division 01 Section, “Substitution Procedures” for procedures in requesting substitutions. The Owner or Owner’s representative shall review all substitution requests for final approval.

D. Acceptance of substitution request signifies manufacturer recognition only. No attempt has been made to check each item as to special features, capacities, or physical dimensions required by this project. Verify requirements before submitting for approval. Acceptance of exact features, sizes, capacities, etc., all of which must meet or exceed design requirements will be determined when submitted during the construction phase.

E. Substitution request must include manufacturer, specific model number, special features, physical dimensions, and capacities of proposed equipment. Verify requirements before submitting for approval.

F. The Contractor shall bear full responsibility for substituted equipment and materials, including, but not limited to:

1. Costs.
2. Available space requirements
3. Effect on other trades
4. Changes in electrical requirements
5. Changes in structural requirements.

PART 3 - EXECUTION

3.1 SUSTAINABILITY

A. Comply with requirements of Division 01 Section “Sustainable Design Requirements”.

3.2 COMMISSIONING

A. Comply with requirements of Division 01 Section “General Commissioning Requirements” and requirements of individual Division 23 Sections for Commissioning of HVAC.

3.3 COORDINATION

A. Refer to Division 01 Section “Project Management And Coordination”.

B. Coordinate available space for equipment and systems with other trades. Refer to Architectural, Structural and Electrical Drawings for additional building details necessary for coordination.

C. Cutting, patching, wiring, finishing or any other work required for relocation of work installed due to interferences between work of the various trades will be at no additional cost to the Owner.

3.4 MANUFACTURER'S INSTRUCTIONS

A. Furnish proper equipment and/or materials required for installation as intended by the manufacturer, for all work described under Division 23. If needed for proper installation or operation, request advice and supervisory assistance from the representative of the specific manufacturer. Manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated. Promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and obtain the Architect's instructions before proceeding with the work.

3.5 EXAMINATION OF SITE

A. Visit site of proposed work and become familiar with conditions affecting work. Verify measurements at the building before beginning work.

3.6 LAYING OUT WORK

A. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Exact locations of such items shall be determined from the Construction Drawings. Verify physical dimensions of each item of mechanical equipment, ductwork system and piping system, to fit available space and promptly notify the Architect prior to roughing-in if conflicts appear. Coordinate equipment to available space and access routes through construction. Offsets or transitions in ductwork or piping systems required for proper system operation and/or installation, whether indicated on drawings or not, shall be provided at no additional cost to Owner.

3.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.8 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate location of concealed equipment and devices requiring access with location of access panels and doors. Allow ample space for removal of parts that require replacement or servicing.

3.9 TEMPORARY USE OF NEW EQUIPMENT

A. New equipment shall not be used for temporary heating, cooling or ventilation unless authorized in writing by the Owner.

END OF SECTION 23 05 00

SECTION 23 05 05 – PROJECT CLOSEOUT FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK - GENERAL

A. This section specifies procedural requirements for HVAC installations project closeout, including but not limited to:

1. Project Record Document submittal.
2. Operation and Maintenance Manual submittal.
3. Operation and Maintenance Instruction and Training.
4. HVAC Equipment and Systems Start-Up.
5. Lubrication.
6. Final Cleaning.
7. Owner Training Session Agenda.

B. Related Sections include the following:

1. Division 01 Section, “Submittal Procedures”.
2. Division 01 Section “Closeout Procedures”.

1.3 PROJECT RECORD DOCUMENTS

A. Record differences between HVAC work as installed and as shown in Contract Drawings on a set of prints of HVAC drawings furnished by Architect. Return these prints to Architect at completion of project. Notations made on drawings shall be neat and legible. Comply with Division 01 Section requirements.

B. Furnish CAD drawing files of as-built record drawings on CD ROM, AutoCad Release 2010 or later version. Comply with Division 01 Section requirements.

C. Mark drawings to indicate revisions to ductwork, size and location both exterior and interior; including locations of coils, dampers, and other control devices, filters, motors and similar items requiring periodic maintenance; actual equipment locations; concealed equipment and control devices.

D. Revise equipment and fixture schedules on the Drawings to indicate actual installed manufacturer and model numbers.

E. Mark specifications to indicate change orders; actual equipment and materials used.

1.4 OPERATION AND MAINTENANCE MANUALS

A. Prepare and submit Operation and Maintenance (O&M) Manuals for HVAC systems provided. Comply with Division 01 Section requirements.

B. Manual binder shall have permanent lettering of a contrasting color. Information to be included on the binder is as follows:

1. The front cover shall be lettered as follows:

HVAC

OPERATION AND MAINTENANCE

MANUAL

(PROJECT NAME)

(CITY AND STATE)

(YEAR)

OWNER:	(NAME)
ARCHITECT:	(NAME
MECHANICAL ENGINEER:	L&S ENGINEERING ASSOCIATES, INC.
GENERAL CONTRACTOR:	(NAME)
HVAC CONTRACTOR:	(NAME)

2. The spine shall be lettered as follows:
HVAC O & M MANUAL (Year)
(Project Name)

C. Provide master index at beginning of Manual showing sections and items included. Use plastic tab indexes for sections of Manual.

D. Cover section: List name, address, and phone number of Project Architect, General Contractor, Mechanical Engineer, HVAC Contractor and all HVAC Sub-Contractors. Provide a list of equipment suppliers with address and phone number.

E. Provide a separate section for each Section of the Specifications. Provide index for each section listing equipment included. Include all items specified.

F. Include descriptive literature (manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined. Data sheets shall be originals or clean copies of originals.[Include copies of approved submittals or shop drawings for all items requiring submittal]

G. One draft copy of the manual shall be submitted for review, comment and approval, as applicable, at least 15 days prior to substantial completion or training, whichever is first. After approval, submit 3 copies of manual to Architect for approval unless otherwise directed by Division 01 Section requirements. Information to be included in manual:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping shut-down, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

5. Schematic control diagrams for each automatic control system. Mark correct operating setting for each control instrument on these diagrams.
6. Testing, Adjusting and Balancing Report.
7. Test records and certifications.
8. Equipment start-up reports.
9. Warranty information and letters of guarantee.
10. Instruction period checklist for each equipment item.

H. Complete O&M Manual shall be available for use by Owner's representatives.

1.5 OPERATION AND MAINTENANCE INSTRUCTION AND TRAINING

A. Instruct Owner's Representative(s) in the Operation and Maintenance procedures described in Operation and Maintenance Manual. Comply with Division 01 Section requirements.

B. Enlist services of qualified personnel, including each sub-trade and factory trained specialists for each major piece of equipment, to attend training sessions and provide operation and maintenance instructions.

C. Submit training agenda, schedule and list of representatives for review 30 days prior to training sessions. Confirm attendance by written notification to all participants.

D. Prepare checklist of all equipment and systems requiring instruction and maintenance for verification and agreement by the Owner's Representative of satisfactory start up and instruction. Checklist shall include a statement of completion by the Contractor, date and topic(s) covered in each training session, and an attendance list of all participants at each training session. Submit a copy of checklist for review 30 days prior to training sessions. Include copy of the completed checklist in Operation and Maintenance Manual.

E. Refer to individual Division 23 Sections for additional instruction/training requirements.

F. All HVAC systems shall be properly functioning prior to instruction period.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 HVAC EQUIPMENT AND SYSTEMS START-UP

A. Provide the services of a factory-authorized service representative to test and inspect unit installation, provide start-up service and demonstrate and train Owner's maintenance personnel.

B. Include certification of factory-authorized representative status as part of equipment submittal from manufacturer. Include copies of any installation and start-up instructions, manufacturer’s checklists and other forms used in start-up as part of the equipment submittal.

C. Include written start-up reports with test data for equipment in Operation and Maintenance Manual.

D. All construction debris, including electrical wiring debris shall be removed from units prior to equipment start up. Areas surrounding and served by equipment being started must be free of construction debris, sheetrock dust and any materials that may adversely affect the equipment.

3.2 LUBRICATION

A. Lubricate all pieces of equipment in accordance with Manufacturer's written instructions prior to project closeout. Include a listing of all equipment with the date of final lubrication in Operation and Maintenance manual.

3.3 FINAL CLEANING

A. Refer to Division 01 general requirements for final cleaning.

B. At time of final cleanup, clean all fixtures and equipment and leave in condition for use intended. Vacuum cabinet interiors of control panels, air handling units, etc. to remove all construction debris including electrical wiring debris.

END OF SECTION 23 05 05

SECTION 23 05 07 – HVAC DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to work of this section.

1.2 SUMMARY

A. Include all labor, equipment, and materials necessary to complete demolition of existing HVAC systems as shown on the drawings and described herein.

B. Mechanical Services to areas occupied by Owner shall be maintained.

C. Related Sections include the following:

1. Division 01 Section, “Summary” for phasing requirements.
2. Division 01 Section, “Execution”.
3. Division 02 Section, “Selective Demolition” for general demolition requirements and procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

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

PART 2 - SALVAGE

2.1 MATERIALS OWNERSHIP

A. The Owner shall have first salvage rights to all removed fixtures and equipment. Coordinate selection with the Owner's Representative.

B. Except for items or materials to be reused, salvaged, reinstalled or otherwise indicated to remain owner’s property, demolished materials shall become Contractor’s property and removed from Project site.

C. Transport and legally dispose of off-site, all materials resulting from demolition not being salvaged.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Condition and Premises: The Owner assumes no responsibility for condition of areas to be demolished. General conditions existing at time of inspection for bidding purposes will be maintained by Owner.

B. Partial Removal: Items of salvageable value to Contractor indicated to be removed may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed. Storage or sale of removed items on site will not be permitted.

C. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.

D. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.

E. Existing Utility Services: Maintain existing utilities indicated to remain, keep in service and protect against damage during demolition operations.

F. Cut and/or patch and repair all existing floor, wall and roof penetrations not being re-used. Comply with Division 01 Section requirements.

G. All roof penetrations that are re-used shall be inspected and made air and water tight.

H. Not all piping, ductwork or equipment items are shown on drawings. Other demolition may be required.

I. Any existing ductwork or piping that is to be reused or left in existing position shall have the opening of such covered and protected during demolition and construction until final connections can be made.

J. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment. Equipment removal shall include removal of all connecting piping, ductwork, etc., either to a point below floor behind wall surface, etc.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

K. If pipe, insulation, or equipment to remain is damaged in appearance during construction, or is rendered unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

END OF SECTION 23 05 07

SECTION 23 05 09 – COMMON MATERIALS AND METHODS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Equipment installation requirements common to equipment sections.
2. Supports and anchorages.
3. Access doors.
4. Drip pans.
5. Through-penetration fire stop systems.
6. Painting.
7. Cutting and patching.

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. Product Data: For the following:

1. Access Doors.
2. Through-Penetration Fire Stop Systems.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

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. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 COORDINATION

A. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers listed.

2.2 ACCESS DOORS

A. Description: Access doors, non-rated and fire-rated for ceiling and wall surfaces.

B. Related sections include the following:

1. Division 23 Section, “Air Duct Accessories” for duct-mounting access doors in HVAC systems.

C. Manufacturers:

1. Acudor Products, Inc.
2. Cesco Products.
3. Elmdor/Stoneman; Div. Of Acorn Engineering Co.
4. Karp Associates.
5. Milcor .

D. Flush, Insulated, Fire-Rated Access Doors and Trimless Frames: Fabricated from steel sheet.

1. Locations: Gypsum board wall and ceiling surfaces.
2. Fire-Resistance Rating: One and a half hours, “B” label.
3. Temperature Rise Rating; 250 degrees at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
5. Frame: Minimum 0.060 inch thick sheet metal with drywall bead.
6. Hinges: Continuous piano hinge.
7. Automatic Closer: Spring type.
8. Latch: Self-latching bolt with interior release.

E. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Gypsum board wall and ceiling surfaces.
2. Door: Minimum 0.060 inch thick sheet metal, set flush with exposed face flange of frames.
3. Frame: Minimum 0.060 inch thick sheet metal with 1 inch wide surface-mounted trim.
4. Hinges: Continuous piano hinge.
5. Latch: Screwdriver operated cam latch.

F. Flush Access Doors and Trimless Frames: Fabricated from steel sheet.

1. Locations: Gypsum board wall and ceiling surfaces.
2. Door: Minimum 0.060 inch thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060 inch thick sheet metal with drywall bead.
4. Hinges: Continuous piano hinge.
5. Latch: Screwdriver operated cam latch.

2.3 DRIP PANS

A. Galvanized steel sheet: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation.

1. Minimum thickness: 18 ga. (0.046 inch)
2. Joints: Sealed water-tight or welded.
3. Construction: Minimum 2-1/2 inch high with hemmed top edges all four sides.
4. Drain connection: 3/4 inch diameter outlet at low point. Stub out a minimum of 2 inches for drain line connection.

2.4 THROUGH-PENETRATION FIRE STOP SYSTEMS

A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
3. Fire-resistance-rated floor assemblies.
4. Fire-resistance-rated roof assemblies.

B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

D. Penetrations located outside wall cavities.

1. Penetrations located outside fire-resistive shaft enclosures.
2. Penetrations located in construction containing fire-protection-rated openings.
3. Penetrating items larger than 4-inch diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

E. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.

F. Related sections include the following:

1. Division 07 Section “Firestopping”.

G. Submittals:

1. Product Data: For each type of through-penetration firestop system product indicated.
2. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.
3. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

H. Manufacturers:

1. Bio-Fireshield
2. Firestop Systems Inc.

3. Hilti Construction Chemicals, Inc.
4. International Protective Coatings Corp.
5. RectorSeal Corporation.
6. 3M Fire Protection Products.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.2 PAINTING

A. Where painting of mechanical systems, equipment, and components is specified in individual Division 23 Sections, comply with requirements in Division 09 Section "Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.3 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.4 ACCESS DOORS

A. Provide access doors wherever required to service valves, dampers, fire dampers, motor or any other items of equipment where concealed, unless specifically indicated on the drawings to be furnished under other Section(s).

B. Size and locate access doors for service and maintenance of equipment items to allow adequate access for required service.

C. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

D. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

E. Adjust doors and hardware after installation for proper operation.

F. Label access doors.

3.5 DRIP PANS

A. Locate drip pans where indicated.

B. Suspend from structure with threaded rods and building attachments.

C. Brace to prevent sagging or swaying.

D. Connect drain line to drain connection, and routed to nearest plumbing drain or elsewhere as indicated.

3.6 THROUGH-PENETRATION FIRESTOP SYSTEMS

A. Examination:

1. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation:

1. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer:
2. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Through-Penetration Firestop System Installation:

1. General: Install through-penetration firestop systems in accordance with manufacturer's written installation instructions and published drawings for products and applications indicated.
2. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

D. Cleaning and Protection:

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

3.7 CUTTING AND PATCHING

A. Comply with Division 01 Section, “Execution” for general requirements for cutting and patching.

B. Cutting shall be performed with masonry saws, core drills or similar equipment to provide neat and uniform openings.

C. Patching shall match adjacent surfaces in materials and finish. Do not endanger or damage installed work through procedures and processes of cutting and patching.

D. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations. No extra reimbursement will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover work to provide for installation of ill-timed work.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Remove samples of installed work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Architect, uncover and restore work to provide for observation of concealed work.

G. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, and other mechanical items made obsolete by new work.

H. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

I. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

END OF SECTION 23 05 09

SECTION 23 05 11 – ELECTRICAL PROVISIONS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to work of this section.

1.2 SUMMARY

A. This section specifies basic requirements for field-installed accessory electrical components specified as a part of packaged mechanical equipment. These components include, but are not limited to controllers, motors, starters, and disconnect switches furnished as an integral part of packaged mechanical equipment, but not factory-installed.

B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are specified within the individual equipment specifications or scheduled on the drawings.

C. Make all required electrical connections from mechanical equipment to accessory electrical components furnished by manufacturer as a part of equipment but intended to be field-installed, including pushbuttons, pilot lights, interlocks, speed controllers, and similar devices.

D. Provide all required electrical connections of field-mounted float control switches, flow control switches, and similar mechanical/electrical devices provided for pumps and similar mechanical equipment.

E. Provide interconnecting wiring between mechanical equipment shipped in multiple parts and designed by the manufacturer to have field-installed interconnecting wiring.

F. All electrical work shall comply with applicable requirements of Division 26.

G. Related Sections include the following:

1. Division 23 Section “Common Motor Requirements for HVAC Equipment”.

1.3 REFERENCES

A. NEMA Standard ICS 2: Industrial Control Devices, Controllers and Assemblies.

B. NEMA Standard 250: Enclosures for Electrical Equipment.

C. NEMA Standard KS 1: Enclosed Switches. Comply with National Electrical Code (NFPA 70).

1.4 SUBMITTALS

A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves as required by the individual equipment specification sections.

1.5 QUALITY ASSURANCE

A. All electrical components and materials shall be labeled by an approved testing agency (UL, ETL, CSA, etc.).

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with applicable requirements of Division 26 and NFPA 70 (National Electrical Code).

B. Install equipment and wiring per manufacturer's instructions.

END OF SECTION 23 05 11

SECTION 23 05 29 – HANGERS AND SUPPORTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes hangers and supports for HVAC equipment.

B. Related Sections include the following:

1. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation and seismic restraint devices.
2. Division 23 Section “Metal Ducts” for duct hangers and supports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Channel Support Systems:
   a. NVent
   b. Thomas & Betts Corp.
   c. Tolco Inc.
   d. Unistrut Corp.

2.2 MANUFACTURED UNITS

A. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
2. Nonmetallic Coatings: Plastic coating, jacket or liner.

2.3 MISCELLANEOUS MATERIALS

A. Mechanical-Anchor Fasteners: Insert-wedge type zinc-coated steel, for use in hardened Portland cement with pull-out, tension and shear capacities appropriate for supported loads and building materials where used.

B. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

C. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Support of equipment shall be accomplished by means of engineered products, specific to each application.

C. Suspended tanks and similar equipment

1. Utilize an engineered and manufactured platform for suspended applications of tanks and similar equipment. Hubbard Enterprises/HOLDRITE Suspended Water Heater Platform or equal. Weight loading capability shall include a minimum safety factor of 2.

3.2 EQUIPMENT SUPPORTS

A. Engineered, factory-fabricated, galvanized steel supports shall be used when suspending equipment from overhead structures or when supporting equipment above the floor.

1. Tanks of 50 gallons or less, suspended from the structure above, shall be installed with an engineered and manufactured product. Hubbard Enterprises/HOLDRITE Suspended Water Heater Platform with integral drain body or equal.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

3.3 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.4 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting.

B. Galvanized Surfaces: Clean welds, bolted connections and abraded area and apply galvanizing repair paint.

END OF SECTION 23 05 29

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes TAB to produce design objectives for the following:

1. Air Systems:
   a. Constant-volume air systems.
2. HVAC equipment quantitative-performance settings.
3. Kitchen hood airflow balancing.
4. Exhaust hood airflow balancing.
5. Existing systems TAB.
6. Verifying that new and existing automatic control devices are functioning properly.
7. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. NC: Noise criteria.

F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

G. RC: Room criteria.

H. Report Forms: Test data sheets for recording test data in logical order.

I. Smoke-Control System: An engineered system that uses fans to produce airflow and pressure differences across barriers to limit smoke movement.

J. Smoke-Control Zone: A space within a building that is enclosed by smoke barriers and is a part of a zoned smoke-control system.

K. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

L. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

M. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

N. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

O. TAB: Testing, adjusting, and balancing.

P. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

Q. Test: A procedure to determine quantitative performance of systems or equipment.

1.4 Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures

1.5 SUBMITTALS

A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.

D. Certified TAB Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

E. Sample Report Forms: Submit two sets of sample TAB report forms.

1.6 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.

B. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:
   a. Submittal distribution requirements.
   b. The Contract Documents examination report.
   c. TAB plan.
   d. Work schedule and Project-site access requirements.
   e. Coordination and cooperation of trades and subcontractors.
   f. Coordination of documentation and communication flow.

C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

D. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

E. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration

1.7 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.8 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project record documents described in Division 1 Section "Closeout Procedures."

D. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

E. Examine system and equipment test reports.

F. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

G. Examine equipment for installation and for properly operating safety interlocks and controls.

H. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices operate by the intended controller.
2. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
3. Sensors are located to sense only the intended conditions.
4. Sequence of operation for control modes is according to the Contract Documents.
5. Controller set points are set at indicated values.
6. Interlocked systems are operating.

I. 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 system readiness 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. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
6. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

B. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

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. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

C. Verify that motor starters are equipped with properly sized thermal protection.

D. Check dampers for proper position to achieve desired airflow path.

E. Check for airflow blockages.

F. Check condensate drains for proper connections and functioning.

G. Check for proper sealing of air-handling unit components.

H. Check for proper sealing of air duct system.

I. 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.

J. Measure air outlets and inlets without making adjustments.

a. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

K. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers.

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 and stratification.

3.5 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: +/- 10 percent.
2. Air Outlets and Inlets: +/- 10 percent
3. Heating-Water Flow Rate: +/- 10 percent
4. Cooling-Water Flow Rate: +/- 10 percent

3.6 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors

3.7 FINAL REPORT

A. General: Computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of the instruments used for procedures, along with proof of calibration.

C. Preliminary Review Report: Submit two (2) draft copies of Preliminary Balance Report for review prior to submission of Final Report.

D. Final Report Contents: In addition to the certified field report data, include the following:

1. Manufacturers' test data.
2. Field test reports prepared by system and equipment installers.

E. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
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 firm who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page of 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. Notes to explain why certain final data in the body of reports vary from design values.
14. Test conditions for fans and pump performance forms, including the following:
    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Fan drive settings, including settings and percentage of maximum pitch diameter.
    d. Settings for supply-air, static-pressure controller.
    e. Other system operating conditions that affect performance.

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 Btuh.
    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. Sheave dimensions, center-to-center, and amount of adjustments in inches.
2. Test Data (Indicated and Actual Values):
    a. Total airflow 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 Btuh.
    i. High-fire fuel input in Btuh.
    j. Manifold pressure in psig.
    k. High-temperature-limit setting in deg F.
    l. Operating set point in Btuh.
    m. Motor voltage at each connection.
    n. Motor amperage for each phase.
    o. Heating value of fuel in Btuh.

G. Indoor-Air Quality Measurement Reports for Each HVAC System:

1. HVAC system designation.
2. Date and time of test.
3. Outdoor temperature, relative humidity, wind speed, and wind direction at start of test.
4. Room number or similar description for each location.
5. Measurements at each location.
6. Observed deficiencies.

H. Instrument Calibration Reports:

1. Report Data:
   a. Instrument type and make.
   b. Serial number.
   c. Application.
   d. Dates of use.
   e. Dates of calibration.

END OF SECTION 23 05 93

SECTION 23 07 00 – HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes insulation systems for HVAC ductwork and Type I kitchen hood exhaust ductwork.

B. Related Sections include the following:

1. Division 23 Section "Metal Ducts" for duct liners.

1.3 DEFINITIONS

A. FSK: Foil, scrim, kraft paper.

B. PVC: Polyvinyl chloride.

C. Conditioned Space: A cooled, heated, or indirectly conditioned space within the insulated building envelope.

D. Unconditioned Space: A space that is not a Conditioned Space.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. For adhesives, sealants and mastics: Documentation including printed statement of VOC content.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports and hangers specified in Division 23 Section "Hangers and Supports for HVAC Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application.

1.8 SCHEDULING

A. Schedule insulation application after duct pressure testing. 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 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 INSULATION MATERIALS

A. Refer to Part 3 schedule articles for requirements about 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. 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 III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products:
   a. CertainTeed Corp.; Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Duct Wrap.
   d. Manson Insulation Inc.; Alley Wrap.
   e. Owens Corning; All-Service Duct Wrap.

F. 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. For equipment applications, provide insulation without jacket or with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products:
   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.

2.3 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. UL tested and certified to provide a 2-hour fire rating.

1. Products:

a. Johns Manville; Super Firetemp M.

B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is UL tested and certified to provide a 2-hour fire rating.

1. Products:
   a. CertainTeed Corp.; FlameChek.
   b. Johns Manville; Firetemp Wrap.
   c. Nelson Firestop Products; Nelson FSB Flameshield Blanket.
   d. Thermal Ceramics; FireMaster Duct Wrap.
   e. 3M; Fire Barrier Wrap Products.
   f. Unifrax Corporation; FyreWrap.
   g. Vesuvius; PYROSCAT FP FASTR Duct Wrap.

2.4 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. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

B. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96, 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, 59 percent by volume and 71 percent by weight.
4. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 200 deg F.
3. Solids Content: 63 percent by volume and 73 percent by weight.
4. Color: White.

2.6 SEALANTS

A. Joint 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:
   a. White for ASJ and PVC.
   b. Aluminum for FSK and metal jackets.

B. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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 JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, Temper H-14; sheet and roll stock ready for shop or field sizing.
   a. Finish and thickness: Stucco embossed; .016-inch thick minimum.
   b. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
   c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
   d. Factory-Fabricated Fitting Covers:
      1) Same material, finish, and thickness as jacket.
      2) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.9 TAPES

A. FSK Tape: Foil-face, vapor-barrier tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.

B. PVC Tape: White vapor-barrier tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

2.10 SECUREMENTS

A. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, length to suit depth of insulation indicated, with self-locking speed washer.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, length to suit depth of insulation indicated with integral 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, 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. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
b. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
c. Adhesive-backed base with a peel-off protective cover.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

D. Bands: Stainless-steel or aluminum with wing seals.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems 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.

3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, forms, vapor barriers or barriers, jackets, and thicknesses required for each 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. 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.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 to 6 inches o.c.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

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. Do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

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 Below-Grade 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 Non-Rated Interior Wall and Partition Penetrations: 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. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations.

1. Firestopping and fire-resistive joint sealers are specified in Division 07 Section "Fire-Resistive Joint Systems" and 23 Section “Common Materials and Methods for HVAC”.

3.5 MINERAL-FIBER INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Where required or recommended by manufacturer, apply adhesives according to recommended coverage rates per unit area for duct and plenum surfaces. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
2. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on bottom of rectangular or square ducts as follows:
   a. On duct bottoms with dimensions 18-inches and larger, place pins spaced 3 inches maximum from insulation end joints, and 18-inches o.c. Install additional pins to hold insulation tightly against surface at cross bracing.
3. Apply insulation with edges tightly secured with staples at 6-inch maximum spacing. Tape secured seam with 3-inch wide pressure-sensitive aluminum foil tape or seal joints with two coats of vapor barrier mastic reinforced with one layer of open weave glass fabric as recommended by manufacturer.
4. Do not overcompress insulation during installation.
5. Cut excess portion of pins extending beyond speed washers. Cover exposed pins and washers with tape matching insulation facing to maintain vapor barrier seal

3.6 FIELD-APPLIED JACKET INSTALLATION

A. 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-barrier jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. 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 or scheduled, secure system to ducts and duct hangers and supports to maintain a continuous UL-listed fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

A. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 7 Section "Through-Penetration Firestop Systems" and Division 23 Section “Common Mechanical Materials and Methods for HVAC”.

3.8 FINISHES

A. Duct, or Equipment Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

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, supply and outdoor air.
2. Indoor, conditioned ventilation supply air from energy recovery units.
3. Indoor, exhaust/relief air from energy recovery units to discharge louver or termination.
4. Outdoor, supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Indoor, exposed ducts specifically indicated not to be insulated.
4. Factory-insulated flexible ducts.
5. Factory-insulated plenums and casings.
6. Flexible connectors.
7. Vibration-control devices.
8. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. If more than one material is listed, selection from materials listed is Contractor’s option.

B. Service: Supply-air, Return-air ducts, within conditioned space.

1. Material: Mineral-Fiber Board or Mineral-Fiber Blanket.
2. Minimum R-value: R-3.3.
3. Field-Applied Jacket: None.
4. Vapor Barrier Required: Yes.

C. Service: Type I Grease Hood ducts.

1. Material: Fire-Rated Insulation System (2-hour rating).
2. Minimum R-value: N/A.
3. Field-Applied Jacket: None.
4. Vapor Barrier Required: None.

END OF SECTION 23 07 00

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2-inch to plus 10-inch wg. Metal ducts include the following:

1. Rectangular ducts and fittings.
2. Single-wall, round, and flat-oval ducts and formed fittings.
3. Double-wall, round, and flat-oval ducts and formed fittings.
4. Duct liner.

B. Related Sections include the following:

1. Division 23 Section "Nonmetal Ducts" for fibrous-glass ducts and thermoset FRP ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors, turning vanes, and flexible ducts.

1.3 QUALITY ASSURANCE

A. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Ch. 3, "Duct System," for commercial kitchen hood ducts, unless otherwise indicated.

1.4 DEFINITIONS

A. NAIMA: North American Insulation Manufacturers Association.

B. SMACNA: Sheet Metal and Air Conditioning Contractors National Association.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Single-wall, round, and flat-oval spiral-seam ducts and formed fittings.
2. Duct liner.
3. For adhesives, sealants and mastics: Documentation including printed statement of VOC content.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation. Where specifically indicated, ducts shall have “galvaneal” (“paint-grip”) finish for surfaces to be painted.

C. PVC-Coated Galvanized Steel: Acceptable by authorities having jurisdiction for use in fabricating ducts with UL 181, Class 1 listing. Lock-forming-quality, galvanized sheet steel complying with ASTM A 653/A 653M and having G90 coating designation. Factory-applied PVC coatings shall be 4 mils thick on sheet metal surfaces of ducts and fittings exposed to corrosive conditions and 2 mils thick on opposite surfaces.

D. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, matte finish for exposed ducts.

E. Stainless Steel: ASTM A 480/A 480M, Type 304 or 316 as indicated, and having a No. 2B finish for concealed ducts and No. 4B polished finish for exposed ducts.

F. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

G. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

H. 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.

2.2 DUCT LINER

A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.

1. Manufacturers:
   a. CertainTeed Corp.; Insulation Group; “ToughGard2” or “ToughGard R” Duct Liner.
   b. Johns Manville International, Inc.; “Linacoustic RC” Duct Liner.
   c. Johns Manville International, Inc.; “Spiracoustic Plus”, “Spiracoustic” Round Duct Liner.
   d. Knauf Fiber Glass GmbH.; “Duct Liner E-M”.
   e. Owens Corning.; “QuietR” Duct Liner.
2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated with tightly bonded non-woven mat to prevent erosion of glass fibers and to facilitate duct cleaning.
   a. Thickness: 1 inch unless otherwise indicated.
   b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
   c. Anti-Bacterial and Fungal Prevention: EPA-registered anti-microbial agent treatment in airstream surfaces applied to aid in the prevention of fungal and bacterial growth. Comply with ASTM C 1338, ASTM G21, ASTM G22.
   d. Maximum Emissions Levels:
      1) Formaldehyde: 0.05 ppm
      2) Total Volatile Organic Compounds (TOVC): 0.50 mg/m^3
      3) Total Particles: 0.05 mg/m^3
   e. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
   f. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
      1) VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   g. Mechanical Fasteners: Galvanized steel suitable for welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
      1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
      2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.

3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

2.3 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

1. VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

1. VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.

1. VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

1. VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.4 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized Steel Ducts: Galvanized steel shapes and plates.
2. Supports for Stainless Steel Ducts: Stainless steel support materials.

3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

2.5 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," using corner, bolt, cleat, and gasket details.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 22 gage or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

E. Duct Dimensions: Unless specifically indicated, duct dimensions on the Drawings are net free areas. Increase duct dimensions as necessary to compensate for liner thickness.

F. Elbow Configuration:

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows." Rectangular duct elbow configuration shall be one of the following types unless specifically indicated otherwise:
   a. Radius Type RE 1 with minimum 1.5 radius-to-width (R/W) ratio. Square throat radius elbows (R/W ratio of 0.5) are not allowed.
   b. Radius Type RE 3 with minimum 1.0 radius-to-width (R/W) ratio and two splitter vanes.
   c. Mitered Type RE 2 with turning 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."
      1) Exception: Vanes not required for general purpose exhaust-air, return-air, and relief-air ducts where duct velocity is 1000 fpm or lower AND duct net inside area is 144 sq. in. (1.0 sq. ft.) or less.
      2) Exception: Maximum velocity limitation: 1500 fpm.

G. Branch Configuration:

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection." Rectangular duct branch configuration shall be one of the following types unless specifically indicated otherwise:
   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Spin-in or self-sealing fitting.

2.6 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

B. Duct Dimensions: Unless specifically indicated, duct dimensions on the Drawings are net free areas. Increase duct dimensions as necessary to compensate for liner thickness.

C. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

D. Flat-Oval, Spiral Lock-Seam Ducts: Fabricate supply ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

E. Manufacturers:

1. Accu Duct Mfg.
2. Ductmate Industries, Inc.
3. Lindlab, Inc.
4. Semco Mfg., Inc.
5. Spiral Pipe of Texas
6. United Sheet Metal Div. United McGill Corp.
7. Ventline, Inc.

F. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
5. Flat-Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.

G. Tees and Lateral Taps: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

H. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

I. Elbow Configuration:

1. 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) 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.
   d. Segmented, adjustable type elbows are not allowed.

J. Branch Configuration:

1. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct only.
   a. Velocity 1000 fpm or lower: 90-degree tap, conical tap, 45-degree tap, or 45-degree lateral.

b. Velocity over 1000 fpm: Conical tap, 45-degree tap, or 45-degree lateral.

K. PVC-Coated Elbows and fittings: Fabricate elbows and fittings as follows:

1. Round Elbows 4 to 8 inches in diameter: Two-piece, die stamped, with longitudinal seams spot welded, bonded, and painted with PVC aerosol spray.
2. Round elbows 9 to 26 inches in Diameter: Standing seam construction.
3. Round Elbows 28 to 60 inches Diameter: Standard gored construction, riveted and bonded.
4. Other Fittings: Riveted and bonded joints.
5. Couplings: Slip-joint construction with a minimum 2-inch insertion length.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Supply Ducts: 2-inch wg.
2. Return Ducts (Negative Pressure): 2-inch wg.
3. Exhaust Ducts (Negative Pressure): 2-inch wg.

EDIT BELOW TO SUIT PROJECT.

B. All ducts and fabrications shall be standard galvanized steel except as follows:

1. Type I Grease-handling Commercial Kitchen Hood exhaust Ducts: Comply with NFPA 96.
   a. Concealed: 16 gage carbon-steel sheet or Type 304, stainless steel with No. 2B finish.
   b. Exposed: 16 gage Type 304, stainless steel with No. 4B finish to match kitchen equipment and range hood.
   c. Weld and flange seams and joints.
2. Clothes Dryer Exhaust Ducts: 24 gage galvanized steel, 0.04-inch thick aluminum or Type 304, stainless steel.

3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards-Metal and Flexible," unless otherwise indicated.

B. Install round duct liner products in accordance with the manufacturer's application guidelines.

C. Install round and flat-oval ducts in lengths not less than 10 feet unless interrupted by fittings.

D. Install ducts with fewest possible joints.

E. Install fabricated fittings for changes in directions, size, and shape and for connections.

F. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

G. Secure ductwork joints and fittings for materials-handling applications such as clothes dryers and sawdust collection systems with fastening devices that do not extend into the duct and airstream.

H. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

I. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

J. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

K. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

L. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

M. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

N. Cap or seal temporary duct openings during construction. Remove caps or seals for final connections.

O. Electrical Equipment Spaces: Route ducts to avoid passing through and above transformer vaults and electrical equipment spaces and enclosures.

P. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

Q. Fire Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section “Air Duct Accessories.”

R. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

S. Protect duct interiors from the elements and foreign materials until building is enclosed.

T. Paint interiors of metal ducts, that do not have duct liner, for 24 inches upstream of registers and grilles where bare sheetmetal is visible from a normal viewer position. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer.

3.1 APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. Apply adhesive coating on all transverse edges or any edge exposed to airflow.

G. Apply adhesive coating on longitudinal seams in ducts where air velocities are greater than 2500 fpm.

H. 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.

I. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

1. Fan discharges.
2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm or where indicated.

J. For double-wall (insulated) ducts, secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

1. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

K. Terminate inner ducts with build outs attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated build outs (metal hat sections), or other build out means are optional; when used, secure build outs to duct walls with bolts, screws, rivets, or welds.

3.2 PVC COATED DUCT

A. Repair damage to PVC coating with manufacturer’s recommended materials.

3.3 TYPE I GREASE-HANDLING COMMERCIAL KITCHEN HOOD EXHAUST DUCTS, SPECIAL INSTALLATION REQUIREMENTS

A. Install ducts to allow for thermal expansion through 2000 deg F temperature range.

B. Install ducts without dips or traps that may collect residues unless traps have continuous or automatic residue removal.

C. Slope duct not less than 1/4 inch per linear foot toward the hood or approved grease receptor.

D. Install access openings at each change in direction and at intervals defined by NFPA 96; locate on sides of duct a minimum of 1-1/2 inches from bottom; and fit with grease-tight covers of same material as duct.

E. Do not penetrate fire-rated assemblies except as permitted by applicable building codes.

3.4 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.

1. For pressure classes 2-inch wg and lower, seal transverse joints at a minimum.

B. Seal ducts before external insulation is applied.

3.5 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

D. Install concrete inserts before placing concrete.

E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 23 Section "Air Duct Accessories." Locate flexible connectors in sections of ductwork below roof level for roof mounted equipment unless indicated otherwise.

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 CLEANING EXISTING SYSTEMS

A. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Use existing service openings where possible.
2. Create other openings to comply with duct standards.
3. Disconnect flexible ducts as needed for cleaning and inspection.
4. Reseal rigid fiberglass duct systems according to NAIMA recommended practices.
5. Remove and reinstall ceiling sections to gain access during the cleaning process.

B. Mark position of dampers and air-directional mechanical devices before cleaning, and restore to their marked position on completion.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or larger) particles.
2. When venting vacuuming system to the outside, use filtration to contain debris removed from HVAC system, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide operative drainage system for washdown procedures.
7. Biocidal Agents and Coatings: Apply biocidal agents if fungus is present. Apply biocidal agents according to manufacturer's written instructions after removal of surface deposits and debris.

F. Cleanliness Verification:

1. Verify cleanliness after mechanical cleaning and before application of treatment, including biocidal agents and protective coatings.
2. Visually inspect metal ducts for contaminants.
3. Where contaminants are discovered, re-clean and reinspect ducts.

G. Verification of Coil Cleaning: Cleaning must restore coil pressure drop to within 10 percent of pressure drop measured when coil was first installed. If original pressure drop is not known, coil will be considered clean only if it is free of foreign matter and chemical residue, based on thorough visual inspection.

END OF SECTION 23 31 13

SECTION 23 31 16 - NONMETAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Fibrous-glass ducts.

B. Related Sections include the following:

1. Division 23 Section "Air Duct Accessories" for dampers, duct-mounting access doors, turning vanes, and flexible ducts.

1.3 QUALITY ASSURANCE

A. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. UL Compliance: UL listed and labeled as complying with UL 181, Class 1.

1.4 DEFINITIONS

A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula Btu x in./h x sq. ft. x deg F at temperature differences specified. Values are expressed as Btu.

B. NAIMA: North American Insulation Manufacturers Association.

C. SMACNA: Sheet Metal and Air Conditioning Contractors National Association.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Fibrous-glass duct materials.

B. Shop Drawings: Show fabrication and installation details for nonmetal ducts.

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 FIBROUS-GLASS DUCTS

A. Manufacturers:

1. CertainTeed Corporation; HVAC Insulation Group; “ToughGard” Duct Board.
2. Johns Manville International, Inc.; “SuperDuct” Duct Board.
3. Knauf Fiber Glass GmbH: “Air Duct Board-M”.
4. Owens Corning.; “EnDuraCoat” Duct Board.

B. Materials:

1. Glass fibers bonded with thermosetting resin.
2. Facing: Fire-resistive, reinforced, foil-scrim-kraft barrier.
3. Air-Side Surface: Treated with polymer coating or tightly bonded,non-woven mat to prevent erosion of fibers by air movement.
4. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
5. Required Markings: EI-rating, UL label, and other markings required by UL 181 on each full sheet of duct board; UL ratings for closure materials.
6. Moisture Absorption: Not exceeding 5 percent by weight at 120 deg F and 95 percent relative humidity for 96 hours when tested according to ASTM C 1104/C 1104M.
7. Vapor-Barrier Permeability: 0.02 perms maximum when tested according to ASTM E 96, Procedure A.
8. Noise-Reduction Coefficient: 0.65 minimum when tested according to ASTM C 423, Mounting A.
9. Temperature Limits: 250 deg F inside ducts; 150 deg F ambient temperature surrounding ducts.
10. Fabrication: Fabricate and assemble ducts according to NAIMA AH116 or SMACNA's "Fibrous Glass Duct Construction Standards".

C. Duct Boards: Rigid, rectangular, fibrous-glass boards with edge treatment; factory molded and faced on one side with fire-resistive, reinforced, foil-scrim-kraft barrier.

1. Thickness: 1 inch.

D. Rigid Round Ducts: Cylindrically molded sections of fibrous-glass duct board fabricated with 10 sides to form near-round ducts. Fire-resistive, reinforced, foil-scrim-kraft facing on the outside.

1. Thickness: 1 inch.
2. End Treatment, Factory-Molded Round Ducts: Premolded, high-density slip joints. Facing extends on end with external portion of joint to form stapling tab.

E. Reinforcements:

1. Channel Reinforcements for Ducts with a Maximum ID of 60 Inches or Less: Channels formed from 22 gage, galvanized sheet metal with ASTM A 653/A 653M, G60 coating designation.
2. Tie-Rod Reinforcements: 12 gage galvanized steel wire, of length to suit termination method.
3. Reinforcing Rod Washers: 2-1/2-inch- square by 24 gage (0.028-inch), galvanized steel washer with turned edges and volcano-type center hole.
4. Sag-Control Supports: 1/2-inch galvanized steel conduit.

F. Closure:

1. Heat-Activated Tape: A minimum of 2-1/2-inch- wide, glass-fiber-reinforced, foil-scrim tape complying with UL 181A, Part H, and imprinted with required information.

G. Hangers and Supports:

1. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   a. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   b. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
2. Hanger Materials: Galvanized sheet steel; galvanized-steel hanger wire; and galvanized-steel channels.

H. Shop Fabrication: Comply with NAIMA AH116 or SMACNA's "Fibrous Glass Duct Construction Standards."

1. Fabricate rectangular and 10-sided ducts and fittings from duct boards. Duct dimensions indicated on Drawings are inside clear dimensions for net free areas.
2. Fabricate mitered elbows with turning vanes.
3. Fabricate 90-degree branch connections from supply ducts with volume-control dampers in branch ducts.
4. Attach metal components to fibrous-glass ducts with galvanized-steel washers on opposite surfaces of duct walls.

PART 3 - EXECUTION

3.1 FIBROUS-GLASS DUCT INSTALLATION

A. Application Limitations: Fibrous-glass duct not allowable for the following applications:

1. As kitchen exhaust or fume exhaust ducts or to convey solids or corrosive gases.
2. In concrete or buried below grade.
3. Outdoors.
4. As casings or housings of built-up equipment.
5. Immediately adjacent to high-temperature electric heating coils without radiation protection.
6. For vertical risers in systems serving more than two stories.
7. With equipment that does not include automatic maximum temperature controls.
8. With coal or wood fueled equipment.
9. Immediately downstream from cooling coils where coil condensation would form on duct interiors.

B. Field fabricate fibrous-glass ducts according to NAIMA AH116 or SMACNA's "Fibrous Glass Duct Construction Standards".

1. Fabricate rectangular and 10-sided ducts and fittings from duct boards. Duct dimensions indicated on Drawings are inside clear dimensions for net free areas.
2. Fabricate mitered elbows with turning vanes.
3. Fabricate 90-degree branch connections from supply ducts with volume-control dampers in branch ducts.
4. Attach metal components to fibrous-glass ducts with galvanized-steel washers on opposite surfaces of duct walls.
5. Install reinforcements.

C. Install fibrous-glass ducts, fittings and accessories according to NAIMA AH116 or SMACNA's "Fibrous Glass Duct Construction Standards".

D. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

E. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

F. Install ducts with a minimum clearance of 1 inch.

G. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

H. Duct Attachments: Support horizontal ducts with trapeze-type hangers.

I. Hangers: Suspend duct attachments from building attachments with one of the following hanger types:

1. Galvanized sheet metal strips, a minimum of 22 gage by 1 inch wide.
2. Galvanized-steel rods, 1/4 inch in diameter, threaded along entire length.
3. Galvanized-steel wire, 12 gage minimum.

J. Attach hangers to joints and reinforcing channels that occur within required hanger spacing. Attach hangers to transmit load to sides and bottom channels and no more than 6 inches from sides of ducts.

K. Support equipment and metal duct components and accessories independent of ducts.

L. Support terminal components separately.

M. Install sheet metal sleeves to support dampers. For motorized dampers, extend sleeves to support operators.

N. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts with sheet metal flanges of same metal thickness as ducts. Overlap opening on 4 sides by at least 1-1/2 inches.

O. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Air Duct Accessories".

P. Inspect fibrous-glass duct systems according to "Inspection Checklist for Fibrous Glass Duct System Installation" in NAIMA AH116. Prepare a written report using the format of this checklist.

Q. Clean ducts according to NAIMA AH122.

END OF SECTION 23 31 16

SECTION 23 33 00 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Turning vanes.
4. Duct-mounting access doors.
5. Flexible connectors.
6. Flexible ducts.
7. Spin-in and self-sealing take-off fittings.
8. Duct accessory hardware.
9. Residential clothes dryer vent wall box.

B. Related Sections include the following:

1. Division 23 Section "Instrumentation and Control for HVAC" for control dampers and damper actuators.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Flexible connectors.
4. Flexible ducts.
5. Spin-in and self-sealing take-off fittings.
6. Residential clothes dryer vent wall box.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA Standard 500 for maximum leakage rates.

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent (1 minimum) of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.

D. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. 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 BACKDRAFT DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. CESCO Products.
4. Duro Dyne Corp.
5. Greenheck.
6. Pottorff
7. Ruskin Company.
8. Vent Products Company, Inc.

B. Description: Multiple-blade, parallel action gravity balanced, with blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, **[adjustment device to permit setting for varying differential static pressure]**.

C. Maximum Leakage Rates:

1. For dampers 24 inches or smaller in either dimension: 40 cfm/sq.ft. at 1.0 inch w.g.
2. For all other damper dimensions: 20 cfm/sq. ft. at 1.0 inch w.g.

D. Frame: 0.090-inch- thick extruded aluminum, with mitered corners.

E. Blades: 0.025-inch- thick, roll-formed aluminum.

F. Bearings: Non-corrosive synthetic.

G. Blade Seals: Vinyl.

H. Blade Axles: Nonferrous.

I. Linkage Tie Bars and Brackets: Aluminum, concealed in frame.

2.4 VOLUME DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. Greenheck.

4. Johnson Controls, Inc.
5. Nailor Industries, Inc.
6. Penn Ventilation Company, Inc.
7. Pottorff
8. Ruskin Company.
9. Vent Products Company, Inc.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design, standard leakage rating, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 20 gage, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 20 gage, galvanized sheet steel; maximum 6-inch width.
3. Aluminum Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
4. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet; maximum 6-inch width.
5. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum; maximum 6-inch width.
6. Blade Axles: Nonferrous.
7. Bearings: Molded synthetic.
8. Tie Bars and Brackets: Aluminum.

D. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting. Provide concealed type regulators, utilizing miter gears and universal joints as required, for dampers located above hard ceilings or in non-accessible locations.

2.5 TURNING VANES

A. 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.

B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

C. Vane Construction: Double wall.

2.6 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include 1-by-1-inch butt or piano hinge and cam latches.

1. Manufacturers:
   a. American Warming and Ventilating.
   b. CESCO Products.
   c. Ductmate Industries, Inc.
   d. Greenheck.
   e. Kees.
   f. McGill AirFlow Corporation.
   g. Pottorff
   h. Nailor Industries, Inc.
   i. Ruskin Company
   j. Ventfabrics, Inc.
2. Frame: Minimum 24 gage galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:
   a. Less Than 12 Inches Square: Secure with two sash locks.
   b. Up to 18 Inches Square: Two hinges and two sash locks.
   c. Up to 24 by 48 Inches: Three hinges and two compression latches.
   d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Pressure-Relief Access Door: **[Single] [Double]** wall and duct mounting; fabricated of galvanized sheet metal **[with insulation fill and thickness]** as indicated for duct pressure class. Include **[vision panel,]** latches, and retaining chain.

1. Manufacturers:
   a. American Warming and Ventilating.
   b. CESCO Products.
   c. Ductmate Industries, Inc.
   d. Greenheck.
   e. McGill AirFlow Corporation.
   f. Pottorff.
   g. Ruskin Company.
2. Frame: 12 gage galvanized sheet steel, with bend-over tabs and foam gaskets.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

E. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.7 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Ventfabrics, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-inches wide attached to two strips of 3-inch- wide, 24 gage, galvanized sheet steel.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 20 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 10 to plus 250 deg F.

2.8 FLEXIBLE DUCTS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Flexmaster U.S.A., Inc.
3. Hart & Cooley, Inc.
4. McGill AirFlow Corporation.
5. Thermaflex

B. Acoustical Flexible Insulated Air-Duct: UL 181, Class 1, acoustically rated resilient calendered film liner duct permanently bonded to a coated spring steel wire helix and supporting a fiberous-glass insulating blanket, and an outer polyethylene vapor barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 5000 fpm.
3. Temperature Range: Minus 20 to plus 250 deg F.
4. Thermaflex M-KE Series or equal.

C. Flexible Duct Clamps: Nylon strap, in sizes 3 through 18 inches to suit duct size.

D. Flexible Elbow: UL listed for return air plenums, molded composite material, one-piece design to install over outside of flexible duct.

2.9 SPIN-IN AND SELF-SEALING TAKE-OFF FITTINGS

A. Spin-in Fitting: Factory-fabricated assembly for making round take-off connections to rectangular ducts.

1. Galvanized sheet steel construction.
2. Spins into round duct opening.
3. Adjustable damper with locking quadrant.
4. Insulation guard for use with internally lined duct.

B. Self-Sealing Fitting: Factory-fabricated assembly for making round take-off connections to rectangular ducts.

1. Galvanized sheet steel construction.
2. Neoprene seal on fitting flange for external attachment to round duct opening.
3. Adjustable damper with locking quadrant.

2.10 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.

2.1 RESIDENTIAL CLOTHES DRYER VENT WALL BOX

A. Manufacturers:

1. InOVate Technologies, Inc. (www.dryerbox.com)

B. Description: Recessed in wall dryer venting box with top outlet for 4-inch round ductwork.

C. Housing: 22 gage aluminized steel; overall dimensions 21” high x 12.5” wide x 5” deep.

D. Schedule:

1. Symbol “DB”: In-O-Vate Technologies, Inc. Model DB-428

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

1. Provide concealed damper regulators for dampers located above hard ceilings and in other non-accessible locations.

F. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. Adjacent to duct-mounted motorized dampers.

G. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.

H. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment."

I. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators. In general, make final duct connections with flexible connectors for units without fan internal vibration isolation. Locate flexible connectors below roof level for rooftop equipment unless indicated otherwise.

J. Connect terminal units to supply ducts with maximum 24-inch lengths of flexible duct. Do not use flexible ducts to change directions.

K. Connect diffusers or light troffer boots to low pressure ducts with maximum 48-inch lengths of flexible duct clamped or strapped in place. Install sheetmetal elbow or flexible elbow at terminal connection to prevent duct crimping.

L. Bends in flexible ducts shall be made with not less than 1 duct diameter centerline radius. Do not compress ducts.

M. Connect flexible ducts to metal ducts with nylon draw straps.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION 23 33 00

SECTION 23 34 23 – HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Centrifugal roof ventilators.
2. Ceiling-mounting ventilators.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on actual site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material gages and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

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. Differentiate between manufacturer-installed and field-installed wiring.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Maintenance Data: For power ventilators to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standards: Power ventilators shall comply with UL 705; UL 762 for grease-laden air applications.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set for each belt-driven unit

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Mfg. Corp.
2. Aerovent; a Twin City Fan Company.
3. Carnes.
4. Loren Cook Company.
5. Greenheck.
6. Madison Manufacturing.
7. PennBarry.
8. Trane Co. (The).
9. Twin City Fan.

2.2 CENTRIFUGAL ROOF VENTILATORS

A. Description: Belt-driven or direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, curb base, and accessories.

B. Housing: Removable, **[spun-aluminum, dome top and outlet baffle] [extruded-aluminum, rectangular top] [galvanized steel, mushroom-domed top]**; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains **[and grease collector]**.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Electronically Commutated Motor (ECM):

1. DC electronic commutation type motor (ECM) specifically designed for fan applications.
2. Permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
3. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.

4. Speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal as scheduled.
5. Minimum of 85% efficient at all speeds.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Pre-lubricated and sealed, self-aligning, pillow-block-type ball bearings.
   a. Ball-Bearing Rating Life: ABMA 9, L_{10} of 40,000 hours.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.

F. Accessories:

1. Disconnect Switch (for 115V/single phase motors only): Non-fusible type, weatherproof enclosure, with thermal-overload protection mounted on fan housing, factory wired.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
4. Motorized Dampers: Parallel-blade dampers for mounting in curb base with electric actuator with end switch; wired to close when fan stops. Dampers shall have a maximum leakage rate when tested in accordance with AMCA Standard 500 of 4 cfm/sf at 1.0 inch w.g.

G. Roof Curbs: Galvanized steel; 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 suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 16 inches.
3. Sound Curb: Curb with sound-absorbing insulation matrix.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.
6. Hinged Subbase: Galvanized steel hinged arrangement permitting service and maintenance.
7. Vented Curb: Unlined with louvered vents in vertical sides.

2.3 CEILING-MOUNTING VENTILATORS

A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

B. Housing: Steel, lined with acoustical insulation.

C. Electronically Commutated Motor (ECM):

1. DC electronic commutation type motor (ECM) specifically designed for fan applications.
2. Permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
3. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
4. Speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal as scheduled.
5. Minimum of 85% efficient at all speeds.

D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Disconnect Switch (for 115V/single phase motors only): Non-fusible type, with thermal-overload protection mounted on fan housing, factory wired.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
4. Motion Sensor: Motion detector with adjustable shutoff timer.
5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
6. Filter: Washable aluminum to fit between fan and grille.
7. Isolation: Rubber-in-shear vibration isolators.
8. Manufacturer's standard roof jack or wall cap, and transition fittings.
9. Motorized Dampers: Parallel-blade dampers for remote mounting in duct with electric actuator with end switch; wired to close when fan stops. Dampers shall have a maximum leakage rate when tested in accordance with AMCA Standard 500 of 4 cfm/sf at 1.0 inch w.g.

EXECUTION

2.4 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware.

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Install motorized dampers in curbs or duct as scheduled. Coordinate interlock wiring between damper actuator end switch and fan with Division 26 – Electrical.

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

2.5 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

2.6 FIELD QUALITY CONTROL

A. Equipment Startup Checks:

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. Verify lubrication for bearings and other moving parts.
6. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
7. Verify interlock operation of motorized dampers and fans. Fan shall be energized when damper actuator end switch is closed.
8. Shut unit down and reconnect automatic temperature-control operators.
9. Remove and replace malfunctioning units and retest as specified above

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 23 34 23

SECTION 23 37 13 – DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, grilles as shown and/or scheduled on the Drawings.

1.3 SUBMITTALS

A. Product Data: For each product scheduled, 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, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carnes
2. Krueger.
3. Nailor Industries
4. Price Industries.
5. Titus.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers. Install duct-mounted registers and

grilles in accordance with manufacturer's recommended procedures to assure airflow and sound performance.

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 23 37 13

SECTION 23 38 13 - COMMERCIAL-KITCHEN HOODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes 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.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Filters/baffles.
2. Fire-suppression systems.
3. 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 water-supply and drain piping connections.
6. Show control cabinets.
7. Show fire-protection cylinders, piping, actuation devices, and manual control devices.
8. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
9. Wiring Diagrams: Power, signal, and control wiring.
10. 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.
    a. Piping Diagram Scale: 1/4 inch = 1 foot.

C. 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. Sprinklers.

d. Access panels.
e. Moldings on hoods and accessory equipment.

1.5 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.

1.6 COORDINATION

A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish one complete set(s) of grease filters/baffles.

PART 2 - PRODUCTS

2.1 HOOD MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 304.

1. Minimum Thickness: 0.050 inch (18 gage).
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).

B. Zinc-Coated Steel Shapes: ASTM A 36/A 36M, zinc coated according to ASTM A 123/A 123M requirements.

C. 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, Section 177.2600, 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.

D. 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.

E. 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 one 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. Captive-Aire Systems.
2. Gaylord Industries, Inc.
3. Grease Master; a division of Custom Industries, Inc.
4. Greenheck.
5. Halton Company.

B. 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 listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
3. Duct Collars: Minimum 0.0598-inch- thick steel at least 3 inches long, continuously welded to top of hood and at corners.

C. Hood Configuration: Exhaust only.

1. Makeup air shall be introduced through laminar-flow-type, perforated metal panels on front of hood canopy.

D. Hood Style: Wall-mounted canopy.

E. 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.

F. Removable Water-Wash Grease Extractor: Stainless steel, tested with hood according to UL 710.

G. Lighting Fixtures: Surface-mounted, 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 **on** wall adjacent to hood.
2. Lighting Fixtures: **[Fluorescent] [Incandescent]** complying with UL 1598.

H. Hood Controls: Wall-mounting control cabinet, of stainless steel.

1. Exhaust Fan Interlock: Factory wire the exhaust fan starters in a single control cabinet for adjacent hoods to operate together.
2. Water-Wash Timer: 365-day, programmable timer shall control sequential wash of multiple hood sections.

2.4 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.

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/A 53M, 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 **[hood] [or] [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. Liquid Extinguishing Agent: Noncorrosive, low-pH liquid.
5. Furnish electric-operated gas shutoff valve.

6. 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.
7. 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.

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. 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.

B. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.

C. Install hoods to operate free from vibration.

D. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches o.c. maximum.

E. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

F. Install lamps, with maximum recommended wattage, in equipment with integral lighting.

G. Set initial temperatures, and calibrate sensors.

H. Set field-adjustable switches.

3.3 CONNECTIONS

A. Install piping with clearance to allow service and maintenance.

B. Install reduced-pressure backflow preventer on washer-water supply. Backflow preventer is specified in Division 23 Section "Domestic Water Piping Specialties."

C. Install washer-water drain piping full size of hood connection to an adjacent floor drain or floor sink.

D. Makeup Water Connection: Comply with applicable requirements in Division 23 Section “Domestic Water Piping Specialties" for valves and accessories on piping connections to water-cooled units.

E. Connect ducts according to requirements in Division 23 Section "Air Duct Accessories." Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquidtight joint.

F. Install fire-suppression piping for remote-mounted suppression systems according to NFPA 17A, "Wet Chemical Extinguishing Systems."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. 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.

C. 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 23 38 1

SECTION 23 82 42 – ELECTRIC WALL AND CEILING HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes wall and ceiling heaters with propeller fans and electric heating elements.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Samples for Verification: Finish colors for each type of wall and ceiling heater indicated with factory-applied color finishes.

C. Operation and Maintenance Data: For wall and ceiling heaters to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. King Electric.
2. Chromalox, Inc.
3. Indeeco.
4. Markel Products Company; TPI Corporation.
5. Marley Engineered Products.
6. QMark; Marley Engineered Products.
7. Raywall; TPI Corporation.
8. Trane Inc.

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, 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.

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, multispeed. Comply with requirements in Division 23 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 with disconnect switch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive electric wall and ceiling heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for electrical connections to verify actual locations before wall and ceiling heater installation.

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

3.2 INSTALLATION

A. Install wall boxes in finished wall assembly.

B. Install electric wall and ceiling heaters to comply with NFPA 90A.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Conductors and Cables."

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 motor rotation and unit operation.
2. Operate electric heating elements to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

A. Adjust initial temperature set points.

END OF SECTION 23 82 42

SECTION 26 05 00 – GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 01 Section “General Commissioning Requirements”.

1.2 SCOPE OF WORK – GENERAL

A. This section specifies general requirements for electrical installations and includes requirements common to more than one section of Divisions 26, 27, and 28. It expands and supplements the requirements specified in sections of Division 01.

B. Provide all materials, labor, transportation, tools, permits, facilities, inspections, utilities fees and incidentals necessary for the complete installation of electrical work indicated and described in the Contract Documents.

C. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required for work indicated or specified under this section of work, or work specified in other sections, provide material and equipment which is usually furnished with such systems in order to complete the installation, whether mentioned or not.

D. All work shown and/or specified shall be completely installed and connected in a first class and workmanlike, professional manner. Work shall be complete in all details.

E. All work shall be performed by trade technicians properly qualified to perform the work required. System-specific sub contractors shall be hired (as required) to furnish and install the system.

F. Workmanship shall comply with the National Electrical Installation Standards (NEIS), published by the National Electrical Contractors Association (NECA).

G. All work shall be done in accordance with system manufacturer’s instructions, recommendations, and requirement, with the exception where the drawings or specifications indicate other detailed instructions.

1.3 SEQUENCE OF WORK

A. Conduct work in a sequence to provide the least possible interference to the activities of the Owner; permit orderly transfer of activities and equipment to completed areas.

B. Work shall be substantially complete by the dates listed in Division 01 Section.

1.4 ALTERNATES

A. Refer to Division 01 Section “Alternates” for description of alternates. Review Contract Documents for additional information.

1.5 DEFINITIONS

A. Provide: Furnish and install complete and ready for intended use.

B. Indicated: Shown on drawings.

C. Noted: Noted on Drawings or in Specifications.

D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical and electrical equipment rooms.

F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants and hidden from sight. Examples include above ceilings, within finished walls and in chases or furred spaces.

H. 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 and utility vaults.

1.6 CODES AND STANDARDS

A. Code Compliance: Comply with most currently adopted edition of following:

1. International Building Code (IBC) Standards and Amendments.
2. International Mechanical Code (IMC), Standards and Amendments.
3. International Fire Code (IFC) Standards and Amendments.
4. National Fire Protection Association (NFPA).
5. National Electrical Code (NEC); NFPA 70.
6. American with Disabilities Act (ADA).
7. Applicable State and local codes, laws and ordinances.

B. Standards and Regulations Compliance: Comply with most currently adopted edition of following:

1. BICSI Telecommunications Distribution Methods Manual (TDMM), Standards/Practices and Amendments.
2. Institute of Electrical and Electronics Engineers (IEEE), Standards/Practices and Amendments.
3. ANSI/TIA/EIA-568-B, Standards and Amendments.
4. ANSI/TIA/EIA-569-B, Standards and Amendments.
5. ANSI/TIA/EIA-606-A, Standards and Amendments.
6. ANSI J-STD-607-A, Standards and Amendments.

C. Comply with Contract Document requirements which exceed minimum code and standards requirements.

1.7 SAFETY OF PERSONS AND PROPERTY

A. Comply with applicable laws, ordinances, rules and regulations of any public authority for the safety of persons and property, including requirements of the Washington Industrial

Safety and Health Administration (WISHA) and/or the Occupational Safety and Health Act (OSHA) and Division 01, General and Supplementary Conditions.

1.8 PERMITS AND FEES

A. Obtain and pay for required permits and fees necessary to fully complete work included in the Contract Documents.

B. Include all required utility company fees or charges for electrical power service or revisions to existing service.

C. Include all required utility company fees or charges for telephone and broadband internet service(s) or revisions to existing service(s). Example of services includes copper (such as POTS and T1) and fiber optic.

D. Include all required utility company fees or charges for the setup and connection of television service(s) or revisions to existing service(s). Example of services includes Cable TV and Satellite TV.

1.9 INTENT AND INTERPRETATION

A. Drawings and Specifications supplement each other and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation, must be included.

B. Drawings are partly diagrammatic and do not necessarily show exact location of new equipment, conduits, and existing utilities, unless specifically dimensioned. Size and location of equipment are drawn to scale where possible, however some graphic symbols may be distorted dimensionally to obtain clarity in representation.

C. Approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details in regard to location. Exact locations are to be determined by actual measurements at the building.

D. Riser and other diagrams are schematic only and do not necessarily show the physical arrangement of equipment. They shall not be used for obtaining quantities or lineal runs of conduit and conductors.

E. Drawings generally indicate required minimum allowable size, quantity and type of conductors and points of termination of conduits. Routing or total number of conduits required for circuits are not indicated. Provide additional conduits as required to complete installation for specific equipment furnished.

F. Receptacles, switches and other devices shall be located symmetrically with Architectural elements and coordinated with equipment or devices furnished in other Sections, or by the Owner. Devices shall be centered on windows, wall spaces, or other items, unless specifically dimensioned otherwise.

G. Electrical drawings shall serve as working drawings for Division 26, 27and 28 work. Refer to Architectural, Structural, Civil, Landscape, and Mechanical drawings for additional detail affecting the installation of work. Architectural drawings shall take precedence over the Electrical drawings if any dimensional discrepancies exist.

1.10 SUBMITTAL OF EQUIPMENT FOR APPROVAL

A. Refer to Division 01 requirements for submittal definitions, requirements and procedures. Additional requirements are listed below.

B. Shop drawings, catalog information, and material schedules shall be submitted for approval of materials and equipment prior to ordering. The submitter is to provide riser and interconnection wiring diagrams for the following low voltage systems:

1. Fire Alarm Notification and Detection.
2. Security and Access Control.
3. Cable/Satellite TV
4. Telecommunication

D. Provide detailed riser and interconnecting wiring diagrams for required systems if not specifically indicated on the drawings.

E. Submittal data shall clearly identify electrical components, devices and accessories as listed and labeled by Underwriter's Laboratory, or other testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Clearly mark submittals as to which items, options, colors, model, etc. to be furnished.

G. Submittals not meeting the following requirements will be returned for revision:

1. Provide a cover page for each item or group of items. Cover page shall provide a 3" x 5" space for Engineer's review stamp.
2. Each cover page must be clearly identified with the project name, specification number and paragraph number.
3. Submittal package must be accompanied by an itemized index listing specification section, paragraph number, item and manufacturer; larger projects will be index tabbed by specification section with index for each section.

1.11 SCHEDULE OF VALUES

A. Furnish to the Engineer, a breakdown of the Contract for work in Divisions 26, 27, and 28 within thirty (30) days of Notice to Proceed.

B. The breakdown shall list cost for materials and labor as follows:

1. Miscellaneous Overhead Expenses.
2. Mobilization.
3. Permits
4. Utility Company Connection Fees
5. Switchboard
6. Switchboard Labor
7. Panelboards
8. Panelboard Labor
9. Feeder Conduit and Conductors Labor
10. Feeder Conduit and Conductors Materials
11. Branch Circuit Conduit, Conductors and Devices Material
12. Branch Circuit Conduit, Conductors and Devices Labor
13. Interior Lighting Fixtures.
14. Interior Lighting Fixture Labor
15. Site Lighting Fixtures
16. Site Lighting Fixtures Labor
17. Fire Alarm and Detection System
18. Fire Alarm and Detection System Labor

19. Telecommunication Systems
20. Telecommunication Systems Labor
21. Access Control System
22. Access Control System Labor
23. Video Surveillance
24. Video Surveillance Labor
25. Equipment Connections.
26. Commissioning Activities
27. Project Closeout:
    a. O & M Manuals
    b. Record Documents
    c. Owner Training

1.12 GUARANTEE

A. Guarantee satisfactory operation of material and equipment installed under Divisions 26, 27, and 28. Repair or replace any defective materials, equipment, or workmanship which may show itself within one year from date of Substantial Completion.

1. Incandescent lamps shall have two month warranty period only.
2. Specific requirements in individual Division 26, 27, and 28 Sections.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Outdated “new” equipment is not acceptable.

B. Electrical components, devices, and accessories to be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2.2 EQUIPMENT AND MATERIAL SUBSTITUTIONS

A. Throughout these Contract Documents, various materials, equipment, apparatus, etc., are specified by manufacturer, brand name, and type or catalog number. Such designation is to establish standards of desired quality and construction and shall be the basis of the bid.

B. Where more than one manufacturer is listed, and only one manufacturer's catalog number is indicated, that standard of quality and construction shall be maintained by materials supplied by other manufacturer(s).

C. Substitutions of equipment or materials shall be made only with written prior approval. Prior approval requests must be received at least ten (10) days prior to bid date unless otherwise instructed. Refer to Division 01 Section “Product Requirements” for procedures in requesting substitutions.

D. Acceptance of substitution request signifies manufacturer recognition only. No attempt has been made to check each item as to special features, capacities, or physical dimensions required by this project. Verify requirements before submitting for approval. Acceptance of exact features, sizes, capacities, etc., all of which must meet or exceed design requirements will be determined when submitted during the construction phase.

E. The Contractor shall bear full responsibility for substituted equipment and materials, including, but not limited to:

1. Costs.
2. Available space requirements.
3. Effect on other trades.
4. Changes in electrical requirements
5. Changes in structural requirements.

PART 3 - EXECUTION

3.1 ELECTRICAL SYSTEMS COMMISSIONING

A. Coordinate electrical systems commissioning with the Commissioning Authority.

B. Comply with requirements of Division 01 Section “General Commissioning Requirements” and requirements of individual Division 26, 27, and 28 Sections for Electrical Systems Commissioning.

C. The Contractor shall have a knowledgeable technician present at all testing and commissioning activities. The technicians shall assist the commissioning authority in the completion of the testing of components and systems, and conduct training.

3.2 COORDINATION

A. Refer to Division 01 Section “Project Management And Coordination”.

B. Coordinate available space for equipment and systems with other trades. Refer to Architectural, Structural and Mechanical Drawings for additional building details necessary for coordination.

C. Cutting, patching, wiring, finishing or any other work required for relocation of work installed due to interferences between works of the various trades will be at no additional cost to the Owner.

3.3 CUTTING AND PATCHING

A. Comply with Division 01 Section “Execution” for general requirements for cutting and patching.

B. Do all cutting, drilling and patching that must be done in order that work is properly installed. All work of this nature is subject to the following conditions:

1. All disturbed construction or finish must be made good.
2. Structural work shall not be disturbed, except on approval of Architect.
3. In general, cutting through floors, walls and partitions is to be avoided and only where absolutely necessary will same be permitted. When necessary, it shall be done in a careful manner and the opening filled about conduits as directed by the Architect. Holes through concrete or masonry shall be made only with a core drill. Obtain permission from Architect for each individual opening.
4. All masonry or other finish damaged or cut into during the installation of this work must be replaced or repaired with materials of like kind and quality as the original materials by skilled labor, experienced in that particular building trade.

3.4 Management of Construction waste

A. Comply with Division 01 waste management and disposal procedures. Separate and segregate recyclable materials by type.

3.5 CLEANUP

A. At the time of final cleanup, all fixtures and equipment, new or existing, shall be thoroughly cleaned and left in condition for use. All debris and unused materials shall be removed from the construction site, leaving the premises in a clean condition.

B. Site shall be kept clean on a day-today basis.

3.6 SLEEVES

A. Sleeves: EMT conduit, with insulated throat bushings for each end.

B. Provide sleeves where required, sized as noted on the Contract Documents. Where not noted, sleeve sizing shall be determined by the type and quantity of cable to be routed through the sleeve per TIA/EIA 569A cable capacity standards, plus an additional 100% for future expansion.

C. Provide roto-hammering or core drilling where required for installation.

D. Seal between sleeve and wall or floor in which the sleeve is installed. Firestop penetration to restore wall or floor to pre-penetration fire-rating.

3.7 PAINTING

A. Paint all exposed conduits, raceways, multi-outlet assemblies and panelboard trim as directed by Architect.

B. Comply with Division 09 Section “Interior Painting” requirements for painting.

3.8 TESTS

A. All work shall be complete in every respect and shall be tested and approved satisfactory to the Architect and in accordance with the local, state and federal regulations governing the installation.

B. Coordinate all testing with the Commissioning Agent.

C. Be responsible for making any and all tests necessary to insure against concealment of defective materials and/or workmanship.

D. Determine, by test, that all wiring and connections are free from shorts between wires and shorts to ground and that all circuits have proper continuity.

E. All defects shall be corrected and retested before installation of fixtures and equipment.

F. All miscellaneous systems shall be tested for conformity to specifications and for proper operation. Provide certification and/or documentation as described in individual Division 26, 27, and28 Sections. Typical tests shall include outlet polarity, insulation resistance, large circuit breaker tests, surge suppression systems, phase relationships and load balance.

3.9 MANUFACTURER'S INSTRUCTIONS

A. Furnish proper equipment and/or materials required for installation as intended by the manufacturer, for all work described under Division 26, 27, and 28. If needed for proper

installation or operation, request advice and supervisory assistance from the representative of the specific manufacturer. Manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated. Promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and obtain the Architect's instructions before proceeding with the work.

3.10 SEISMIC RESTRAINTS

A. Equipment, conduits, raceways, cable tray, etc. shall be provided with seismic restraints in accordance with Code requirements.

3.11 EXAMINATION OF SITE

A. Visit site of proposed work and become familiar with conditions affecting work. Verify measurements at the building before beginning work.

3.12 SITE UTILITY SERVICES

A. Where applicable, make connections to temporary electrical service immediately so as to provide the use of this service by other trades. Comply with Division 01 Section “Temporary Facilities and Controls” requirements.

3.13 EXISTING UTILITIES

A. Locations of existing concealed electrical utilities and connection points have been indicated as closely as possible from available information. Assume that such connection points are with in a 10-foot (10') radius of indicated locations. Where connection points are not within this radius, contact the Architect for a decision before proceeding.

3.14 LAYING OUT WORK

A. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Exact locations of such items shall be determined from the Construction Drawings. Verify physical dimensions of each component of electrical equipment, to fit available space and promptly notify the Architect prior to roughing-in if conflicts appear. Coordinate equipment to available space and access routes through construction. Offsets in conduits required for proper system installation shall be provided at no additional cost to Owner.

3.15 OPENINGS IN CONDUITS

A. Cap or seal temporary openings in conduits or raceways during construction. Remove caps or seals for final connections.

3.16 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.17 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate location of concealed equipment and devices requiring access with location of access panels and doors. Allow ample space for removal of parts that require replacement or servicing.

B. Access Doors: Prime coated 14 gauge steel, and flush, with screwdriver operated cam lock; frame to accommodate construction type. Access doors shall be manufacturered by Acudor, Elmdor or approved equivalent. See Division 08 Section “Access Doors and Frames.”

C. Access doors shall be a minimum size of 24” square and compatible with the surface in which they are installed. Access door fire rating shall be equivalent to the wall, ceiling or floor they are installed in.

3.18 CONCRETE BASES

A. Concrete forms and Reinforcement Materials as specified in Division 03:

1. Forms: 2-1/2 inch minimum height, ¾ inch chamfered edge at top of form.
2. Reinforcement 6x6x10/10 welded fabric
3. Provide concrete pads for electrical equipment and bases for site lighting fixtures.

B. Concrete: 3000-psi, 28-day compressive strength as specified in Division 03.

3.19 FIRESTOPPING

A. Material: Conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions. Manufactured by:

1. Specified Tech. Inc.
2. Metacaulk
3. Dow Corning
4. 3M Fire Protection Products
5. Tremco Sealants and Coatings

B. Firestopping Materials: Firestopping materials shall emit no toxic or combustible fumes, and shall allow for normal movement of the building structure and the penetrating elements without adversely affecting the adhesion or integrity of the firestopping system.

C. Openings in fire-rated walls, ceilings, or floors shall be protected by maintaining an effective barrier against the spread of flame, smoke, and gases. Where the penetrating elements are cables, corrugated plastic ducts, or other combustible items, fire stopping materials shall be intumescent type. Firestopping shall consist of UL listed fire-rated assemblies and shall be installed in accordance with UL approved installation details.

END OF SECTION 26 05 00

SECTION 26 05 05 – ELECTRICAL PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Division 01 Section “Submittal Procedures”.
2. Division 01 Section “Closeout Procedures”.

1.2 SCOPE OF WORK - GENERAL

A. This section specifies procedural requirements for electrical installations project closeout, including but not limited to:

1. Project Record Document submittal.
2. Operation and Maintenance Manual submittal.
3. Operation and Maintenance Instruction and Training.
4. Electrical Equipment and Systems Start-Up.
5. Final Cleaning.
6. Training Session Agenda.

1.3 PROJECT RECORD DOCUMENTS

A. Record differences between electrical Work as installed and as shown in Contract Drawings on a set of dedicated electrical “as-built” plans. Plans to be obtained from the Architect. Return the finished plans to the Architect at completion of the project. Notations made on drawings shall be neat and legible using red ink only. Mistakes or corrections shall be crossed out and the correction made next to it. Comply with Division 01 Section requirements.

B. Hard copy record drawings shall be convereted to electronic AutoCAD 2012 (or later) format and saved on to CD-Rom. If Contractor can not provide this service, L&S Engineering shall be hired to perform conversion.

C. Mark drawings to indicate the following:

1. Revisions to conduits and conductors; size and location both exterior and interior.
2. Revisions to branch circuiting.
3. Revisions to device and outlet location and/or height.
4. Revisions to lighting fixture locations.
5. Concealed equipment and/or devices.
6. Installed location of all underground site utilities including but not limited power, telecommunication, and future conduit raceways.

D. Revise equipment and fixture schedules on the plans to indicate actual installed manufacturer and model numbers.

E. Mark specifications to indicate change orders; actual equipment and materials used.

F. Record the following information for each connected motor and equipment item:

1. Nameplate data (volts, amps, phase)

2. Actual current drawn by each equipment item and each motor larger than 1/3 horsepower when operating at or near normal load.
3. Rating and catalog number or each thermal overload device finally selected for each motor over 1/3 horsepower.

G. Record the voltage between phases and between each phase and neutral, and the actual current in each phase at each panel with normal load applied.

1.4 OPERATION AND MAINTENANCE MANUALS

A. Prepare and submit Operation and Maintenance (O&M) Manuals for electrical systems provided. Comply with Division 01 Section requirements.

B. Manual binder shall have permanent lettering of a contrasting color.

C. Information to be included on the binder cover is as follows:

ELECTRICAL

OPERATION AND MAINTENANCE

MANUAL

(Project Name)

(Project Location)

(Year)

OWNER:	(NAME)
ARCHITECT:	(NAME)
ELECTRICAL ENGINEER:	L&S Engineering Associates, Inc.
GENERAL CONTRACTOR:	(NAME)
ELECTRICAL CONTRACTOR:	(NAME)

1. The spine shall be lettered as follows:
ELECTRICAL O & M MANUAL (Year)
(Project Name)

D. Provide master index at beginning of Manual showing sections and items included. Use plastic tab indexes for sections of Manual.

E. Cover section: List name, address, and phone number of Project Architect, General Contractor, Electrical Engineer, Electrical Contractor and all Electrical Sub-Contractors. Provide a list of equipment suppliers with address and phone number.

F. Provide a separate section for each Section of the Specifications. Provide index for each section listing equipment included. Include all items specified.

G. Include descriptive literature of each manufactured item (catalog cut sheets, etc). Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined. Data sheets shall be originals or clean copies of originals. Copies of faxes are not acceptable.

H. Include copies of approved submittals or shop drawings for all items requiring submittal.

I. One (1) copy of the O&M Manual shall be submitted for review and approval by the Design Engineer. After approval, submit three (3) copies of the manual to the Architect for approval, unless otherwise directed by Division 01 Section requirements.

J. Information to be included in O&M Manual:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping shut-down, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Sequence of operation for each installed system.
5. Itemized listing of lamp type and source for all installed lighting fixtures.
6. Test records and certifications.
7. Equipment start-up reports.
8. Warranty information and letters of guarantee.
9. Instruction period checklist for each equipment item.
10. Recommended supply source(s) for repair parts.

K. Complete O&M Manual shall be available for use by Owner's representatives during instruction and training sessions.

L. Provide electronic files of approved O&M Manual. Comply with requirements of Division 01 Section “Operation and Maintenance Data”.

1.5 OPERATION AND MAINTENANCE INSTRUCTION AND TRAINING

A. Instruct Owner's Representative(s) in the Operation and Maintenance procedures described in Operation and Maintenance Manual. Comply with Division 01 Section requirements.

B. Enlist services of qualified personnel, including each sub-trade and factory trained specialists for each major piece of equipment, to attend training sessions and provide operation and maintenance instructions.

C. Submit training agenda, schedule and list of representatives to Design Engineer for review 30 days prior to training sessions. Confirm attendance by written notification to all participants.

D. Prepare checklist of all equipment and systems requiring instruction and maintenance for verification and agreement by the Owner's Representative of satisfactory start-up and instruction. Checklist shall include a statement of completion by the Contractor, date and topic(s) covered in each training session, and an attendance list of all participants at each training session. Submit a copy of checklist to Design Engineer for review 30 days prior to training sessions. Include copy of the completed checklist in Operation and Maintenance Manual.

E. Minimum instruction time shall be 8 hours, unless otherwise specifically noted. Refer to individual Division 26, 27, and 28 Sections for additional instruction/training requirements.

F. All electrical systems shall be properly functioning prior to instruction period.

PART 2 - EXECUTION

2.1 ELECTRICAL EQUIPMENT AND SYSTEMS START-UP

A. Provide the services of a factory-authorized service representative to test and inspect unit installation, provide start-up service and demonstrate and train Owner's maintenance personnel.

B. Include certification of factory-authorized representative status as part of equipment submittal from manufacturer.

C. Include written start-up reports with test data for equipment in Operation and Maintenance Manual.FINAL CLEANING

A. At time of final cleanup, clean all lighting fixtures, devices and equipment and leave in condition for use intended. Vacuum cabinet interiors of control panels, mechanical units, etc. to remove all electrical construction debris.

2.3 SAMPLE TRAINING AGENDA

A. This agenda shown on the following pages represents the minimum training required. Prepare a specific agenda for Project as appropriate for the equipment provided. All training for Division 28 shall be per the individual sections.

B. The final agenda shall provide the names of the Contractors and manufacturer's representatives responsible for training in the locations identified as [Contractor] and [Mfr's Rep.].

C. In the space labeled "Acknowledged" in the agenda, the Owner will indicate those areas for which training was received and accepted as adequate to satisfy the training requirements.

D. A copy of the final training agenda shall be provided to the Owner for approval thirty (30) days prior to the training session.

Sample Training Agenda

Date: _____

Time: _____

Location: _____

Goals of the training:
For the Owner to know the maintenance requirements and proper operation of the installed electrical systems.

Time	Topic	Presented by	Acknowledged
1 hour	System Overview		
	- Electrical Distribution	[Contractor]	_____
	- Electrical Systems Overview	[Contractor]	_____
	- TVSS	[Contractor]	_____
	- Selective Coordination	[Contractor]	_____
	- Personal Protection Ratings	[Contractor]	_____
1 hour	Fire Alarm System		
	- O&M Manuals - Overview	[Mfr's Rep]	_____
	- Description of Operation	[Mfr's Rep]	_____
	- Demonstration of Operation	[Mfr's Rep]	_____
	- Explanation of Alarms	[Mfr's Rep]	_____
1 hour	Lighting Control System		
	- O&M Manuals - Overview	[Contractor]	_____
	- Description of Operation	[Contractor]	_____
	- Demonstration of Operation	[Contractor]	_____
1 hour	Communication Cabling Systems		
	- O&M Manuals - Overview	[Mfr's Rep]	_____
	- Description of Operation	[Mfr's Rep]	_____
	- Demonstration of Operation	[Mfr's Rep]	_____
	- Demonstration of Programming	[Mfr's Rep]	_____
1 hour	Cable TV Systems		
	- O&M Manuals - Overview	[Mfr's Rep]	_____
	- Description of Operation	[Mfr's Rep]	_____
	- Demonstration of Operation	[Mfr's Rep]	
1 hour	Video Survelliance		_____
	- O&M Manuals - Overview	[Mfr's Rep]	_____
	- Description of Operation	[Mfr's Rep]	_____
	- Demonstration of Operation	[Mfr's Rep]	_____
1 hour	Generator		
	- O&M Manuals - Overview	[Mfr's Rep]	_____
	- Description of Operation	[Mfr's Rep]	_____
	- Demonstration of Operation	[Mfr's Rep]	_____
	- Explanation of Alarms	[Mfr's Rep]	_____
1 hour	Nurse Call System		

Time	Topic	Presented by	Acknowledged
	- O&M Manuals - Overview	[Mfr's Rep]	
	- Description of Operation	[Mfr's Rep]	
	- Demonstration of Operation	[Mfr's Rep]	
	- Explanation of Alarms	[Mfr's Rep]	

Attendees: (list names or attach a separate sign-in sheet)

Training was provided for the attendees listed, on the agenda items acknowledged above.
Signed _____ Date _____
Owner's Representative

END OF SECTION 26 05 05

SECTION 26 05 07 – ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to work of this section.

B. Related Sections include the following:

1. Division 01 Section, “Summary” for phasing requirements.
2. Division 01 Section, “Cutting and Patching”.
3. Division 01 Section, “Selective Demolition” for general demolition requirements and procedures.
4. Division 01 Section 028082 “Lighting and Electrical Components.”

1.2 SUMMARY

A. Include all labor, equipment, and materials necessary to complete demolition of existing electrical systems as shown on the drawings and described herein.

B. Electrical services to areas occupied by Owner shall be maintained. If interruption of service is necessary, coordinate and schedule work with owner to minimize interruption.

C. Provide temporary raceways, circuits and connections to maintain power and communications systems in all occupied areas.

D. Remove and dispose of all transformers and related equipment which contain polychlorinated biphenals (PCB's) in full compliance with EPA regulations.

E. Remove and dispose of all fluorescent light tubes which contain mercury or other hazardous materials in full compliance with Federal, State, and local laws and regulations.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless idicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

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

PART 2 - SALVAGE

2.1 MATERIALS OWNERSHIP

A. The Owner shall have first salvage rights to all removed lighting fixtures and equipment. Coordinate selection with the Owner's Representative.

B. Except for items or materials to be reused, salvaged, reinstalled or otherwise indicated to remain owner's property, demolished materials shall become Contractor's property and removed from Project site.

C. Transport and legally dispose of off site, all materials resulting from demolition not being salvaged.

PART 3 - EXECUTION

3.1 PHASING

A. This project is phased to facilitate student occupation of the building during construction. It may be necessary to make temporary power or communication connections to accommodate the phasing. Existing power and systems will need to be selectively demoed to maintain services.

B. Maintain the following services to all buildings on the campus.

1. Electrical power systems
2. Local area network for data and voice systems
3. Fire alarm systems
4. Clock and bell systems
5. Security and access control systems.

C. The fire alarm system and intercommunications system shall be maintained at all times between the secondary school and the elementary/gymnasium.

3.2 CONTINUITY OF SERVICE

A. Obtain permission from the Architect and Owner's Representative prior to interruption of existing electrical systems. Reconnect existing circuit loads were necessary.

B. Where live circuits are encountered during demoltion, relocate and/or extend the circuits as required to accommodate construction.

C. Protect, brace and support existing active electrical circuits or equipment as required.

D. Circuits damaged during work of this contract shall be repaired. Data cables shall be replaced from termination jack to patch panel.

E. Schedule work to avoid interruptions to the occupied facilities. The Owner may require work to be performed on nights, weekends or holidays. Include overtime work as necessary.

3.3 DEMOLITION

A. Condition and Premises: The Owner assumes no responsibility for condition of areas to be demolished. General conditions existing at time of inspection for bidding purposes will be maintained by Owner.

B. Contractor shall visit the site and inspect all transformers and related equipment which is suspected of containing PCB's.

C. All equipment which is not labeled as containing PCB's, but is suspect shall be tested for contamination.

D. All equipment which is determined to contain PCB's (either by label or test) shall be removed and disposed of utilizing a method which is in full compliance with all EPA regulations for handling, transporting, and disposing of equipment containing PCB's.

E. Cleanup of any existing spillage containing PCB's shall be by the General Contractor.

F. Employ the services of a qualified company that specializes in the testing, handling, and disposal of items containing PCB's for removal and disposal of contaminated equipment.

G. Certify in writing to the Owner that all methods of handling and disposal of the PCB contaminated equipment have been accomplished in accordance with the EPA, and the regulations governing PCB's

H. Not all conduit, devices or equipment are shown on drawings. Other demolition may be required.

I. Partial Removal: Items of salvageable value to Contractor indicated to be removed, may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed. Storage or sale of removed items on site will not be permitted.

J. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.

K. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.

L. Existing Utility Services: Maintain existing utilities indicated to remain, keep in service and protect against damage during demolition operations.

M. Cut and/or patch and repair all existing floor, wall and roof penetrations not being re-used. Comply with Division 01 Section requirements.

N. All roof penetrations that are re-used shall be inspected and made air and water tight.

O. Cut and remove buried raceway and conductors, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

P. Remove, store, clean, reinstall, reconnect and make operational components indicated for relocation.

END OF SECTION 26 05 07

SECTION 260519 – WIRE AND CABLE

PART 1 - GENERAL

1.1 PROVISIONS

A. A complete system of wires shall be installed in the raceway system.

B. All wiring rated greater than 100 amps shall be aluminum. Branch circuits and feeders rated 100 amps and less shall be copper.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26, 27, 28.

1.3 SUBMITTALS

A. Complete manufacturer's data, including catalog cuts. Submit parts replacement/ordering information as part of O & M Manuals.

B. All submittals shall be made in accordance with requirements of Section 26 05 00 and Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All wiring shall be rated at 600 volts.

B. Wire sizes #12 AWG and #10 AWG shall be solid, type THHN/THWN. Wire sizes #8 AWG and larger shall be stranded, type THHN/THWN or sizes #4 AWG and larger may be type XHHW. Minimum wire size shall be #12 AWG, unless noted otherwise.

1. Exceptions:
   a. See Sections 271500 and 283111 for Communications Systems wire and cable requirements.

C. Aluminum conductors shall be stranded AA-8030 series aluminum alloy with XLPE insulation. Insulation shall be rated for 600V Type RHHW-2, compact stranded conductors.

D. Metal Clad Cable (MC) shall be made in accordance with U.L. 1569. Armor shall be galvanized interlocking steel strip with THHN conductors rated 90 degrees Celsius. Provide a neutral conductor for each phase conductor.

E. All wire shall be marked with gauge and insulation type on 24" centers, and color coded as required by the N.E.C.

F. All wire and cable shall be brought to the job in the original containers bearing the U.L. label.

G. Molded connectors with metal thread-on core shall be used for splicing #12 and #10 wires. Stranded cables shall be connected to lugs using mechanical connectors, and shall be wrapped with electrical tape to a thickness equal to the wire insulation.

H. Compression connectors for aluminum conductors shall be dual listed for use with both copper and aluminum conductors. Connections shall be made with hydraulic compression tool and shall have oxide-inhibiting compound. Connectors shall be Burndy Hyplug.

I. Support vertical conductors in raceways with a screw body and wedging type plug segments made to support cables and relieve strain without damaging conductor insulation.

J. Wire pulling lubricants shall be non-toxic, polymer based and compatible with conductor insulation. The dielectric strength of the conductor insulation shall not be reduced.

K. Termination fittings for aluminum conductors shall be Burndy "Hyplugs".

2.2 ACCEPTABLE MANUFACTURERS

A. Copper Wire and cable shall be as manufactured by Rome, Southwire, General Cable, American Insulated Wire, Superior/Essex or Cerrowire.

B. Aluminum wire shall be manufactured by Stabiloy.

C. MC cable shall be manufactured by AFC Cable Systems or Alflex.

D. Molded connectors shall be as manufactured by 3M or Buchanan.

E. Mechanical connectors shall be manufactured by Burndy, O.Z./Gedney Co., or Thomas & Betts.

F. Cable supports shall be manufactured by O.Z./Gedney.

G. Wire pull lubricant shall be manufactured by Thomas & Betts or Ideal.

H. Tape shall be manufactured by 3M.

I. Substitutions may be considered only when submitted in conformance with Section 26 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wires shall be pulled in such a manner as to avoid kinking or abrasion to the insulation. Use only approved lubricants which do not deteriorate conductors or insulation. Oil or grease shall not be used to lubricate wires.

B. Make sure that all conduit fittings have insulated bushings in place before pulling wires. If it is found that the insulating bushings are not in place before pulling wire, the wire will be removed and replaced with new at the contractor’s expense.

C. Where more than three current carrying conductors are installed in a single raceway, the minimum wire size shall be increased to comply with NEC Table 310-16, Note 8.

D. Where the distance from the overcurrent device to the first outlet exceeds 100 feet, the minimum wire size shall be #10 AWG.

E. MC cable may be used only for connections to luminaries. MC cable shall not exceed 6 feet in length.

F. All receptacle circuits associated with computer outlets shall have separate neutrals. No shared neutrals will be allowed. Neutral conductor shall be considered as "current-carrying" for the purpose of applying NEC Table 310-16, Note 8, above.

G. Wiring shall be arranged as shown on the drawings. Combining of homeruns will be allowed for up to three 20-amp circuits. Each circuit shall have a separate neutral.

H. Provide separate equipment ground conductor full length of all raceways. This conductor is not shown on the drawings and is in addition to the conductors shown.

I. Conductor insulation shall be color coded as follows:

CONDUCTOR	208Y/120 VAC	480Y/277 VAC
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White *	Grey *
Ground	Green	Green

1. * Neutral shall have colored stripe where so specified

J. Except where conductor sizes are indicated on the drawings, the following schedule, listing minimum conductor size, shall be adhered to:

CIRCUIT OVERCURRENT DEVICE RATING	CONDUCTOR SIZE
20 amperes or less	12
30 amperes	10
40 amperes	8
50 amperes	6
60 amperes	4
70 amperes	4
80 amperes	3
90 amperes	2
100 amperes	1

K. For paralleled conductors, lengths of the conductors shall be identical and one conductor for each phase and neutral shall be run in each conduit.

L. All terminations of aluminum wire shall be made with aluminum compression type fittings only, used in conjunction with hydraulic actuated dies. Dies shall compress the full circumference of the cable.

3.2 TESTING

A. Measure and record insulation resistance values for each service entrance conductor and each conductor rated 100 amps or more. Adjust measurements for ambient temperature. Test as recommended per wire manufacturer using 500 VDC or 1,000 VDC testing equipment. Replace wires with resistance of less than one megohm.

B. Inspect wire and cable for physical damage and proper connection.

C. Torque test conductor connections and terminations to manufacturer's recommended values.

D. Perform continuity test on all power conductors. Verify proper phasing connections.

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING

PART 1 - GENERAL

1.1 PROVISIONS

A. Provide grounding for the entire electrical system as required in Article 250 of the N.E.C., and as specified herein.

B. Provide grounding and bonding of telecommunications cabling as required by the NEC and as called for in ANSI/TIA/EIA 569 and 607-B, and as specified herein.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26.

B. See Sections 26 05 00, 26 05 19, 26 24 13, and 26 24 16.

1.3 SUBMITTALS

A. Complete manufacturer's data, including catalog cuts. Submit parts replacement/ordering information as part of O & M Manuals.

B. All submittals shall be made in accordance with requirements of Section 26 05 00 and Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All grounding and bonding conductors shall be copper. Aluminum or copper clad aluminum is not allowed.

B. Electrical System Ground Bar: 12 inch long, 4 inch wide, ¼ inch thick, extruded copper bar with two insulated supports.

1. Bar shall be drilled to accept standard 2-hole lugs.
2. Bar shall have wire clamp connectors and be capable of connecting a minimum of #6 AWG solid conductors.

2.2 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers shall be as listed above.

B. Substitutions may be considered only when submitted in conformance with Section 26 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The following are specifically included as requiring grounding:

1. All primary equipment and enclosures.

2. Electric service, equipment, and enclosures.
3. All raceways.
4. Neutral conductor on interior wiring systems.
5. Main and branch circuit panelboards.
6. Non-current carrying parts of fixed equipment.
7. Grounding terminal of all receptacles.
8. Motors.
9. Telecommunication rooms.

B. Install ground rod vertically, with top flush with ground level unless physically protected. Connect to water service on street side of main shutoff valve, building structural steel, and service transformer ground rod.

C. Provide ground strap between each wiring device and its associated outlet box.

1. Exception: Straps may be omitted if self-grounding devices are utilized.

D. Provide separate ground conductor full length of all raceways. Ground conductor is not shown on the drawings, and is in addition to conductors shown.

E. Provide a ground bar in each telecommunications space. Provide (1) #2 AWG continuous, insulated ground conductor from each ground bar to the main electrical service ground bar. Provide (1) #6 AWG insulated ground conductor from ground bar to each telecommunications rack in the telecommunication spaces.

F. Telecommunication room grounding: Self-Supporting and Cabinet-Mounted Equipment Rack Ground Bars:

1. When ground bars are provided at the rear of lineup of bolted together equipment racks, bond the copper ground bars together using solid copper splice plates supplied by the ground bar manufacturer.
2. Bond together nonadjacent ground bars on equipment racks and cabinets with #6 AWG insulated copper wire bonding jumpers attached at each end with compression-type connectors and mounting bolts.
3. Provide a #6 AWG bonding jumper between the rack and/or cabinet ground busbar and the aluminum pan of an overhead cable tray or the raised floor stringer as appropriate.

G. Backboards: Provide a screw lug-type terminal block or drilled and tapped copper strip near the top of backboards used for communications cross-connect systems. Connect backboard ground terminals to the aluminum pan in the telephone-type cable tray using an insulated #6 AWG bonding jumper.

H. Other Communication Room Ground Systems: Ground all metallic conduits, wireways, and other metallic equipment located away from equipment racks or cabinets to the cable tray pan or the telecommunications ground busbar, whichever is closer, using insulated #6 AWG ground wire bonding jumpers.

I. Telecommunications Cable Grounding

1. Bond all metallic cable sheaths in multi-pair communications cables together at each splicing and/or terminating location to provide 100 percent metallic sheath continuity throughout the communications distribution system.
2. At terminal points, install a cable shield bonding connector; provide a screw stud connection for ground wire. Use a bonding jumper to connect the cable shield connector to an appropriate ground source like the rack or cabinet ground bar.
3. Bond all metallic cable shields together within splice closures using cable shield bonding connectors or the splice case grounding and bonding accessories provided by the splice case manufacturer. When an external ground connection is

provided as part of splice closure, connect to an approved ground source and all other metallic components and equipment at that location.

J. Conduit: ground and bond metallic conduit systems as follows:

1. Ground metallic service conduit and any pipes entering or being routed within the computer room at each end using #6 AWG bonding jumpers.
2. Bond at all intermediate metallic enclosures and across all joints using #6 AWG bonding jumpers.

3.2 TESTING

A. Test ground electrode as required to assure resistance to ground less than 10 ohms. If resistance is higher than 10 ohms, add additional interconnected ground rods until resistance is below 10 ohms. Install additional ground rods no closer than 6 feet from original rod.

END OF SECTION 26 05 26

SECTION 26 05 29 – SUPPORT DEVICES

PART 1 - GENERAL

1.1 PROVISIONS

A. Support all raceways from the building structure as required by the N.E.C. and as described below.

B. Support lighting fixtures in accordance with IBC and as described below.

C. Support cabling as described below.

D. Support electrical equipment to walls or ceilings with concealed backing.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26, 27, 28.

1.3 SUBMITTALS

A. Complete manufacturer's data, including catalog cuts on standard equipment, and shop drawings for all custom equipment. Submit parts replacement/ordering information as part of O & M Manuals.

B. All submittals shall be made in accordance with requirements of Section 260500 and Division 01.

PART 2 - PRODUCTS

2.1 PROHIBITED MATERIALS

A. The following materials and products are prohibited from supporting or securing raceways, fixtures, panels, enclosures, and others requiring support:

1. Nails
2. Wire
3. Perforated tape or plumber's tape
4. Duct tape
5. Plastic zip ties
6. Glue and/or adhesive

2.2 MATERIALS

A. Provide two-hole pipe (conduit) straps; one hole shall only be used where space is limited and installation requires it. Straps shall be Kindorf #C-144 series or equal.

B. Provide channel-mounted pipe straps equivalent to Kindorf C-105 or C-106.

C. Lay-in pipe hangers shall be Kindorf #C-149 or equal.

D. Trapeze or wall surface supports shall be Kindorf "bolt-hole" base galvanized steel channels with #C105 and #C106 single bolt pipe straps.

E. Galvanized steel channels and associated support rods shall be selected to accommodate weight of associated raceway and wire. System shall be equal to “Unistrut”. Threaded Rods shall be 3/8-inch diameter with continuous UNC threads with load rating of at least 500 pounds.

F. Lighting fixture supports shall be as recommended by the light manufacturer. T-bar type fixtures shall be supported using standard T-bar accessories. Coordinate t-bar type with architectural specifications. Comply with ASTM C636.

G. Cable supports: Provide galvanized steel “D” rings or galvanized steel “J” hooks with Velcro wraps to secure cables. Bridle rings are not acceptable. Minimum “J” hook width shall be 3/4”. Size hooks per quantity of communication cables.

H. Provide surface mounted wall supports of steel strut channels and electrical attachment accessories.

I. Provide adjustable, galvanized steel bar hangers equivalent to Raco #920 or #922.

J. Provide adjustable, galvanized steel, box brackets equivalent to Erico “Caddy” #TSGB.

K. Provide backing that matches material and is compatible with building components.

2.3 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers shall be as listed above.

B. Substitutions may be considered only when submitted in conformance with Section 26 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Individual conduits shall be secured with steel pipe straps or lay- in pipe hangers.

B. Multiple rows of suspended conduit shall be supported from trapeze style hangers.

C. Multiple runs of conduit on ceiling or wall surfaces shall be mounted on flush or surface steel channels.

D. Ceiling support wires shall not be used for support of conduits and other raceway systems.

E. Support lighting fixtures as recommended by the manufacturer. If installed in T-bar ceilings, support as required by N.E.C., and in addition, provide (2) #12 gage slack wire hangers from the fixture housing to the structure above. Comply with International Building Code.

F. Outlet boxes in framed walls or ceilings shall be supported by horizontal box brackets attached to two studs. Outlet boxes in suspended ceilings shall be supported by bar hangars attached to two ceiling support channels.

G. Communication and control cables shall be sported by “J” Hooks and “D” Rings. Supports shall insure that the cable will not kink, sag or distort. Supports shall be spaced at less than 60 inches apart. Group cables by system in Velcro wraps.

H. Connect freestanding equipment to the building structure. Anchor floor-mounted equipment to the floor with appropriate fasteners.

I. Support suspended electrical equipment from the building structure and provide sway bracing.

END OF SECTION 26 05 29

SECTON 26 05 31 – OUTLET BOXES

PART 1 - GENERAL

1.1 PROVISIONS

A. Each switch, wall receptacle, light fixture, telecom work area outlet, A/V wall device, and other miscellaneous device shall be provided with an outlet box.

B. All outlet boxes shall be of the flush type unless specifically noted otherwise.

C. Box dimensions shall be selected to meet wiring space requirements. Depth may be limited by building conditions.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26, 27, 28.

1.3 SUBMITTALS

A. Complete manufacturer's data, including catalog cuts on standard equipment, and shop drawings for all custom equipment. Submit parts replacement/ordering information as part of O & M Manuals.

B. All submittals shall be made in accordance with requirements of Section 26 05 00 and Division 01.

PART 2 - PRODUCTS

2.1 PROHIBITED MATERIALS

A. Sectional outlet boxes shall not be utilized.

2.2 MATERIALS

A. Flush outlet boxes shall be galvanized pressed steel, of the knockout type, not less than 4" square, minimum 14 U.S. gauge.

B. Provide extension rings for all flush boxes. Boxes which occur in concrete block walls shall be equipped with 1-1/2" square cornered tile extensions.

C. Outlet boxes installed in surface metallic raceway systems shall be shallow boxes manufactured as part of the system.

D. Surface mounted outlet boxes shall be utilized only in conjunction with exposed conduits and shall be of the cast metal type with internal hubs and mounting flanges.

1. Exception: Exposed outlet boxes serving equipment connections in mechanical spaces and other unfinished areas may be pressed steel.

E. Boxes for exterior below grade installation shall be watertight, rated for exterior use, with gasketed covers and watertight connections. Boxes shall be cast steel, fully coated with corrosive protective compound. Boxes in paved areas shall be traffic rated.

2.3 ACCEPTABLE MANUFACTURERS

A. Pressed steel boxes shall be manufactured by Bowers, Raco, or T&B (Steel City).

B. Cast metal boxes shall be manufactured by Bell.

C. Surface boxes which are part of surface metallic raceway systems shall be manufactured by the same manufacturer as the surface metallic raceway.

D. Substitutions may be considered only when submitted in conformance with Section 26 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All outlet boxes shall be flush unless specifically noted otherwise.

B. This Contractor shall carefully lay out all outlets and check with the plumbing, heating, ventilating, and other contractors so that the outlets are not blocked, hidden, or rendered inaccessible due to equipment or piping of these trades passing over, under, across, or in close proximity to same, or to cause the devices or fixtures in or on these outlets to be inaccessible for use or maintenance.

C. Any minor changes in the location of outlets from those shown on the plans shall be made without extra charge if so directed by the Architect before installation.

D. Where two or more of the same type devices occur adjacent to each other, they shall be in a gang type box with a gang type cover. Where different type devices occur adjacent to each other, space outlet boxes so that finish plates will be spaced one inch apart (verify with Architect).

E. Contractor shall consult the Architectural drawings for exact height of all outlets not specified herein or shown on the drawings.

F. Flush ceiling and wall outlet boxes shall have a 3/8" fixture stud where fixture depends on such for support.

G. Each ceiling outlet occurring in a suspended ceiling shall be supported from a bar hanger rigidly attached to ceiling support channels.

H. Outlet boxes shall be supported independent from the raceway system.

I. All switch outlets shall be located where shown, on strike side of door, and shall be 6" from the door casing, unless it is necessary to center switch between door and other construction for appearance.

J. Where two or more outlets occur on the same wall, unless individually noted otherwise, they shall be mounted at exactly the same height.

K. Where outlets are shown side by side but at different heights, they shall be centered one above the other unless otherwise indicated.

L. Outlets which are shown immediately opposite one another on two sides of a wall shall have boxes sized to prevent contact between the two. Nipples between boxes are prohibited.

M. Outlets shown immediately opposite one another on two sides of a fire rated wall shall have 24" minimum horizontal separation.

N. No outlet or group of outlets in a single stud space of a fire rated wall shall have a total opening area larger than 16 square inches.

O. All unused openings in outlet boxes must be left sealed or closed with plugs.

P. Grout around all outlet boxes to seal space between box and wall or ceiling materials.

3.2 MOUNTING HEIGHTS

A. Outlet boxes shall be mounted at heights as shown on the drawings. Dimensions are measured to the top of the box unless a "B" follows the dimension. In this case, the dimension is to the bottom of the box.

1. Exception: In spaces where existing outlets are installed, new outlets shall be mounted at the same height as existing similar outlets.

END OF SECTION 26 05 31

SECTION 26 05 32 – PULL AND JUNCTION BOXES

PART 1 - GENERAL

1.1 PROVISIONS

A. Furnish and install pull and junction boxes in all locations shown or required for proper installation of the raceway and wiring systems.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26, 27, 28.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide galvanized sheet steel junction and pull boxes, with screw-on covers, of the type, shape, and size to suit each respective location and installation.

1. Type for various locations:
   a. 100 cubic inches or smaller: Standard outlet box with stamped knockouts.
   b. 150 cubic inches or larger: Code gauge steel with slides formed and welded, with screw covers unless shown to have hinged doors. Hinged doors shall have locking device same as furnished for panelboards. Knockouts shall be factory stamped, or formed in the field with a cutting tool to provide a clean, symmetrically cut hole.
   c. Exterior or wet areas: Weatherproofed galvanized steel construction with proper gaskets and corrosion resistant fasteners.
   d. Ordinary Cast Metal Boxes: Provide cast aluminum or malleable iron with a minimum wall thickness of 1/8". Boxes shall have integral threaded raceway hubs and mounting flanges. Boxes shall be corrosion resistant on the inside and outside and contain gasketed covers held in place with a minimum of four corrosion-resistant screws.

2.2 APPROVED MANUFACTURERS

A. Pull and junction boxes shall be as manufactured by the following:

1. Appleton Electric Co, Circle AW, Hoffman, Keystone, panelboard manufacturer

B. Cast Metal Boxes:

1. Appelton, Crouse Hinds, OZ/Gedney

C. Substitutions may be considered only when submitted in conformance with Section 26 05 10.

PART 3 - EXECUTION

3.1 PROHIBITED INSTALLATION METHODS

A. No box shall be secured to the ceiling system, HVAC ductwork, or mechanical piping.

3.2 INSTALLATION

A. Install electric boxes as indicated, and in compliance with N.E.C. requirements, in accordance with manufacturer's recommendations and with recognized industry practices to ensure that the boxes serve the intended purpose.

B. Provide pull and junction boxes wherever necessary for proper installation of the various electrical systems.

C. Provide knockout closures to cap all unused holes where blanks have been removed.

D. Coordinate and locate boxes to ensure accessibility of electrical wiring.

E. Secure boxes rigidly to the building element on which they are mounted, or solidly embed boxes in concrete or masonry.

F. Identify all boxes with label showing the individual feeder or electrical system.

G. Boxes shall have the appropriate NEMA rating for the location.

H. Ordinary cast metal boxes shall be used in exposed locations in mechanical, electrical and telecommunications rooms.

END OF SECTION 26 05 32

SECTION 26 05 33 – RACEWAY SYSTEM

PART 1 - GENERAL

1.1 PROVISIONS

A. All Division 26, 27 and 28 wires and cables shall be enclosed in a raceway system unless specifically noted otherwise.

B. All raceways shall be concealed unless noted otherwise.

C. Separate raceway systems shall be provided for each of the various wiring systems:

1. Line voltage power
2. Fire alarm system
3. Telecommunication system(s)
4. Video surveillance system
5. Security and access control system
6. HVAC controls and building management system (DDC)
7. ADA door system

D. Raceways for telecommunication cabling shall comply with ANSI/TIA/EIA Standards 568 and 569.

E. All conduit and electrical power required for the special systems in Division 27 and 28 shall be furnished and installed by the Electrical Contractor as part of the overall Division 26 Work.

F. Provide a complete raceway system for all mechanical system low voltage controls. Coordinate with mechanical contractor; review all related specifications and drawings for extent of work.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26, 27 and 28.

B. See Sections 01 35 13, 26 05 00, 26 05 19, and 26 05 29.

1.3 SUBMITTALS

A. Complete manufacturer's data, including catalog cuts. Submit parts replacement/ordering information as part of O & M Manuals.

B. All submittals shall be made in accordance with requirements of Section 26 05 00 and Division 01.

PART 2 - PRODUCTS

2.1 PROHIBITED MATERIALS

A. “Pot-metal” or cast fittings, couplings, or connectors.

B. Aluminum raceways, fittings, couplings, and connectors.

C. Electrical Non-Metallic Tubing (ENT). Also known by trade name “smurf tubing”.

2.2 MATERIALS

A. Rigid Steel Conduit: Standard iron pipe size with screwed joints for electrical raceway use, in conformance with ANSI C80.1 “Rigid and Steel Conduit.” Raceway shall be zinc coated by hot dip galvanizing or sherardizing. Manufacturer shall be Allied Tube and Conduit or Triangle PWC.

B. Electrical Metallic Tubing: Zinc-coated steel in conformance with ANSI C80.3 “Electrical Metallic Tubing,” manufactured by Allied Tube and Conduit, or Triangle PWC.

C. Rigid Non-Metallic Conduit: Polyvinyl chloride, Schedule 40, heavy-wall, U.L. labeled, in conformance with U.L. Article 651 and NEMA TC-2 as manufactured by Carlon Electrical Products or P.W. Pipe.

D. Rigid Non-Metallic Conduit, Type “EB”: Polyvinyl chloride, designed for encased burial, in conformance with U.L. 651A, U.L. 657A, and NEMA TC-6, as manufactured by Carlon Electrical Products or P.W. Pipe.

E. Flexible Conduit: Galvanized steel in conformance with UL-1 “Flexible Metal Conduit”, manufactured by International, American Brass, or All-Flex.

F. Flexible Conduit, Liquidtight: Galvanized steel in conformance with UL-360 “Liquid-Tight Flexible Steel Conduit”, manufactured by American Brass Co. “Sealtite” or “Flex-Seal” with copper bonding tape and with weatherproof exterior jacket.

G. Surface Metal Raceway: Painted or powder coated steel with snap-on covers. Provide one or two compartment raceway system as needed. Color to be white; verify with architect prior to ordering. Provide raceway system of size required for wiring needs, furnished with all associated hardware. System shall be equal to Legrand Wiremold 4000 series.

H. Fittings, Couplings and Connectors: Utilize fittings listed and approved for specific conduit or raceway system used. All fittings, couplings, and connectors shall be steel or malleable iron and shall have insulated bushings molded or locked into the metallic body of the fitting for protection of conductors. Fittings for galvanized rigid steel raceways shall be the threaded type. Fittings for EMT shall be or compression type. Fittings for flexible conduit shall be of the wedge and screw or the squeeze and clamp type. Fittings for liquid tight flexible conduit shall have a threaded grounding cone, and a compression ring with gland for tightening. Fittings shall be manufactured by Appleton, Thomas & Betts, OZ/Gedney or same manufacturer as conduit.

2.3 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers shall be as listed above.

B. Substitutions may be considered only when submitted in conformance with Section 26 05 00.

PART 3 - EXECUTION

3.1 PROHIBITED LOCATIONS AND INSTALLATION METHODS

A. Electrical metallic tubing shall not be installed underground, in concrete, or exterior (non-galvanized).

B. No raceway shall be secured to the ceiling system, ceiling hangers, HVAC ductwork, or mechanical piping.

C. Rigid non-metallic conduit (PVC) shall not be used inside a building unless encased in concrete.

3.2 REQUIRED LOCATIONS

A. Rigid steel conduit shall be used for all exposed exterior raceways, for transition of non-metallic raceways before rising above floor slabs or grade and in locations specifically noted or required by code. Conduit shall be galvanized or have similar anti-corrosion coating or plating.

B. Rigid non-metallic conduit shall be used for all conduits installed underground (with rigid steel elbows), in concrete slabs and in locations where specifically noted.

C. Flexible conduit can be used wherever concealed and not subject to damage.

D. Liquidtight flexible conduit shall be used in place of flexible conduit in damp or wet locations, including all connections to pumps.

E. Surface metal raceways shall be used only in finished areas where surface raceways are required by building conditions or as specifically noted. Contractor shall make all attempts to conceal raceway system before utilizing surface metal raceway system.

F. Electrical metallic tubing shall be used in all locations not noted above.

3.3 INSTALLATION

A. Underground raceways (other than single conduits) shall be arranged as shown in NEC Figure B.310.15(B)(2)(2).. Maximum depth to the top of all buried raceways shall be 30-inches.

B. Maximum size raceway to be installed in concrete floor slabs shall not be larger in outside diameter than 1/3 the overall thickness of the slab. Raceways shall be installed in middle third of the slab thickness and leave at least 1-inch concrete cover. Raceways shall be secured to reinforcing to prevent sagging or shifting during concrete placement. Raceways shall be spaced no closer than three diameters laterally to prevent voids in the concrete. Curved portions of bends shall not be visible above the finished slab.

C. Non-metallic raceways run in concrete slabs shall make a transition to rigid steel conduit before rising above the slab.

D. Stub-ups in floor slabs shall be made with an adjustable top or coupling threaded inside for plugs, set flush with the finished floor. For connections to equipment, extend raceway from fitting with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor.

E. Maintain minimum 6-inch separation from steam and hot water lines.

F. All raceways shall be installed parallel with or at right angles to the building lines, and not installed diagonally.

G. The locations of all raceways shall be coordinated with all other trades. If a conflict occurs due to lack of this coordination, then changes in the location of the raceways shall be made without extra charge.

H. For conduits one inch and larger, hickey bends are not acceptable. Either manufactured elbows or bends fabricated in a bending machine must be used.

I. Where a conduit enters a box or other fitting through a knockout, an approved double locknut and insulating bushing must be provided. All conduits shall be equipped with insulating bushings at all outlets, pull boxes, panels, etc.

J. Flexible conduit connections to motors shall include (1) 90 degree bend.

K. All conduit shall be cleaned by pulling a swab through the conduit before pulling in wires.

L. Branch raceway runs are shown schematically. Except where exact routing is indicated, branch circuit raceways may be grouped, and the actual routing of branch circuit raceways may be altered, providing actual locations are properly entered on the “As-Built” drawings.

M. Conduit connections between outlet boxes less than 24 inches apart on opposite sides of a wall shall be made with a loop of flexible conduit (no nipples).

N. Provide expansion fittings for all rigidly fastened conduits spanning expansion joints, and for all runs 1-1/2 inch or larger exceeding 150 feet in length. Fittings shall be hot-dipped galvanized malleable iron with a packing ring to exclude water, a pressure ring, and a separate external bonding jumper.

O. Seal around all conduits at ceiling, floor, and wall penetrations with an approved fire stop material to provide airtight fireproof seal.

P. Provide roof jack at all roof penetrations. Coordinate roof jack type and installation with General Contractor. Equipment must be compatible with required roof guarantee.

Q. Install raceway sealing fittings per the manufacturer’s recommendations. Sealing fittings shall be located in approved, accessible locations and filled with U.L. listed sealing compound. For concealed raceways, install fittings in a flush steel box with a blank cover. Sealing fittings shall be installed where raceways enter/leave a hazardous area, a refrigerated area and as otherwise required by the code.

R. Where conduit runs are 100 feet or longer contain the equivalent of four (4) 90E bends, pull/junction boxes shall be provided. Pull box locations shall be indicated on the record drawings.

S. Minimum size conduit shall be 3/4 inch, except where a single circuit of two #12 or two #14 AWG wires are installed, which requires 1/2 inch conduit minimum. Minimum size conduit to be 3/4 inch below grade. Conduit sizes shown on the drawings shall supersede these requirements.

T. All unused raceways shall be provided with a nylon pull string. Raceways larger than 1-1/2 inch shall be provided with a 1/4 inch poly pull line.

END OF SECTION 26 05 33

SECTION 26 05 34 – EQUIPMENT ENCLOSURES

PART 1 - GENERAL

1.1 PROVISIONS

A. This section of the specification applies to the enclosures for enclosed equipment other than grouped equipment. Grouped equipment includes motor control centers, switchboards, panelboards, etc.

B. Provide weather-tight NEMA-rated enclosures for equipment mounted outdoors or exposed to moisture.

C. Items covered includes:

1. Switches (fusible and non-fusible; motor starting).
2. Starters (magnetic, manual, combination).
3. Circuit breakers.
4. Pilot devices including push-button stations.
5. Contactors.
6. Control enclosures.

1.2 SUBMITTALS

A. List manufacturer and certify compliance with industry standards.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Enclosures used indoors in non-designated areas shall be NEMA 1 unless otherwise noted.

B. Enclosures used outdoors in non-designated areas shall be NEMA 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate location of enclosures with other trades.

B. Install disconnect switch and similar device enclosures where accessible per code.

C. Enclosures for individual units shall be mounted at 4'- 6" above floors to centerline of switch, controls, etc.

D. Utilize mounting hardware designed for the intended use.

E. Provide supports and brackets required to attach the enclosure.

F. Enclosures shall be installed parallel and perpendicular to architectural and structural elements.

END OF SECTION 26 05 34

SECTION 26 05 35 – SURFACE METAL RACEWAY

PART 1 - GENERAL

1.1 SUMMARY

A. This specification covers a two-channel surface metal raceway system to provide power outlets and communication wiring. The surface metal raceway shall consist of a base, blank cover, and appropriate fittings and devices to complete installation per electrical drawings.

1.2 SUBMITTTALS

A. Provide product data for each type of multi-outlet assembly.

PART 2 - PRODUCT

2.1 MATERIALS

A. The raceway shall be a two-piece design with a base and snap on cover. Total width shall be 4.75" by 1.75" deep with a cross sectional area of 7.44 square inches. Raceway shall have ivory finish.

B. The cover shall include receptacles and/or communications outlets as shown on the drawings. Communication jacks shall comply with Section 271500.

C. Provide a barrier in raceway to separate low voltage wiring from branch circuit wiring.

D. Raceway shall be equivalent to Wiremold 4000 series. Provide device mounting brackets as required #V4050 and #5507.

E. Fittings: A full complement of fittings must be available including but not limited to couplings, flat, internal and external elbows, tees, entrance end fittings, blank end fittings, cover clips, wire clips and support clips. The fitting covers shall be painted with an enamel finish to match the raceway. All fittings shall be supplied with a base where applicable. Transition fittings shall be available to adapt to an existing flush wall box and to other series raceways manufactured by The Wiremold Company.

F. Device and Extension Boxes: Device boxes shall be available to mount standard devices and device face plates in single-gang, two-gang and three-gang configurations. The boxes shall be available in depths of 1-3/8" and 2-3/4". The box covers shall be painted with an enamel finish to match the raceway. Extension boxes shall be available in single gang, two gang and three gang configurations for extending from existing flush wall boxes.

G. Wiring Devices: A full complement of wiring devices shall be available designed to mount directly to the base section of the raceway without additional plates or mounting hardware. Devices shall consist of medium base light sockets, grounding receptacles and isolated ground receptacles in 5-15R, 5-20R and 6-15R NEMA configurations.

H. Communications Devices and Accessories: The raceway manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP (including Category 6), STP (150 ohm) fiber optic, coaxial and other cabling types with face plates and bezels to facilitate mounting. A complete line of preprinted station and port identification labels, snap-in icon buttons as well as write-on station identification labels shall be available.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prior and during installation, refer to system layout drawing containing all elements of the system. Installer shall comply with detailed manufacturer's instruction sheets which accompany system components as well as complete system instruction sheets, whichever is applicable.

B. Mechanical Security: All raceway systems shall be mechanically continuous and connected to all electrical outlets, boxes, cabinets, in accordance with manufacturers installation sheets.

C. Electrical Security: All metal raceway shall be electrically continuous and bonded in accordance with the national Electrical Code for proper grounding.

D. Raceway Support: Raceway shall be securely supported at intervals not exceeding 10 feet or in accordance with manufacturer's installation sheets.

E. Completeness: All raceway systems shall be installed complete, including insulating bushings and inserts where required by manufacturer's installation sheets. All unused raceway openings shall be closed.

END OF SECTION 26 05 35

SECTION 260551 – DEVICE PLATES

PART 1 - GENERAL

1.1 PROVISIONS

A. Provide each wiring device and each outlet with a plate.

B. Plate shall be size and type to match device.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26.

1.3 SUBMITTALS

A. Complete manufacturer's data, including catalog cuts on standard equipment, and shop drawings for all custom equipment. Submit parts replacement/ordering information as part of O & M Manuals.

B. All submittals shall be made in accordance with requirements of Section 26 05 00 and Division 01.

PART 2 - PRODUCTS

2.1 PROHIBITED MATERIALS

A. Sectional plates shall not be utilized.

2.2 MATERIALS

A. All devices shall be equipped with satin finished stainless steel plates, of type to match device.

B. Provide Type 302 stainless steel with satin finish equivalent to P&S Sierra “SS” series.

C. All junction boxes in finished areas shall be provided with blank plates.

D. All outlets for communications and A/V devices shall be provided with plates to match device. Provide satin stainless steel if available.

E. Plates on exposed pressed steel boxes shall be pressed steel of the same manufacture as the box, unless noted otherwise.

F. Weatherproof while-in-use receptacle covers shall be cast aluminum with gasket. Plate shall mount on a horizontal single gang outlet and meet or exceed UL requirements. Provide a lockable hasp. Cover shall be equivalent to Intermatic #WP101HMC.

2.3 ACCEPTABLE MANUFACTURERS

A. Plates shall be manufactured by P&S, Arrow Hart, Hubbell, or Leviton.

B. Substitutions may be considered only when submitted in conformance with Section 26 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install plate on each device outlet, communications outlets, and junction box.

B. Device plates shall be fitted tight to wall. Adjust device to accommodate.

C. All receptacles other than 15 or 20 amperes, 120 volts, shall be engraved with designation of amperage, voltage, and phase, in 3/16" high letters. See Section 26 05 53.

D. All device plates shall be identified as to circuit number. See Section 26 05 53.

END OF SECTION 26 05 51

SECTION 26 05 53 – ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 GENERAL

A. All identification shall use the room numbers assigned by the Owner. Obtain a list of room numbers from the Owner's Representative prior to preparing identification

1.2 PROVISIONS

A. Install nameplates on all main distribution panels, starters, panelboards, telephone cabinets, disconnect switches (including those at main panels), lighting control panel(s), and miscellaneous Division 27 and 28 systems boxes, enclosures, and cabinets installed under this contract.

B. Install plates with engraved labels at all control switches noted on the drawings.

C. Install printed labels on all device plates, showing circuit number.

D. Install engraved plastic nameplates at each protective device in switchboard and distribution centers, showing circuit service.

E. Install type written branch circuit directory cards in all panelboards.

F. Provide arc flash information on electrical equipment.

G. Install printed labels on cover of all junction boxes, showing system identification and/or circuit number.

H. All wiring in all outlet and junction boxes shall be properly identified as to cable source or circuit number. Verify type of marker with Engineer before installation.

1.3 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26, 27, 28.

B. See Sections 26 05 00, 26 09 43, 26 24 13, 26 24 16, 26 27 26, and 26 28 16.

1.4 SUBMITTALS

A. Detailed shop drawings for all custom nameplates.

B. All submittals shall be made in accordance with requirements of Section 26 05 00 and Division 01.

PART 2 - PRODUCTS

2.1 PROHIBITED MATERIALS

A. Dymo (or equivalent) labels shall not be utilized, unless specifically noted.

B. Permanent type marking pens (i.e. Sharpie).

2.2 MATERIALS

A. Nameplates:

1. Nameplates shall be fabricated from black Bakelite, with 1/4" or 3/8" engraved white letters.
2. Wherever engraved plates are noted on the drawings, such labels shall be engraved directly into the metal or plastic plate, dead front, or other material.
3. Engraved letters shall be 1/4" or 3/8" high, filled with black enamel, and read as directed.

B. Printed labels shall be matte white polypropylene with adhesive back designed for exterior applications. Label text shall be 3/4“-high, black and shall be applied to the label by a thermal transfer printer. Printed labels shall be made using a Brady ID PAL printer.

C. The available fault current shall be indicated on the main distribution panel. Fault current information and date of calculation shall be located on the incoming section of the main switchboard.

D. A warning sign complying with NEC Article 110.16 shall be provided for all switchboards, panelboards, motor starters, dry-type transformers, disconnect switches, and lighting control panels. Arc flash signs shall be in accordance with ANSI Standard Z535.4 requirements. Signs shall state “Warning”, “Arc Flash Hazard”, and “Appropriate PPE Required.”

E. Schedules:

1. Provide typewritten directory for each panel, on heavy card stock, showing all circuit numbers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Nameplates:

1. Panelboards: Mount above door opening. On dead front panels install above circuit breakers, unless panelboard is located in a utility-type room, then install nameplate on outside of panelboard above door.
2. Telecom and Miscellaneous LV Systems Cabinets: Mount nameplate on outside of cabinet above door(s).
3. Disconnect Switches, Relays, Contactors, and Lighting Control Panel(s): Mount nameplate on outside of cabinet, near top.
4. Control Switches: Install nameplate in location as directed near switch. Nameplate is required unless engraved labels are specified.
5. Junction Boxes: Install nameplate on exterior of cover.

B. Schedules:

1. Panelboards: Mount in frame under plastic cover, on back side of door. Schedule shall show circuit service for each circuit breaker, using "Owners" room numbers. Spares and spaces shall be written in pencil.

C. Device Plates:

1. Provide line voltage branch circuit identification labels on all receptacle outlet device plates.
2. Provide network identification labels on all telecom work area outlets.

END OF SECTION 26 05 53

SECTION 26 08 00 – COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 COMMISSIONING AUTHORITY

A. The commissioning authority (CA) TestComm, LLC has been contracted directly with the owner for this project. The CA has overall responsibility for planning and coordinating the commissioning process. However, commissioning involves all parties involved with the design and construction process, including the Electrical (Division 26, 27 and 28) contractor, as many HVAC system components require electrical power, low voltage, fire alarms and controls in order to operate as specified.

1.2 CONTRACTOR RESPONSIBILITY

A. The Electrical (Division 26, 27 and 28) contractor's responsibilities are defined in Section 01 91 13, "Commissioning Requirements" of the specifications. Each subcontractor and supplier within Division 26, 27, and 28 shall review Section 01 91 13, and their bids shall include for carrying out the work described, as it applies to each section within the Division 26, 27, and 28 specifications, individually and collectively.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 26 08 00

SECTION 26 09 23 – NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 PROVISIONS

A. This Section of the Specification applies to low voltage lighting controls for the project.

B. Provide complete lighting controls for interior lighting as indicated on the plans and specified herein. Specifications shall take precedence over the plans if discrepancies arise.

C. Adjust and test the lighting controls, and demonstrated operation to the Owner's Representative and Commissioning Agent.

D. Instruct the Owner's staff in operating the controls and recommended maintenance procedures.

1.2 RELATED REQUIREMENTS

A. Drawings and the general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work in this section

B. See Sections 26 05 00, 26 05 19, 26 05 31, and 26 05 32

1.3 GENERAL DESCRIPTION

A. Interior vestibules, common spaces and corridors shall have time-based controls consisting of automatic relays and low voltage switches. Lighting installed under sky-lights and adjacent to windows shall be provided with daylight harvesting and photocells.

B. Interior office area lighting shall be occupancy based with dual technology occupancy sensors, power pack relays and slave relays.

C. Dining and Entertainment Rooms shall be provided with daylight harvesting and individual room controls including dual technology occupancy sensors, photocells, and low voltage wall controls.

D. Include low-voltage cabling and all other miscellaneous equipment and devices required for a complete and operable lighting control system.

1.4 SYSTEM OPERATION

A. Time-based controls for interior lighting shall provide automatic on/off control as indicated.

1. Control interior lighting by zone, with each zone incorporating a separate override switch.
2. Time-based control zones shall include spaces in the building where no occupancy-based controls are provided, other than areas where lighting must remain in operation 24-hours per day, in mechanical and electrical equipment rooms.

3. Each time-based control zone shall be equipped with means to manually override the automatic lighting controls, which shall enable the lighting in that zone to remain in operation for an adjustable time period set for no longer than 2 hours. The manual override switch shall be located within sight of the controlled lighting.
4. Interior lighting in each time-based control zone shall be enabled during normal business hours by automatic controls which switch on and off automatically at preprogrammed times each day. The controls shall incorporate separate schedules for each day of the week, with automatic pre-programmed schedule changes for holidays and special events.

B. Occupancy-based controls for interior lighting shall provide automatic shut-off control as indicated.

1. Control interior lighting by room, with automatic controls functioning to turn off the general room lighting after a time delay when no occupant is present in the room.
2. Occupancy sensors shall provide complete and proper volumetric coverage of each room.
3. Occupancy-based controls, except wall switch occupancy sensors, shall include means for automatic self-adjustment. Sensors shall have adjustable sensitivity and time-delay settings, which shall be adjusted in each room to suit the actual room conditions. Dual-technology sensors shall also be equipped with selectable technology logic, initially set to require actuation of both technologies to activate the sensor and either technology to keep it activated. The occupancy sensors shall be aimed and adjusted such that the presence of one occupant anywhere in a room is sufficient to keep the control from automatically shutting off the lighting, without requiring excessive activity or special movement on the part of the occupant. Normal air movement while the room is unoccupied shall not in itself cause the occupancy sensors to remain activated.
4. Wall switch occupancy sensors, shall include means for manual adjustment. Sensors shall have adjustable sensitivity and time-delay settings, which shall be adjusted in each room to suit the actual room conditions. The occupancy sensors shall be adjusted such that the presence of one occupant within sight of the sensor is sufficient to keep the controls from automatically shutting off the lighting, with sufficient time-delay to allow an occupant to conduct any normal functions that may be out of sight from the sensor. Normal air movement while the room is unoccupied shall not in itself cause the occupancy sensor to remain activated.
5. Occupancy based controls, except wall switch occupancy sensors, shall include auxiliary contacts for interface with the energy management system for HVAC system control, in accordance with requirements of Division 23.

C. Dimming daylight harvesting controls for interior lighting shall provide automatic dimming control as indicated.

1. Control interior lighting in daylight zones room by room, with automatic controls to dim the general room lighting in the daylight zone, after a time delay, whenever the ambient illumination in the daylight zone increases or decreases outside of the pre-set dead band beyond the setpoints for the current level.
2. Increase in ambient illumination in the daylight zone shall cause the lamps to dim proportionately, with the row closet to the window dimming more than the row or rows farther away. Decrease in the ambient illumination in the daylight zone shall cause the lamps to increase lumen output proportionately.
3. The controls shall include an automatic shut-off feature, capable of automatically shutting off a channel when the daylight remains adequate to cause the channel to fully dim for a pre-set interval. The controls shall include facilities to disable this feature.
4. The controls shall provide separate adjustable dimming rates and time delays for each lighting channel in each daylight zone.

5. In each room that is equipped with dimming day-light harvesting controls, a manual override dimmer switch shall be provided. The manual override switch shall permit switching between automatic control and manual control of lighting in the daylight zone. When manual override dimmer switch is activated, the controls shall hold the lighting at the user-designated level until the controls are returned to automatic control.
6. Dimming daylight harvesting controls shall be compatible with occupancy sensors which shall function as described above to shut off all lights in the room, including those in the daylight zone, when the room is unoccupied. Occupancy sensors shall shut off the lights in the room regardless of the ambient illumination.

D. Automatic lighting controls which are programmed or which are time-based shall incorporate back-up capabilities for at least 10 hours upon interruption of power.

1.5 SUBMITTALS

A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.

1. Shop Drawings:
   a. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
   b. Scale drawing for each area showing exact location of each sensor, room controller, and digital switch.
   c. Show coverage areas of each sensor.
2. Product Data: Catalog sheets, specifications and installation instructions.
3. Include data for each device which:
   a. Indicates where sensor is proposed to be installed.
   b. Prove that the sensor is suitable for the proposed application.

B. Test Reports: Record of all field test data. Submit to the Commissioning Authority with a copy to the Architect.

C. Training Documentation: Sign-off form and attendee sign-in sheet for the training session.

1.6 WARRANTY

A. Provide a five year complete manufacturer's warranty on all products to be free of manufacturers' defects.

PART 2 - PRODUCTS

2.1 LIGHTING CONTROLS

A. Design based around Acuity Controls nLight. Provide the following devices as required

1. Dual Technology Occupancy Sensors
2. Daylight Sensor
3. WallPods
4. Scene Controllers
5. Power Relay Packs
6. UL 924 Emergency Operation
7. nPanel4 Dimming Relay Panel
8. nLight Enabled Fixtures
9. nLight Bridge
10. nLight Gateway

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements

B. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.

C. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

1. Adjust time delay so that controlled area remains lighted for 5 minutes after occupant leaves area.

D. Provide written or computer-generated documentation of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
3. Load Parameters (e.g. blink warning, etc.)

E. Re-programming – After 30 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Architect / Owner of the activities.

3.2 FIELD TESTING

A. Upon completion of the installation, the system shall be tested by the manufacturer's factory authorized representative who will verify a complete fully functional system.

B. The electrical contractor shall provide both the manufacturer, commissioning agent and the electrical engineer with ten working days written notice of the system startup and adjustment date.

C. Upon completion of the system testing the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

END OF SECTION 26 09 23

SECTION 26 24 16 – BRANCH CIRCUIT PANELBOARDS

PART 1 - GENERAL

1.1 PROVISIONS

A. Furnish and install all lighting and power branch circuit panelboards shown on the drawings.

B. Panels shall be mounted in steel cabinets arranged for flush or surface mounting as indicated on the plans.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26, 27, 28.

B. See Sections 26 05 00 and 26 05 53.

1.3 SUBMITTALS

A. Complete manufacturer's data, including catalog cuts on standard equipment, and shop drawings for all custom equipment. Submit parts replacement/ordering information as part of O & M Manuals.

B. Include drawing showing height, width, and depth of each panel.

C. Include schedule showing circuit breaker size and number of poles, keyed to circuit number. Schedule shall be arranged the same as the panel schedules included in the specifications.

D. All submittals shall be made in accordance with requirements of Section 26 05 00 and Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cabinet and trim shall be of code gauge steel (minimum) with 4" (minimum) wiring gutter all around. All panelboards shall be equipped with a hinged, locking door. Two keys shall be furnished with each cabinet, and all locks on all cabinets shall be keyed alike.

B. Where panels occur adjacent to one another, cabinets and doors for each panel shall be of the same height.

C. All surface mounted panels, unless noted otherwise, shall extend from the floor to the top of the panel, with dividers, blank panels, and miscellaneous hardware as required. Entire cabinet (less front) shall be furnished as one piece, or if not of one-piece construction, shall have factory fabricated metal skirts which are designed to provide positive alignment of top and bottom sections. Panelboards which have sections which are not perfectly aligned will not be accepted.

D. All panelboards shall be painted with gray lacquer over rust preventative primer. Sides and top of surface mounted panels shall be painted to match fronts.

E. Panels shall be of the circuit breaker type, and shall have capacity and arrangement as shown on the panel schedule.

F. Branch circuit breakers shall be bolt-on type and shall be of the ambient compensated, thermal magnetic type, which will provide inverse time delay overload, and instantaneous short circuit protection. All branch circuit breakers shall have a minimum interrupting rating of 10,000 amperes RMS symmetrical. Branch circuit breakers shall have one, two or three poles as designated on the panel schedule. No circuit breakers utilizing handle ties for two or three pole operation will be acceptable.

1. Voltage and current ratings shall be as indicated on the drawings.

G. Provide a typewritten directory for each panel, placed inside the panel door. The directory shall list all rooms served by each breaker, using the "Owner's" room numbers. Directories shall be installed in a metal directory frame and glass. Spares and spaces shall be written in pencil.

H. Where panels contain contactors, they shall be mounted behind a hinged, locking door. Contactor section shall be below the circuit breaker section unless otherwise noted. Provide all required barriers.

I. All multi-section panels shall be equipped with a "bus rated" main circuit breaker in each section.

J. Each panel shall be equipped with a ground lug for feeder ground.

K. Each panel and cabinet and the units comprising same shall bear the manufacturer's nameplate and the U.L. label.

2.2 ACCEPTABLE MANUFACTURERS

A. Panelboards shall be Siemens type “P2” or “P3”, depending on sub feed disconnect size requirements.

B. Other Acceptable Manufacturers: G.E., Cutler-Hammer, or Square D equipment which is the approved equal of the above is considered acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount panels in locations shown, making sure that code-required clearances exist.

B. All panels shall be mounted with top at the same height; approximately 6'-6".

C. Where cabinets cannot be set fully flush due to shallowness of all of partition, trim protruding sides with approved metal or hardwood molding, fastened to cabinet so as to conceal intersection of wall and cabinet.

D. If paint is damaged during shipping or installation, damaged portion shall be sanded smooth and entire panel repainted.

E. Provide (5) extra 3/4" conduits stubbed into accessible ceiling spaces above each flush mounted panel.

F. Utilize hydraulic actuated dies to compress the cable connecting lugs. Dies shall compress the full circumference of the cable.

END OF SECTION 26 24 16

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.1 PROVISIONS

A. Provide wiring devices at all device outlet locations shown on the drawings.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26.

B. See Sections 26 05 00, 26 05 38, 26 05 51, 26 05 53 and 26 09 43.

1.3 SUBMITTALS

A. Complete manufacturer's data, including catalog cuts. Submit parts replacement/ordering information as part of O & M Manuals.

B. All submittals shall be made in accordance with requirements of Section 26 05 00 and Division 1.

PART 2 - PRODUCTS

2.1 MATERIALS

A.

WALL SWITCHES	
Single Pole Switches	Hubbell #1221-I
Three-Way Switches	Hubbell #1223-I
Four-Way Switches	Hubbell #1224-I
Single Pole Switch with Red Pilot Lamp	Hubbell 1221-PL (120 volt) Hubbell 1221-PL7 (277 volt)
Weatherproof Switch	Hubbell #1781-I
Momentary Contact Switch	Hubbell #1557-I

B.

WALL SWITCHES	
Single Pole Switches	Leviton #1221-I
Three-Way Switches	Leviton #1223-I
Four-Way Switches	Leviton #1224-I
Single Pole Switch with Red Pilot Lamp	Leviton #1221-PLR (120 volt) Leviton #1221-7PLR (277 volt)
Momentary Contact Switch	Leviton #1256-I

C.

WALL RECEPTACLES	
Duplex Receptacles	Hubbell #CR5362I
Safety Receptacles	Hubbell #HBL8200SGI
Clock Receptacles	Hubbell #5235
Dryer Receptacle	Hubbell 9350
Range Receptacle	Hubbell #7962
GFI Receptacle	Hubbell #GF5352-I
WeatherProof Receptacles	Hubbell #GF5352-I w/#WP-26 plate

D.

WALL RECEPTACLES	
Duplex Receptacles	Leviton #5362-I
Safety Receptacles	Leviton #5262-SGI
Clock Receptacles	Leviton #5361-CH
Dryer Receptacle	Leviton #5207
Range Receptacle	Leviton #5206
GFI Receptacle	Leviton #6599-I
WeatherProof Receptacles	Leviton #6599-I w/#G196-V plate

E. Unless noted otherwise, devices shall have ivory finish.

F. Cord Reel Receptacles: COXREELS #PC10-3012B

G. Additional devices shall be as noted on the drawings.

2.2 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers shall be as listed above.

B. A&H, Hubbell, P&S and Leviton devices which are the approved equal of those specified above are considered acceptable.

C. Substitutions may be considered only when submitted in conformance with Section 26 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount devices securely to outlet boxes.

B. Provide ground straps between each wiring device and its associated outlet box.

1. Exception: Ground strap not required with self-grounding devices.

C. Orient receptacles so that ground pin is at top.

D. Mount weatherproof receptacles vertically, up 18" from finished grade.

E. All Toilet Rooms, Kitchen and Food Preparation locations shall have GFI type receptacles.

F. All receptacles within 6 feet of a sink shall be GFI type receptacles.

G. All interior damp or wet location outlets shall be weather-resistant type GFI receptacles.

H. All exterior damp or wet location outlets shall be weather-resistant type GFI receptacles.

I. Provide device labeling per Specification Section 26 05 53.

END OF SECTION 26 27 26

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 PROVISIONS

A. Furnish and install fuses in all fusible equipment, and provide spare fuses as described herein.

B. Provide fuse cabinet in main electrical room on available wall space. Cabinet shall be sized to accommodate quantity and size of spare fuses included under this contract.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26.

B. The supplier shall submit a list of fuse manufacturers and types to be used on this project for review. Time current curves for all fuses shall be submitted to the Engineer for his use. Curves shall be drawn for minimum melting time and for total clearing time on standard log-log transparency paper or Mylar.

1.3 SUBMITTALS

A. Complete manufacturer's data, including catalog cuts, time-current curves, and coordination data as required below. Submit parts replacement/ordering information as part of O & M Manuals.

B. All submittals shall be made in accordance with requirements of Section 260510 and Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fuses shall be high interrupting, current-limiting, U.L. approved, and shall be Bussman types listed below:

MAIN SWITCHES	250 V	600V	600V CLASS J
0-600A	LPNRK	LPSRK	LPJ
ABOVE 600A	KRPC	KRPC	KRPC
FEEDERS			
0-600A	LPNRK	LPSRK	LPJ
ABOVE 600A	KRPC	KRPC	KRPC
GENERAL PURPOSE	FRNR	FRSR	LPJ
MOTORS	LPNRK	LPSRK	LPJ
FLUORESCENT BALLASTS	HLR/GLR	HLR/GLR	HLR/GLR

B. Class RK5 fuses shall be used for safety switches and combination starters. Class RK5 fuses shall be dual element time delay rejection-type fuse with interrupting capacity rating of 200,000 Amps. Fuses shall have 10 seconds time delay at 500% rate current. Fuses shall clearly indicate with the fuse has blown. RK5 fuses shall be Bussman FRS-R-SPI.

2.2 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers shall be as listed above.

B. Fuses have been selected to assure system coordination and compatibility. Submit fuse curves and equivalency charts with all proposed substitutions.

C. Substitutions may be considered only when submitted in conformance with Section 26 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish and install fuses in all fusible equipment. Type shall be selected from the above schedule. Ampacity shall be as shown on the drawings, or selected to match equipment rating.

B. Provide fuse clips and adaptors as required to match fuse type to fuseholder.

C. Install fuses in fuseholder with fuse rating visible.

D. Provide (3) spare fuses of each different type and size used on the project.

E. Coordinate location of spare fuse cabinet with owner prior to install.

END OF SECTION 26 28 13

SECTION 26 28 16 – DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 PROVISIONS

A. Provide equipment and/or branch circuit disconnect switches in all locations shown or specified and in all locations required by code.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26.

1.3 SUBMITTALS

A. Complete manufacturer's data, including catalog cuts. Submit parts replacement/ordering information as part of O & M Manuals.

B. All submittals shall be made in accordance with requirements of Section 26 05 00 and Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Each motor and/or equipment item shall be equipped with a one, two, or three pole fused, heavy-duty disconnect switch sized to match the motor and/or equipment.

1. Disconnect switches for 120 VAC, single phase motors rated ½ HP or less shall be enclosed, toggle-type manual motor starters with integral overload protection and a red LED pilot “run” light. Provide General Electric #CR101.

B. Switches shall be externally operable, quick-make, quick-break, with neutral connecting block as required, and lockable operating handle. Mount in code gauge steel cabinet.

C. See Section 262813 for fuse requirements.

D. Provide Class R rejection kits on fuseholders.

2.2 ACCEPTABLE MANUFACTURERS

A. Disconnect switches shall be manufactured by Cutler-Hammer, General Electric, Siemens, or Square D.

B. Substitutions may be considered only when submitted in conformance with Section 26 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switch at the controller location and wire to disconnect both motor and/or equipment and associated controller.

B. If the motor and/or equipment are not in sight from the controller location, provide a second disconnect switch at the motor and/or equipment, whether shown on the drawings or not.

C. Install where accessible and within reach of personal, as required by code.

END OF SECTION 26 28 16

SECTION 26 28 17 – CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 PROVISIONS

A. Provide molded case, insulated case, or power circuit breaker mounted in grouped equipment. Grouped equipment includes motor control centers (if applicable), panelboards, etc.

B. Circuit breakers shall be of the same brand as the panelboard manufacturer.

C. Related Specifications:

1. See Sections 26 05 34, and 26 24 16.

D. The Contractor shall submit the following shop drawings and data for review by the Engineer:

1. Ratings: Voltage, frame size, trip rating, trip settings, interrupting capacity at rated voltage.
2. Dimensions, mounting details and enclosure types.
3. Certification that the breakers conform to the standards required and that they are all listed for the applications on this job.
4. Time-current curves on standard log-log transparencies.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Where interrupting current ratings are shown that do not comply with the standard ratings of the manufacturer, the next highest rating shall be provided by the Contractor.

B. Molded case breakers shall comply with NEMA Standard AB-1-1986. They shall be thermal magnetic trip free, non-interchangeable trip, non-adjustable trip unless otherwise noted.

C. Refer to the power riser diagram and panelboard schedules for required interrupting capacity ratings (AIC) of circuit breaker devices.

D. Power circuit breakers shall comply with NEMA Standard SG-3-1981 and shall be as follows:

1. Power circuit breakers shall use a "stored energy" mechanism in closing and tripping the breaker. This shall consist of steel springs which shall be fully charged by the operator prior to closing and which, when released, shall provide enough energy to close and latch the breaker under any service conditions within the specified rating of the breaker. When the breaker is tripped it shall be driven open by steel springs which shall be fully charged at all times after closing to permit instantaneous tripping upon closure if necessary. The breakers shall be trip free.
2. Solid state type trips shall be used consisting of current transformers, a solid-state unit to interpret the output of the current transformers, and a tripping solenoid acting directly to trip the breaker. The current transformers shall have taps which can be changed simply in the field to permit trip ratings to be changed in any of the manufacturer's standard settings. Trip units shall be capable of being calibrated and tested by a portable test set. The time delay and pickup characteristics shall also be variable in the field. The devices shall be designed such that performance

at any setting is repeatable. A ground detection device shall be provided; it shall be an integral part of the trip device and provide field adjustable settings.

3. Power circuit breakers used for motor starting shall have a position switch and auxiliary contacts.
4. The manufacturer shall be capable of furnishing certified test reports for the test required in NEMA Standard SG-3-1981.

E. Circuit breakers shall be fully rated for interrupting ratings shown above. Series rated breakers are not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Molded case breakers shall be firmly attached to bus and cable. Connections shall be rechecked after the first load cycle has been applied to the breaker.

B. Individual units in enclosure shall be mounted at 4' - 6" above the floor on walls and 3' - 6" above floor, when strut supported at motors, etc.

C. Provide time/current coordination curves for all circuit breakers on standard log-log transparencies.

END OF SECTION 26 28 17

SECTION 26 29 24 – MOTOR CONNECTIONS

PART 1 - GENERAL

1.1 PROVISIONS

A. Furnish and install all power wiring for all permanently installed motors, starters, equipment and control systems. All circuit protection, disconnect switches, and motor starters shall be furnished by Division 26 - Electrical, except for specifically noted starters, integral to equipment specified in other Sections. Review all contract documents for requirements.

B. It shall be understood that the symbol representing "motor connection" shall include disconnect switches at all motors and starters, and starters where required.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26, 27, 28.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide all required relays, wiring, and miscellaneous equipment for Fire Alarm Fan Shutdown. Interconnecting controls shall be rated to match starter control voltage.

B. Branch circuit protection and disconnect switches shall be provided under Division 26. See Sections 26 24 16, and 26 28 16

PART 3 - EXECUTION

3.1 INSTALLATION

A. Make a single (unless otherwise noted) line voltage connection to each motor and equipment item, and "line and load" line voltage connections to motor starters.

B. Check the rotational direction of all motors after final service connections have been made, and make all phase corrections required.

C. Check all motors for proper lubrication and overload protection before placing in operation.

END OF SECTION 26 29 24

SECTION 26 29 25 – EQUIPMENT CONNECTIONS

PART 1 - GENERAL

1.1 PROVISIONS

A. Make all required connections to equipment furnished by the Owner, or under Division 01 through 26.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26.

B. See Sections 26 05 00, 26 05 38, 26 27 26, and 28 31 11.

PART 2 - PRODUCTS

2.1 See referenced sections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide disconnect switch at all equipment unless cord/cap connected.

B. Where equipment has a cord connection, install a new plug on cord if equipment plug does not match the receptacle provided.

C. Coordinate all receptacles, plugs, wiring, and locations with the equipment provided PRIOR to rough-in. Make sure code required clearances are provided.

D. Provide all required connections from fire/smoke dampers to fire alarm system for shut-down of HVAC units.

E. Locate receptacle for each electric water cooler so that cord and plug are concealed inside or behind cooler. Provide hardwired connection if required. All receptacles for electric water coolers shall be protected by a GFI breaker.

F. Kitchen Fire Suppression Systems.

1. Provide wiring from fire suppression panel to:
   a. Remote pull stations
   b. Gas solenoid valves
   c. Shunt-trip breaker(s)
   d. Fire alarm panel
2. Provide a 1P-20 amp circuit to each suppression panel. Do not connect to a panel which is shunt-tripped by a fire suppression system.
3. Provide shunt-trip breakers for all electrical sources located under kitchen hoods that are provided with fire suppression system. Wire to shut off all power to equipment and receptacles under the hood upon activation of the fire suppression system.

G. Kitchen Equipment:

1. Verify all rough-in and connection requirements from drawings provided by the equipment supplier. Make final connection to all equipment.
2. Conceal conduit stub-ups for equipment connections in walls behind equipment. Install boxes flush in wall with flush cover plates. Keep exposed conduits, boxes, and flexible to a minimum length and exposure in order to meet health department regulations.

3.2 ELECTRICAL SYSTEMS COMMISSIONING

A. The equipment and systems referenced in this Section are to be commissioned per Division 01 Section 01810 “Commissioning”. The Contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Consultant.

END OF SECTION 26 29 25

SECTION 26 29 33 - CONTACTORS

PART 1 - GENERAL

1.1 PROVISIONS

A. Furnish and install contactors as required to control lights and equipment.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26.

B. See Sections 26 05 00, 26 24 16, and 26 09 43.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Contactors shall be NEMA rated with replaceable coils and silver alloy contacts.

B. Contactors which are mounted in panelboards, or group mounted in cabinets shall be mounted on isolation pads for noise control.

C. Contactors which are mounted in panelboards, or group mounted in cabinets shall be of the "open" type, without housing.

D. Contactors shall be multiple-pole, mechanically held, electrically operated on electrically held remote-control switches as indicated, fully rated for all types of lighting loads, including high-intensity discharge and fluorescent. Number of poles shall be as indicated on the Drawings. Minimum withstand current ratings shall be 22,000 amps at 250 volts AC, 60 HZ and 14,000 amps at 480 volts AC, 60 HZ.

E. Contactors shall have visual indication of contact position.

F. Contactors shall have coils and contacts capable of being replaced in the field without disturbing the line and load wiring.

G. Control relays shall be electrically held, remote controlled switches with single or multi-pole contacts as indicated.

H. Contactor and relay coil voltages shall be as required to interface with the control devices indicated.

I. Each mechanically held contactor shall be equipped with a 2-wire control module to allow contactors to be controlled by a 2-wire voltage control unit.

2.2 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers ASCO Siemens, G.E., Square D, and Cutler Hammer.

B. Substitutions may be considered only when submitted in conformance with Section 26 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount contactors in the location shown on the drawings. Provide code required clearances.

B. Provide complete control wiring, with all required accessories to accomplish control as noted on the drawings.

END OF SECTION 26 29 33

SECTION 26 51 00 - LIGHTING

PART 1 - GENERAL

1.1 PROVISIONS

A. Provide lighting fixtures in all locations shown on the drawings.

B. Bidders shall acquaint themselves with the conditions and requirements of the building construction, as this work is based on furnishing all materials required to entirely complete each fixture ready for use.

1.2 RELATED REQUIREMENTS

A. All provisions of the contract including Division 01 apply to work specified in each section of this Division 26.

B. See Sections 26 05 00, 26 05 29, and 26 28 13.

1.3 SUBMITTALS

A. Complete manufacturer's data, including catalog cuts on standard equipment, and shop drawings for all custom equipment. Submit parts replacement/ordering information as part of O & M Manuals.

B. If lamps are included with the fixture, provide lamp submittal data.

C. All submittals shall be made in accordance with requirements of Section 26 05 00 and Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

A. See schedule for listing of required lighting fixtures. Fixtures shall be complete with trim, mounting hardware, and lamps.

B. All fixtures shall bear the U.L. label associated with the type, location, and usage of the individual fixture.

C. Fixtures manufactured with pre-painted metal will not be accepted.

D. LED Drivers

1. Certified by Electrical Testing Laboratory (ETL)
2. Minimum Efficiency of 85%
3. Sound “A” rating.
4. Minimum power factor of 90%
5. Temperature Range: -30 deg. C to 50 deg C.
6. Conform to electromagnetic interference standard FCC Regulation Part 15, Subpart J.
7. Lamp-driver combination shall not reduce normal rated life of lamps.

E. All fixtures shall be complete with lamps of one of the following types:

1. LED: Lamp shall be rated for 50,000 hours of operation before reaching L70.
2. All other lamps shall be as required by equipment or as noted on the drawings.

F. All plastic lenses shall be K-12 virgin acrylic unless noted otherwise. All flat plastic lenses shall be 0.125" minimum thickness.

G. All louvered fixtures shall be shipped with dust covers and shall be removed after final building vacuuming has been completed.

H. Fixtures mounted to T-bar ceilings shall utilize standard T-bar accessories as manufactured by the A&G Co. or equivalent.

I. Luminaires noted or indicated as emergency units shall be connected to a circuit from the emergency generator.

2.2 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers shall be as listed above, and in the fixture schedule.

B. Substitutions may be considered only when submitted in conformance with Section 26 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount fixtures securely and adequately to meet the requirements of NFPA 70, Para. 410.16 and UBC Standard 47-18. Mount in locations as indicated on the drawings as follows:

B. Surface/Suspended

1. Mount stem suspended fixtures on swivel hangers which are a standard catalog item of the same manufacture as the fixture. Provide one more hanger than the number of fixtures in the row. Coordinate degree of swivel with the ceiling slope.
2. Mount cable suspended fixtures with cable and hangers which are a standard catalog item of the same manufacture as the fixture. Cable hangers shall be adjustable for leveling the fixtures. Provide the number of hangers as recommended by the fixture manufacturer. Electrical feeds for cable suspended fixtures shall be with a coiled cord.
3. Mount surface fixtures at two support points. Provide 1-1/2" metal spaces for fixtures which occur on combustible ceilings. Submit spacer for approval.

C. Recessed

1. Coordinate recessed fixture locations with the acoustical tile pattern, concealed ductwork, piping, etc.
2. Check ceiling type (lay-in, gypboard, etc.) before ordering fixtures.
3. Fixtures installed in T-bar ceilings shall be supported as required by N.E.C.
4. All recessed fixtures (in accessible ceilings) shall be connected by means of a flexible conduit which is attached to a 4" square junction box. Box may serve more than one fixture.

D. Verify all measurements. Contractor is responsible for fixtures fitting in place in a satisfactory and workmanlike manner, to the approval of the Architect.

E. Contractor shall verify fixture locations with the Architectural Reflected Ceiling Plans, where such plans are provided.

END OF SECTION 26 51 00

SECTION 27 05 28 – PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide all materials and labor for the installation of complete and dedicated pathway systems for Division 27 and Division 28 sections.

B. This section includes requirements for conduit raceways, boxes, cabinets, racks, cable trays, and other related materials and equipment.

C. Related Sections:

1. Division 26 Section — "General Electrical Requirements"
2. Division 26 Section — "Grounding and Bonding"
3. Division 27 Section — "Communications Structured Cabling System"

D. Products installed (but not furnished) under this section:

1. Grounding and Bonding conductors, ground bars, and connections.
2. Firestopping system and labels.

1.3 REFERENCES

A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.

1. General:
   a. National Electrical Code (NEC)
   b. National Electrical Safety Code (NESC)
   c. Washington Industrial Safety and Health Act (WISHA)
   d. Occupational Safety and Health Act (OSHA)

1.4 DEFINITIONS

A. “EMT shall mean Electrical Metallic Tubing.

B. “RMC” shall mean Rigid Metal Conduit.

C. “Raceway” shall mean any enclosed channel system including but not limited to conduits and boxes for routing wires or cables.

D. “Pullbox” shall mean a metallic box with a removable cover used to facilitate pulling cable through conduit runs longer than 100’ or in which there are more than 180 degrees of bends.

E. “Junction box” shall mean a pullbox wherein a feeder conduit transitions to multiple distribution conduits.

1.5 SYSTEM DESCRIPTION

A. Furnish and install into satisfactory and successful operation all materials, devices, and necessary accessories to provide a complete pathway system specified herein and/or shown on the Contract Documents. The system shall provide dedicated pathways for the following low voltage systems:

1. Mechanical Systems Building Management System (i.e. DDC) – refer to mechanical specifications and drawings for control requirements.
2. Communications Structured Cabling System (Section 27 15 00).
3. Commercial Intercommunications and Program Systems (Section 27 51 23).
4. Access Control System (Section 28 13 00).
5. Video Surveillance System (Section 28 23 00).
6. Digital Addressable Fire Alarm System (Section 28 31 11).

B. The work shall include materials, equipment and apparatus not specifically mentioned herein or noted on the Contract Documents but which are necessary to make a complete working system of pathways.

C. All low voltage wiring and cables shall be routed within a pathway system. Cables and wires shall not be run “free-air” unless specifically noted on the drawings or herein.

D. Make all attempts to minimize the quantity of homerun pathways by utilizing larger size raceways where a bundle of cables (i.e. communication structured cabling system) from a single room/area (such as a classroom) are to be routed to the nearest MDF or IDF. Provide larger size conduit raceways such as 3”C or 4”C from a room/area junction box to the appropriate rack/cabinet. Raceway sizing shall be determined by the contractor based on cable fill tables.

1.6 SUBMITTALS

A. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.

1.7 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NEC, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NECA's "Standard of Installation."

C. Comply with NEC.

1.8 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

B. Coordinate layout and routing with all other trades prior to starting work. Conflicts encountered during construction shall be addressed and corrected by the contractor. If a conflict cannot be resolved the contractor shall issue a RFI.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials and equipment shall consist of conduits, outlet boxes, fittings, enclosures, supports, pull boxes, ladder cable trays, and other raceway incidentals and accessories as required for all pathway systems listed under 15(A).

B. Approved manufacturers shall be:

1. Appleton
2. Raco
3. Hubbell
4. Cooper
5. T&B (Steel City)
6. Crouse Hinds
7. OZ Gedney
8. Specified Technologies Inc

2.2 MATERIALS

A. Conduit:

1. EMT: 1” minimum conduit size for all communication structured cabling pathways. All other systems shall be minimum 3/4” size. Flexible metal conduit (FMC) is not acceptable.
   a. Conduit: Galvanized steel tubing meeting ANSI C80.3.
   b. Couplings: Steel, cast iron, or malleable iron compression type employing a split, corrugated ring and tightening nut, with integral bushings and locknuts. Indent-type and setscrew-type couplings are not permitted.
2. RMC: 1” minimum conduit size for all communication structured cabling pathways. All other systems shall be minimum 3/4” size.
   a. Conduit: Hot dipped galvanized steel with threaded ends meeting ANSI C80.1.
   b. Couplings: Unsplit, NPT threaded steel cylinders with galvanizing equal to the conduit.
   c. Nipples: Same as conduit, factory-made up to 8 inches in diameter, no running threads.

B. Sleeves:

1. EMT conduit, with insulated throat bushings for each end

C. Outlet boxes:

1. Minimum dual gang (4”x4”), with 3 1/8” minimum depth, with extension rings (if needed) and single gang covers (i.e. mud rings), unless otherwise noted on the Contract Documents. Combined interior depth of outlet box, extension ring and cover shall be a minimum 2-1/2”. Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for 1” trade size conduit or connector entrance, meeting NEMA OS 1.

D. Junction and Pull Boxes:

1. Stamped steel, deep drawn, one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance. Boxes 6”x6”x4” or larger may be code gauge fabricated steel continuously welded at seams and painted after fabrication.
2. Dry locations: meeting NEMA OS 1.
3. Wet locations: meeting NEMA OS 3R.

E. Miscellaneous Fittings:

1. Locknuts and conduit bushings to be malleable iron.
2. Through wall seals and floor seals shall be OZ Gedney “FS” and “WS” series or equal.

F. Pull Strings:

1. Plastic or nylon with a minimum test rating of 200 lbs.

2.3 FIRESTOPPING

1. Conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions.
2. Fire-rated through-wall pathways shall be Specialized Technologies Inc. “EZ-Path” and/or “SpecSeal” systems with penetration labeling.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.

B. All work shall comply with applicable safety rules and regulations including OSHA and WISHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.

C. All work shall comply with the standards, references and codes listed in PART 1 -- References above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.

D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

E. Install the raceway system in a manner ensuring that communications circuits, when installed, are able to fully comply with the ANSI/TIA/EIA and other references listed in Part 1 — References, above.

F. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

G. Remove surplus material and debris from the job site and dispose of legally.

3.2 EXAMINATION

A. Examine surfaces and spaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions. Provide a raceway for each circuit indicated. Do not gang raceway into wireways, pullboxes, junction boxes, etc., without specific approval from the Designer. Do not group home runs or circuits without approval from the Designer.

B. Conduit:

1. Install EMT unless other conduit is shown on the Contract Documents, is required by Code, or is permitted under these specifications.
2. Install conduit as a complete, continuous system without wires, mechanically secured and electrically connected to metal boxes, fittings and equipment. Blank off unused openings using factory-made knockout seals.
3. Run conduit in the most direct route possible, parallel to building lines. Do not route conduit through areas in which flammable material may be stored.
4. Keep conduit at least 6 inches away from parallel runs of flues and steam or hot-water pipes or other heat sources operating at temperatures above one-hundred degrees Fahrenheit. Install horizontal conduit runs above water piping.
5. Keep conduit away from sources of electromagnetic interference as follows:
   a. 5 inches from fluorescent lighting
   b. 12 inches from conduit and cables used for electrical power distribution
   c. 48 inches from motors or transformers
6. Do not exceed 90 meters total length for a given conduit run to be used for distribution cabling (from outlet box to telecommunications room), including intermediate conduits and junction boxes.
7. Install conduit exposed, except in finished areas or unless shown otherwise on the drawings. Do not install conduit below grade/slab unless specifically shown on the Contract Documents as being installed below grade/slab.
8. Install exposed conduit in lines parallel or perpendicular to building lines or structural members except where the structure is not level. Follow the surface contours as much as practical. Do not install crossovers or offsets that can be avoided by installing the conduit in a different sequence or a uniform line.
   a. Run parallel or banked conduits together, on common supports where practical.
   b. Make bends in parallel or banked runs from same centerline to make bends parallel.
9. Conduits concealed above ceilings, furred spaces, etc., which are normally inaccessible may be run at angles not parallel to the building lines.
10. Wherever practical, route conduit with adjacent ductwork or piping and support on common racks. Base required strength of racks, hangers, and anchors on combined weights of conduit and piping.
11. Where conduits cross building expansion joints, use suitable sliding or offsetting expansion fittings. Unless specifically approved for bonding, use a suitable bonding jumper.
12. Support conduits as specified in Section 260500 “General Electrical Requirements"
    a. Provide anchors, hangers, supports, clamps, etc. to support the conduits from the structures in or on which they are installed. Do not space supports farther apart than five feet.
    b. Provide sufficient clearance to allow conduit to be added to racks, hangers, etc. in the future.
    c. Support conduit within three feet of each outlet box, junction box, gutter, panel, fitting, etc.
13. Ream conduits to eliminate sharp edges and terminate with metallic insulated grounded throat bushings. Seal each conduit after installation (until cable is

installed) with a removable mechanical-type seal to keep conduits clean, dry and prevent foreign matter from entering conduits.

14. Install a pull string in each conduit.
15. Do not install conduits in wet, hazardous or corrosive locations.
16. Where conduit is embedded in masonry, embed conduit in the hollow core of the masonry. Horizontal runs in the joint between masonry units are not permitted.
17. Where conduit is shown embedded in concrete, embed conduit a minimum of two inches from the exterior of the concrete. Do not place conduit in concrete less than five inches thick.
    a. One inch trade size conduit shall be used. Conduits sized larger or smaller than one inch trade size conduit are not permitted embedded in concrete.
    b. Run conduit parallel to main reinforcement.
    c. Conduit crossovers in concrete are not permitted.
18. Where conduit exits from grade or concrete, provide a rigid steel elbow and adapter.
19. Where conduit enters a space through the floor and terminates in that space, terminate the conduit at 4” above the finished floor.
20. Where several circuits follow a common route, stagger pullboxes or fittings.
21. Where several circuits are shown grouped in one box, individually fireproof each conduit.
22. Bend and offset metal conduit with standard factory sweeps or conduit fittings. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
    a. Conduit sweeps:
        1) Sweeps shall not exceed 90 degrees.
        2) Do not exceed 180 degrees for the sum total of conduit sweeps for a section of conduit (between conduit termination points).
        3) Sweep radius shall be at least 10 times the internal diameter of the conduit.
        4) 90-degree condulets (LB’s) and electrical elbows are not acceptable.
    b. Factory-manufactured sweeps are required for bends in conduit larger than 1 inch trade size.
    c. For bends in 1 inch trade size conduit, field-manufactured bends (using a hydraulic bender with a 1” boot) are permitted only when factory-manufactured sweeps are not suitable for the conditions. In all other cases, factory-manufactured sweeps are required. “Hickey-bender” use is prohibited.
23. Connect conduit to hub less enclosures, cabinets, and boxes with double locknuts and with insulating type bushings. Use grounding type bushings where connecting to concentric or eccentric knockouts. Make conduit connections to enclosures at the nearest practicable point of entry to the enclosure area where the devices are located to which the circuits contained in the conduit will connect.
24. Penetrations for raceways:
    a. Do not bore holes in floor and ceiling joists outside center third of member depth or within two feet of bearing points. Holes shall be 1-¼ inch diameter maximum.
    b. Penetrate finished walls and finished surfaces with a PVC or sheet metal sleeve with an interior diameter (ID) at least 1/4" greater than the outer diameter (OD) of the conduit, set flush with walls, pack with fiberglass, seal with silicone sealant and cover with escutcheon plate.
    c. Penetrate poured-in-place walls and free slabs with a cast iron sleeve (or Schedule 40 PVC black pipe sleeve for above-grade only) with retaining ring or washer. Set sleeves flush with forms or edges of slab. Pack around conduit with fiberglass and seal with silicone sealant.
25. Raceway terminations and connections:

a. Join conduits with fittings designed and approved for the purpose and make joints tight. Do not use set indent-type or screw-type couplings.
b. Make threaded connections waterproof and rustproof by applying a watertight, conductive thread compound. Clean threads of cutting oil before applying thread compound.
c. Make conduit terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
d. Cut ends of conduit square using a hand saw, power saw or pipe cutter. Ream cut ends to remove burrs and sharp ends. Where conduit threads are cut in the field, cut threads to have same effective length, same thread dimensions and same taper as specified for factory-cut threads.
e. Provide double locknuts and insulating bushings at conduit connections to boxes and cabinets. Align raceways to enter squarely and install locknuts with dished part against the box. Use grounding type bushings where connecting to concentric or eccentric knockouts.
f. Where conduits are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

26. Install conduit sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed conduits, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
    a. Where conduits pass from warm to cold locations, such as the boundaries of air conditioned or refrigerated spaces and where conduits enter or exit buildings from outdoor areas, including underground ducts or conduit runs.
    b. Where otherwise required by the NEC.
27. Conduit shall be clean and dry.

C. Sleeves:

1. Provide sleeves where required, sized as noted on the Contract Documents. Where not noted, sleeve sizing shall be determined by the type and quantity of cable to be routed through the sleeve per TIA/EIA 569A cable capacity standards, plus an additional 100% for future expansion.
2. Provide roto-hammering or core drilling where required for installation.
3. Seal between sleeve and wall or floor in which the sleeve is installed. Firestop penetration to restore wall or floor to pre-penetration fire-rating.

D. Outlet Boxes:

1. Provide outlet boxes and covers as shown on the Contract Documents and as needed. Verify that the appropriate cover type and depth is provided for each type of wall and finish. Provide extension rings as needed.
2. Coordinate box locations with building surfaces and finishes to avoid bridging wainscots, joints, finish changes, etc.
3. Install boxes in dry locations (not wet, corrosive, or hazardous).
4. Attach boxes securely to building structure with a minimum of two fasteners. Provide attachments to withstand a force of one hundred pounds minimum, applied vertically or horizontally.
5. Install boxes at the following heights to the bottom of the box, except where noted otherwise:
    a. Wall mounted telephones: 46 inches above finished floor.
    b. Workstation outlets: 16 inches above finished floor.

c. Place boxes for outlets on cabinets, countertops, shelves, and similar boxes located above countertops two inches above the finished surface or two inches above the back splash. Verify size, style, and location with the supplier or installer of these items prior to outlet box installation.

6. Recessed mounted outlet boxes:
   a. Recess boxes in the wall, floor, and ceiling surfaces in finished areas. Set boxes plumb, level, square and flush with finished building surfaces within one-sixteenth inch for each condition. Set boxes so that box openings in building surfaces are within one-eighth inch of edge of material cut-out and fill tight to box with building materials. Single gang opening shall extend at least to the finished wall surface and extend not more than 1/8 inch beyond the finished wall surface. Provide backing for boxes using structural material to prevent rotation on studs or joists.
   b. Install floor boxes level and adjust to finished floor surface.

E. Junction Boxes:

1. Provide junction boxes as shown on the Contract Documents and as required.
   a. Where sizing is not shown on the Contract Documents, size junction box length and depth according to the size of the feeder conduit in the following table:

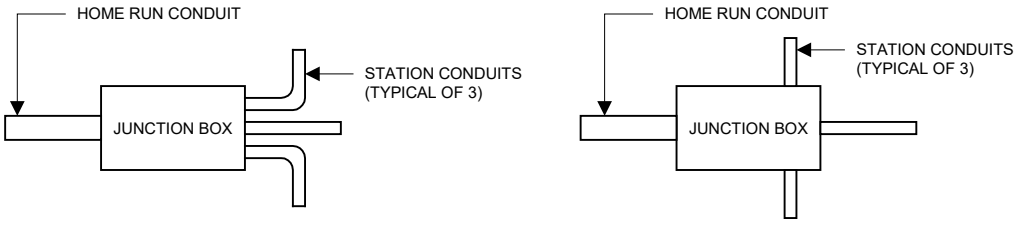
Feeder Conduit Size	Box Length	Box Depth
1”	12”	4”
1-¼”	12”	4”
1-½”	12”	4”
2”	24”	4”
2-½”	24”	6”
3	36”	6”
3-½”	48”	6”
4”	60”	6”

   b. Where sizing is not shown on the Contract Documents, size junction box width according to the following formula:
      1) From the table below, select the width associated with the largest conduit on the distribution side of the box. For each additional distribution conduit, add the “Increase Width” value associated with the size of that distribution conduit to the box width for the largest distribution conduit.
         a) For example, if the distribution side of the junction box has one 1-¼” distribution conduit and three 1” distribution conduits, the total distribution-side width would be 6”+2”+2”+2”=10”.
      2) Repeat the above process for the feeder side of the junction box. Junction boxes are typically fed by a single conduit, therefore unless the box has more than one feeder conduit, the “Increase Width” part of the formula is unnecessary.
         a) For example, if the feeder side of the junction box has two 2” feeder conduits the total feeder-side width would be 8”+5”=13”.
      3) The larger of the two width calculations (distribution side vs. feeder side) shall be the width of the junction box to be provided.

a) For example, if the distribution-side width were 10” and the feeder-side width were 13”, provide a 13” wide junction box.

Conduit Size	Box Width	For each additional conduit Increase Width
1”	4”	2”
1-¼”	6”	3”
1-½”	8”	4”
2”	8”	5”
2-½”	10”	6”
3	12”	6”
3-½”	12”	6”
4”	15”	8”

2. A junction box may not be substituted for a 90-degree bend. 90 degree condulets (LB’s) are not acceptable.
3. Install junction boxes in an accessible location, readily accessible both at time of construction and after building occupation. Do not install junction boxes in inaccessible interstitial building spaces.
4. Where junction boxes are to be mounted on ceiling structure above ceiling grid, do not mount higher than 4’ above grid (mount on wall instead).
5. Install hinged-cover enclosures and cabinets plumb, and supported at each corner.
6. Install junction boxes so that the access door opens from the side where the cable installer will normally work – typically from the bottom (floor side) of the box.
   a. Where a junction box is installed in a ceiling space, provide full access to the junction box door and adequate working room for both the installation personnel and for proper looping of cable during installation.
   b. Provide a lockable access cover (or junction box door if junction box is exposed) in hard lid ceilings.
7. Install junction boxes such that conduits enter and exit at opposite ends of the box as follows:



CORRECT INSTALLATION INCORRECT INSTALLATION

F. Pull Boxes:

1. Provide pull boxes as shown on the Contract Documents and as required.
   a. Where sizing is not shown on the Contract Documents, size pull boxes as follows:

Size of Largest Conduit	Box Width	Box Length	Box Depth
1”	4”	12”	4”
1-¼”	6”	12”	4”
1-½”	8”	12”	4”
2”	8”	24”	4”
2-½”	10”	24”	6”
3	12”	36”	6”
3-½”	12”	48”	6”
4”	15”	60”	6”

b. Where a pull box is required with conduits 1” trade size or smaller, an outlet box may be used as a pull box. Where outlet boxes are used as pull boxes, the outlet boxes shall be dedicated for use as a pull box and shall not host cable termination hardware.

2. A pull box may not be substituted for a 90-degree bend. 90 degree condulets (LB’s) are not acceptable.
3. Install pull boxes in an accessible location, readily accessible both at time of construction and after building occupation. Do not install pull boxes in inaccessible interstitial building space.
4. Where pull boxes are to be mounted on ceiling structure above ceiling grid, do not mount higher than 4’ above grid (mount on wall instead).
5. Install hinged-cover enclosures and cabinets plumb, and supported at each corner.
6. Install pull boxes so that the access door opens from the side where the cable installer will normally work (typically from the bottom, or floor side, of the box).
   a. Where a pull box is installed in a ceiling space, provide full access to the junction box door and adequate working room for both the installation personnel and for proper looping of cable during installation.
   b. Provide a lockable access cover (or pull box door if pull box is exposed) in hard lid ceilings.
7. Install pull boxes such that conduits enter and exit at opposite ends of the box.

G. Firestopping:

1. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.
2. Maintain fire rating of penetrated fire-rated walls. Firestop and seal each penetration made during construction.
   a. Provide firestopping material for through and membrane penetrations of fire-rated barriers.
   b. Installation shall be performed in strict accordance with manufacturer’s detailed installation procedures.
   c. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer’s recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply of sealing material in a manner acceptable to the local fire and building authorities.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and in accordance with accepted industry practice, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 27 05 28

SECTION 27 15 00 – COMMUNICATIONS STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work specified in this section.

B. Requirements in each of the Division 27 specification sections apply to every other Division 27 section whether specifically referenced or not.

C. Requirements in each of the Division 26 specification sections apply to Division 27 sections whether specifically referenced or not.

1.2 SUMMARY:

A. Provide a complete telecommunications structured cabling system for transmission of voice and data signals from designated demarcation points to outlets at various locations as indicated on the drawings.

B. Provide temporary equipment and interconnections to the existing telecommunications system, as required to accommodate project phasing.

C. Test the system performance.

1.3 DESCRIPTION

A. System shall include, but not be limited to innerducts, outside plant cables, riser cables, horizontal station cables, cable terminations, terminal blocks, patch panels, fiber optic patch panels, equipment racks, telecommunications outlets and accessories as required to form a complete and functional system, ready for use. Provide associated cable supports, grounding and bonding.

B. System shall be ready for connection of Owner-provided hubs, routers, switchers, data concentrators and other similar active electronic equipment for data communications. Allocate space for Owner-provided equipment in the equipment racks located in the various telecommunications equipment rooms.

C. System shall be ready for connection of Owner-provided telephone switching equipment. Allocate space for Owner-provided equipment in the main telecommunications room. System does not include telephone switching equipment.

D. System does not include telephone instruments, computers, printers, facsimile machines, modems and other similar utilization equipment. Software is not included.

E. Materials and installation shall conform to the requirements set forth in the latest editions of EIA/TIA Standards 568, 569, 570, 606 and 607 and the recommendations contained in associated technical service bulletins.

F. Terminations of horizontal station twisted-pair cable shall conform to the EIA/TIA 568B wiring (pin-out) configuration. Verify configuration with Owner prior to ordering materials.

G. Provide proper identification and labeling of all telecommunications media, devices and equipment included in this Project, in accordance with the Owner's direction.

H. Conduct performance testing of all telecommunications media provided under this Project.

I. The catwalk area is considered an environmental air space per the National Electrical Code and will require all cabling routed in this area to be plenum rated.

1.4 QUALIFICATIONS OF SYSTEM INSTALLER

A. The System Installer shall be trained and certified by the manufacturer of the equipment, devices and cable provided on this project, as required to offer the system warranty as specified herein. The training shall cover all aspects of installation and testing. Personnel who have not completed the requisite training employed by the System Installer shall not take part in the installation, termination or testing of the cabling or system. Such personnel may assist in installation management or scheduling but may not install, terminate test the fiber or network cabling. Cabling contractor shall possess A Commscope Systimax VAR Certificate for the State of Washington or must possess a Leviton Premier Network Installer Certificate for The State of Washington.

1. For a list of Certified Premier Network Contractors in the State or Washington please contact Andy Honeycutt @ 408-978-3349
2. For a list of Certified Commscope Systimax VAR Contractors in the State or Washington please contact Kyle Graebner @ 206.321.8547

B. The System Installer shall be an organization specializing in installation of control-voltage systems and having the equivalent of 5 years of experience in installing telecommunications structured cabling systems similar in scope and complexity to the system required for this Project. The organization shall own and maintain tools and equipment necessary for successful installation and testing of the system and shall employ factory-trained technicians skilled in installation of telecommunications systems and adequately trained in the use of such tools and equipment.

C. The company and technicians shall be licensed as required by the local jurisdiction to perform work on low voltage systems and hold a valid (WA LE-06) Licensed Contractor License and shall have successfully installed at least one (1) other telecommunication structured cabling system similar to the type, size, complexity and manufacturer as that provided for this Project. The previously installed system shall have been in operation for at least 18 months. Furnish references with submittals to document the following:

1. The name of the System Installer to be employed on this Project.
2. A technical resume of experience for the technician who will be responsible for installation of telecommunications equipment, devices, and cable, including terminations on this Project.
3. Information regarding at least one (1) project where the named technician was responsible for installation of a telecommunications structured cabling system of the same type, size, complexity, and manufacturer as that provided for this project. The system shall have been in operation for at least 18 months. Identify the manufacturer and model of the amplification equipment installed, as well as the project name, location, date of completion and owner. Furnish name and telephone number of the owner's representative for that project, to serve as a reference.
4. A list of all telecommunications structured cabling system installations completed by the organization within the past 5 years. Describe each installation in a manner that allows comparison to this Project. Include name and telephone number of the owner's representative for each project, to serve as a reference.
5. Documentation demonstrating that the Contractor employs a minimum of one Registered Communications Distribution Designer (RCDD) certified by and in current good standing

with BICSI. The RCDD shall be a direct full time employee of the Contractor (i.e. an RCDD consultant/sub-contractor to the Contractor is not acceptable). The document shall also declare that the Contractor will continue to employ a minimum of one RCDD throughout the duration of the project.

6. The contractor shall maintain a staffed service organization (physical office presence) with spare parts in stock within 403km (50 miles) of the Project site.

1.5 WARRANTY AND REGISTRATION

A. In addition to the warranty specified in the General Conditions, the manufacturer of the telecommunications equipment, devices and cable shall warranty the entire telecommunications structured cable system to be in compliance with applicable codes and standards, and to be free from defects in materials and workmanship. The extended warranty shall apply to all passive structured cabling system components, and shall cover failure of the system to support applications in accordance with the performance levels stipulated in the referenced TIA/EIA standards. This additional warranty shall be the Leviton Certified Cabling System Lifetime System Warranty and be in effect from the date of final field testing and acceptance of the system, and shall cover the full cost of all repairs and all replacement costs for the entire system. Include warranty certificate in the Operating and Maintenance Manuals.

B. Upon successful completion of the installation and subsequent inspection by the manufacturer's project manager, the manufacturer of the telecommunications equipment, devices and cable shall register the telecommunications structured cable system installation, and shall furnish a numbered registration certificate to the Owner. Include copies of the certificate in the Operating and Maintenance Manuals.

1.6 SUBMITTALS

A. Installer Qualifications: For Telecommunications Cable System Installer.

B. Product Data: For all equipment, devices, cables, labels, and support devices provided on the Project.

C. Shop Drawings: Floor plans showing identification of each outlet, telecommunications room equipment placement plans, telecommunications room wall elevations and equipment rack layouts.

D. Meeting Minutes: For pre-installation meeting.

E. Test Summary: Summary of field test results.

1.7 INFORMATION FOR OPERATING AND MAINTENANCE MANUALS

A. Submittals: Information submitted for review, up dated to record any changes.

B. Test Reports: Record of all field test data.

C. Operation Instructions: Supply a detailed narrative description of the system operation. Indicate expansion capability, application conditions and limitations of use. Include manufacturer's installation and operating instructions.

D. Maintenance Instructions: List replacement parts, including source. Indicate recommended maintenance and testing procedures, and the intervals involved for each. List all individual system components that require periodic maintenance. Detail trouble-shooting procedures. Furnish service directory with names and telephone numbers to obtain service.

E. Registration Certificate: Manufacturer's installation registration certificate.

F. Warranty: Manufacturer's warranty certificate.

PART 2 - PRODUCTS

2.1 MATERIALS NOT INCLUDED

A. Telephone switching equipment.

B. Telephone instruments, computers, printers, facsimile machines, modems, and other similar utilization equipment.

C. Network hubs, routers, switchers, data concentrators and other similar active electronic equipment for data communications.

D. Computer software.

2.2 MATERIALS

A. OPEN CABLING & DEVICE MOUNTING SUPPORTS

1. Provide all accessories and mounting hardware required for a complete and working installation of open cabling supports.
2. J-Hooks:
    a. J-hooks shall comply with TIA requirements for structured cabling systems and pathway supports. Galvanized finish. Follow manufacturer's recommendations for quantity of cables supported. Provide all hardware necessary for secure mounting to the structure.
        1) Manufacturer Erico Caddy or Equal:
            a) 1" Dia., Part No. CAT16HP
            b) 1-5/16" Dia., Part No. CAT21HP
            c) 2" Dia., Part No. CAT32HP
            d) 3" Dia., Part No. CAT48HP
3. Adjustable Cable Support:
    a. Cable supports shall comply with TIA requirements for structured cabling system and pathway supports. Follow manufacturer's recommendations for quantity of cables supported. Provide all hardware necessary for secure mounting to the structure.
        1) Manufacturer Erico Caddy, Part No. CAT425
4. Conduit Waterfalls:
    a. Waterfalls shall be provided at the ends of 4-inch conduits and conduit sleeves installed horizontally where the pathways transition from conduit to ladder rack and cable tray pathways. Waterfalls shall be utilized to provide bend radius of all horizontal and backbone cabling. Waterfalls shall be UL Listed and rated for UL 94V-0. Material shall be glass reinforced flame retardant nylon 6.6.
        1) Manufacturer Panduit, Part No. CWF400
5. Firestopping putty shall be a one-part, two-stage intumescent, non-hardening compound. The putty, when exposed to high heat or flame shall be capable of expanding a minimum of five times. Range of continuing expansion shall be from 230°F to >1,000°F (110°C to >538°C). The putty shall be soft and pliable with aggressive adhesion and shall not contain any water-soluble intumescent ingredients. The putty shall be UL Classified and/or FM Systems Approved and tested to the requirements of ASTM E814 (UL1479).
    a. Manufacturer Specified Technologies, Inc. SpecSeal:
        1) 24" Putty bar, Part No. SSP28
        2) 36" Putty bar, Part No. SSP100

6. All tie wraps installed in the plenum spaces shall be plenum rated.
    a. Manufacturer Panduit, Part No. PLT2S-C702 (or equal)

B. Configuration: All multi-pair wiring jacks shall conform to a consistent pin-out configuration. Confirm the pin-out configuration with the Owner's Representative prior to ordering products, and verify that catalog numbers correspond with the correct pin-out configuration.

C. Cable Terminations:

1. 48-port minimum capacity, except as otherwise indicated
2. Connector module housing with provisions for storage and protection of excess fiber
3. Rack-mounted or wall-mounted as indicated
4. Include connector panels with sufficient ports for all fibers terminated at each unit
5. Include label holders and color-coded labels
6. Preload connector panels with Type LC connectors for termination of multi-mode fibers
7. Preload connector panels with Type LC connectors for termination of single-mode fibers
8. Include retaining trough mounted underneath each fiber optic patch panel

D. Patch panels for Multi-pair Category 6 Riser Cables:

1. 48-port capacity, except as otherwise indicated
2. Category 6 compliant
3. Rack-mounted as indicated
4. Include label holders and color-coded labels
5. Include retaining trough mounted underneath each patch panel
6. Shall be Leviton 6 Flat 110-Style #69586-U48

E. Patch panels for Multi-pair Category 6 Cables:

1. 48-port capacity, except as otherwise indicated
2. Category 6 compliant
3. Rack-mounted as indicated
4. Include label holders and color-coded labels
5. Include retaining trough mounted underneath each patch panel
6. Shall be Leviton Cat5e Flat 110-Style #59586-U48.

F. Telecommunication Station Outlets:

1. Faceplate for Wall-mount Telephone:
    a. 1-port capacity
    b. Finish shall stainless steel
    c. Include recessed jack for connection to telephone
    d. Include two (2) mounting studs
    e. Shall be Leviton #4108W-1SP
2. Single-Gang Faceplate:
    a. 4-port capacity
    b. Recessed designation strips with clear plastic covers for labels
    c. Finish shall match wiring devices – see Section 262726
    d. Include port identification
    e. Include jacks as indicated on Drawings
    f. Include blank inserts for all unused ports
    g. Shall be Leviton #42080-4IS
3. Multi-pair Telecom Jack:
    a. 8-pin RJ-45 insulation displacement modular type
    b. Category 6 compliant
    c. Station location (Work Area Outlet WAO) jacks shall be White
    d. WAO jacks shall be Leviton #61110-R*6 Category 6 U/UTP
4. Copper Patch Cables (Contractor Provided):

a. Owner will provide patch cords to interconnect patch panels and active network equipment for data switches and wireless access point activations and between Work Area Outlets (WAO) and computers.

5. Multi-mode Fiber Optic Jack:
   a. "LC" connector type (except where otherwise indicated)
   b. Equivalent to Leviton Quickport Duplex Multi-Mode MM #41085-MLI
   c. Equivalent to Leviton Quickport Duplex Single-Mode SM #41085-SLI
6. Fiber Optic Patch Cables:
   a. For Multimode fiber "LC" to "LC"
      1) Leviton #62DLC-M02
   b. For Single Mode fiber "LC to "LC"
      1) Leviton #UPDLC-S02

G. Direct Connect Connectivity

1. Where noted on drawings for alternate terminations, provide 8-Position modular plugs for 24-23 AWG solid conductors for Category 6 cabling.
   a. Manufacturer Tyco Electronics:
      1) Modular Plug, 25-box, Part No. 5-1375204-4 (or equal)
      2) Termination Kit, Part No. 1375204-1 (or Equal)

H. Equipment Rack

1. Where shown on the drawings, provide 7 feet high universal self-support racks equipped as detailed on the Drawings and as follows. Finish is manufacturer's standard black finish. Each equipment rack shall be secured to the concrete floor with concrete floor mounting kit.
   a. Manufacturer CPI:
      1) Equipment Rack, Part No. 55053-703
      2) Concrete Floor Mounting Kit, Part No. 40604-001

I. Rack Mount Vertical Cable Management

1. Where shown on the drawings, provide 7-feet high by 6-inch wide or 10-inch wide vertical CCS cable management.
   a. Manufacturer CPI:
      1) 6-inch Vertical Management, Part No. 40098-703
      2) 10-inch Vertical Management, Part No. 40100-703
         a) To be mounted between all racks when ganged together

2.3 WIRE AND CABLE

A. General: Grounding conductors shall be minimum #6 AWG. All wire and cable shall be suitable for Power-Limited Communications Circuit use. Minimum insulation rating shall be 300 VAC. Multi-pair cables shall be rated CM, CMG, CMR or CMP. Indoor/Outdoor, Outdoor, OSP, or other cabling types may be required depending on the installation pathway and routing determined by the Contractor. Fiber-optic cable shall be rated OFN, OFNG, OFNR or OFNP. CM, CMG, OFN and OFNG cable shall not be used for riser cables. Cable installed in environmental air spaces shall be plenum rated. Comply with standard EIA color coding.

B. All cabling installed below slab-on-grade shall be wet location rated regardless of the exposure length.

C. Cabling shall be protected throughout the duration of construction against damaged caused by moisture or paint or other harmful elements. Cables exposed to these elements shall be replaced entirely. The Telecommunications Installer shall at the pre-construction meeting notify the General Contractor and other trades that could produce agents that are potentially damaging.

D. In addition to NEC and WAC requirements, Chapter 3 of the current edition of the NEC shall apply to all structured cabling.

E. In addition to NEC and WAC requirements, Chapter 9, table 1 shall apply and no raceway shall exceed 40% fill. Since there are numerous manufacturers and cable types, the Contractor shall assure that the cable selected will comply with the 40% fill ratio. The Contractor shall provide a larger raceway if the conductor selected by the Contractor exceeds the maximum fill ratio as listed in Chapter 9 table 1.

F. Multi-pair Riser Cable (Shielded): Shielded #24 AWG twisted-pair cable with over-all jacket.

G. Multi-pair Riser Cable (Unshielded): Unshielded #24 AWG twisted-pair CMP plenum cable with over-all jacket. Performance shall comply with 5e.

2.4 HORIZONTAL CABLE

A. Category 6 4-pair Indoor Cable

1. Each horizontal cable shall be constructed from 23-24 AWG FEP (plenum) insulated solid bare copper conductors formed into four individually twisted pairs and enclosed by a PVC (plenum) jacket in the color yellow. Cable shall be NFPA 262; CMP (plenum) rated unless otherwise noted.
2. Each conductor shall have an impedance of 100Ω ±10% / 100m.
3. Each cable shall meet the most current technical characteristics of ANSI/TIA/EIA-568-C.2, for Category 6, 100Ω UTP:
    a. Manufacturer Berk-Tek
        1) Part. No. 10136749
    b. Commscope Systimax
        1) Part. No. 700210123
4. Category 6 4-pair Outdoor Cable
    a. Category 6 outdoor cable shall be 100 ohm 4 twisted pair flooded cable.
    b. Each conductor shall have an impedance of 100Ω ±10% / 100m.
    c. Each cable shall meet the most current technical characteristics of ANSI/TIA/EIA-568- C.2, for Category 6, 100Ω UTP:
        1) Wire map
        2) Length
        3) Insertion loss (Attenuation) 32.6dB/100m @ 250MHz
        4) Near-end crosstalk (NEXT) loss 39.3dB/100m @ 250MHz
        5) Attenuation to crosstalk ratio (ACR) 6.2dB/100m @ 250MHz
        6) Equal-level far-end crosstalk (EL-FEXT) 20.8dB/100m @ 250 MHz
            a) Manufacturer Berk-Tek - Part No. 10139885
            b) Manufacturer Commscope Systimax: 1. Part No. 760008888

2.5 INNERDUCT

A. Innerducts shall be corrugated plastic, designed to facilitate low-friction installation of fiber-optic cables. Innerducts shall be free of “reel memory” that can cause spiraling in conduit. Where installed indoors, innerducts shall be plenum-rated, constructed of polyvinylidene fluoride (PVDF). Innerducts installed outdoors may be constructed of PVDF or high-density polyethylene (HDPE).

2.6 TEXTILE INNERDUCT

A. Standard Outdoor Textile Innerduct: Micro (33mm), 2-inch, 3-inch and 4-inch single or multi-cell polyester/nylon textile innerduct containing 1250lb polyester flat woven pull tape. Productivity Redefined www.maxcell.us 600 Plum Creek Drive Wadsworth, OH 44281 1-888-387-3828

B. Detectable Outdoor Textile Innerduct: Micro (33mm), 2-inch, 3-inch and 4-inch single or multi-cell polyester/nylon textile innerduct containing 1250lb polyester flat woven pull tape, and a solid copper, polyvinyl color coated conductor (19AWG minimum) for tracing and rated for a minimum of 6 amps and 600 volts. Conductor shall be placed in the sidewall edge fold of the textile sleeve.

C. Indoor Textile Innerduct (Riser-listed): Micro (33mm), 2-inch, 3-inch and 4-inch single or multi-cell nylon textile innerduct containing 1250lb polyester flat woven pull tape which meets UL2024A for flame propagation and smoke density values for general applications.

D. Plenum-Listed Textile Innerduct: Micro (33mm), 2-inch and 3-inch single or multi-cell nylon textile innerduct containing 200lb nylon-resin flat woven pull tape which meets UL2024A for flame propagation and smoke density values for use in air handling spaces. 2.5

2.7 TEXTILE INNERDUCT FITTINGS

A. Conduit Plugs: Compression-type conduit plugs with locking nuts for sealing and securing one or more textile innerducts within a 4-inch inside diameter conduit, e.g.: a. 4-inch plug with nine holes for cables in a 3 pack (9-cell) configuration

B. Termination Bags: Inflation-type bags for sealing and securing around one or more textile innerducts and cables within 2-inch outside diameter or larger conduit. 2.6

2.8 PULL TAPE

A. Pull Tape: measuring and pulling tape constructed of synthetic fiber, printed with accurate sequential footage marks. Color-coded. 2.7

2.9 PENETRATION SEALING MATERIALS

A. Duct Water Seal: products suitable for closing underground and entrance conduit openings where innerduct or cable is installed, to prevent entry of gases, liquids, or rodents into the structure. Fabric mesh innerduct where shown on the drawings.

2.10 CABLE LUBRICANTS

A. Lubricants specifically designed for installing telecommunications cable shall be used to reduce pulling tension as necessary when pulling cable into conduit.

2.11 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers shall be as listed above, and as follows.

1. Devices: Leviton or Commscope Systimax
2. Protector Panels: Circa, Marconi, Surge Technologies.
3. Equipment Racks: Chatsworth
4. 4-Pair cable: Berk-Tek or Commscope Systimax
5. Fiber-optic Cable: Berk-Tek or Commscope
6. Innerduct: Endot, Pryamid,
7. Fabric Innerduct: MaxCell Group/TVC Communications.
8. Filler Foam: Hilti CF124.
9. Cable Lubricant: Dyna-Blue, American Polywater, or Yellow 77. Only use lubricants approved by manufacture for each type of cable.

B. Substitutions may be considered only when submitted in conformance with Section 26 01 00.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to beginning rough-in for the telecommunications services, arrange a pre-installation meeting on the site between all parties involved in the telecommunications cable system installation, including the Telephone Utility Company, the Owner's Information Technology Representative, the Telecommunications Cable System Installer and the Electrical Systems Installer. All parties shall review the telecommunications cable system shop drawings, the manufacturer's installation instructions, applicable regulations and any site conditions pertinent to installation of the telecommunications cable system.

B. Prepare minutes of the pre-installation meeting and distribute them to all parties in attendance at the meeting, and to the Owner's Representative and the Architect.

3.2 INSTALLATION – GENERAL

A. Install the telecommunications cable system in accordance with the manufacturer's recommendations. Locate equipment and devices as indicated.

B. Provide equipment racks, cabinets and backboxes matched to the device or equipment. Where manufacturer's installation instructions indicate use of standard outlet boxes, boxes shall be in accordance with Section 26 05 31. Install plumb and aligned with building elements.

C. Attach racks, cabinets, and backboxes securely to the building structure in accordance with Section 26 05 29.

D. Provide bonding connections in accordance with Section 26 05 26 and manufacturer's installation instructions.

E. Cables shall be arranged as shown on the shop drawings. Outside telecommunications equipment rooms or enclosures, cable shall be installed in raceways, except control-voltage cables run above accessible ceilings consisting of removable tiles. Raceways shall conform to the requirements of Section 26 05 33, and shall be bonded to the power system ground.

F. Visually inspect cable prior to installation. Cable with faulty insulation or outer jackets shall not be used.

G. Terminations shall be made in a neat and workmanlike manner. Installation and termination of cable shall conform to the applicable requirements and recommendations contained in the referenced EIA/TIA standards.

H. All terminations, patch panels and outlets shall be clearly and logically labeled in accordance with the requirements in Section 26 05 53.

I. Provide equipment identification in accordance with Section 26 05 53.

J. Where a common cable insulation type is not available to meet all installation environments that said cable my encounter between the work area outlet and the final patch panel termination point, a consolidation point may be required to convert the cable types. Such consolidation point shall be located in a readily accessible location inside a metallic enclosure that will be bonded to the building grounding system.

K. Routing methods can change the type of cable required and the size of raceway required. The Installation Contractor shall communicate these impacts with all effected parties prior to bid to

assure that proper cable ratings and raceway sizes are provided. Failure to fully communicate these requirements could result in rework that will be the sole responsibility of the Contractor.

3.3 OUTSIDE PLANT CABLING (Under SLAB)

A. Prior to installation, review the pathway, installation procedure, and materials to be used with the Owner's Representative.

B. Routing: Route innerducts and cable as indicated on the Contract Drawing. Select pull and feed locations best suited to minimize overall pulling tension. Calculate pulling tension required and verify that it does not exceed the maximum tension recommended by the manufacturer.

C. Innerduct: Pull innerduct using a break-away tension swivel that is rated at 80% of the maximum tension recommended by the manufacturer of the innerduct. Utilize sheaves and multi-sheave quadrant blocks within and above manholes and utility tunnel access hatches to minimize pulling friction and chafing damage. All innerduct installed in the same duct shall be pulled together as a group. Maintain tension on the innerduct as it is fed into the duct from the supply reel. Pulling tensions shall be eased by application of lubricant as the innerduct is pulled into the duct. All spilled lubricant shall be completely cleaned up. The length of each innerduct segment shall be sufficient to allow each end of the innerduct to extend at least 1 m (3 ft) beyond the end of the duct it occupies, to allow for shrink-back. Temporarily protect ends of innerduct with duct tape, until cables are installed. Each segment of innerduct shall be plugged at each end with filler foam once the installation is complete.

D. Textile Innerduct Installation:

1. Provide textile innerduct in conduit and wire ways, and place textile innerduct within and under cable trays using continuous unspliced lengths of textile innerduct between maintenance holes, pull boxes, and/or termination points as indicated on the drawings.
2. Make a 2" incision, approximately 18" from the end of textile innerduct. Pull out and cut off approximately 2 feet of pull-tape. Thus allowing the pull tape ends to retract back into the cells.
3. Using approximately 6 feet of pull tape, tie a non-slip knot to the incision. Then tie 3 to 6 half-hitch knots down to the end of textile innerduct. Apply black vinyl tape over all knots and the end of textile innerduct. Using a Bow Line knot tie a swivel to the end of 3 feet pull tape. For multi-pack installations one swivel is sufficient, but stagger each textile innerduct.
4. Using a Bow Line knot, attach the pull rope located in the rigid conduit to the other end of the swivel. Install textile innerduct – ensuring that no twist is introduced to the innerduct.
5. Provide suitable textile innerduct slack in the maintenance holes, hand holes, pull boxes, and at turns to ensure there is no kinking or binding of the product.
6. Textile Innerduct Mountings, Hangers and Attachments: When exposed indoors or in maintenance holes, hold firmly in place using independent support.
    a. Design & install hangers and other similar fittings adequate to support loads and so as to not damage innerduct.
    b. Do not fasten textile innerduct to steam, water, or other piping, ductwork, mechanical equipment, electrical equipment, electrical raceways, or wires
    c. When appropriate, use the following cable ties to secure textile innerduct through previously created incisions:
        1) Plenum areas: plenum-rated plastic or stainless steel
        2) Non plenum areas: Conventional flame-retardant nylon ties
        3) Underground locations : Conventional plastic cable ties
7. Maintenance Hole and Hand Hole Installation:
    a. At locations where textile innerduct will be continuous through a manhole or hand hole, allow sufficient slack so that the innerduct may be secured to the side of the vault maintaining the minimum bend radius.

b. At maintenance holes serving as the junction location, pull the exposed end of the innerduct to the far end of the vault, install termination bag, and secure to the vault.

8. Cable Tray and Runway Installation: Cut incisions every 24 inches into the edge of the textile innerduct and cable wrap to one side of vertical ladder rack or horizontal ladder-type cable tray at each incision. 3.4 Penetrations
   a. Seal all conduit and textile innerduct entering structures at the first box or outlet to prevent entrance into the structure of gases, liquids or rodents.
   b. Inspect fire stopping installation by others between building structure and conduit, wire way, and cable tray to verify integrity of installation.
   c. Exposed Textile Innerduct Penetrations: Install conduit sleeves or fire barrier sealing systems in all openings where open and exposed textile innerduct passes through fire-rated walls and floors. After installation, install intumescent fire barrier penetration sealing material (Hilti system) between textile innerduct and sleeves or fire barrier system.
   d. Raceway Penetrations: After textile innerduct installation, install intumescent fire barrier penetration sealing material (Hilti system) between textile innerduct and conduit or wire way at all exposed penetration locations.
   e. Protect adjacent surfaces from damage during water seal or fire stop installation. Repair any damage.
   f. Document entire installation process for future referral.

E. Cable Continuity: Cables shall be installed in one continuous length between buildings. Measure each run before cutting or pulling cable to select cutting length from reels. Do not splice cable, except as required to comply with NEC 770.50, which applies when fiber-optic outside plant cable (not rated as a riser or plenum rated cable) penetrates the exterior of a building and traverses a distance within the building greater than 15 m (50 ft) to the termination point. If the distance is greater than 15 m (50 ft), the cable must change from outside-rated cable to inside-rated cable or be encased in rigid conduit. The rating of this extension cable is pathway dependent (within a plenum or riser environment). The change in cable type shall necessitate a splice at the building penetration and shall conform to all standards and codes noted herein. If it is determined that a splice is necessary to comply with these requirements, first contact the Owner's Representative to discuss available alternatives before proceeding.

F. Slack: Allocate adequate slack for proper splice or termination at the following locations:

1. Splice Points
2. Equipment enclosures
3. Telecommunications rooms

G. Sealing Cable: Whenever it becomes necessary to cut any cable, the cut ends shall immediately be capped and sealed to positively exclude moisture. The seals shall be carefully maintained until final connections are made.

H. Protection of Cables: Care must be observed in handling the cable so as not to subject the jacket to undue abuse. Vehicular traffic shall not be allowed to pass over the cable nor shall it be pulled over rocks, fences or other sharp objects. Cable reels must be set up so that the cable is pulled from the top of the reel. Abrasion at cable supports or other adjacent structures shall be avoided. At points where proper clearances cannot be maintained, place plastic guards over exposed area of cable. A standard line wire grip or come-along is to be used when pulling up and tensioning cable. The support wire insulation must not be removed for this operation. Any damage to support wire insulation must be repaired with weatherproof coating such as Scotchkote Brand Electrical Coating or equivalent.

I. Cable Pulling: Cables shall be pulled into innerducts in the new telecommunications conduits as shown on the Contract Drawings. Any deviations in cable routing shall be submitted to the Owner in advance for approval. Pulling sheaves shall allow for no less than 20 times the cable OD for fiber optic cable pulling radius and 8 times the cable OD for copper cable pulling radius.

Select cable pull and feed locations best suited to minimize overall cable pulling tension. Cable pulling tensions shall be eased by application of the cable pulling lubricant as the cable is pulled into the duct. Cable pulling lubricant shall not harm the cable jacket and shall be a type approved by the Cable Manufacturer. All spilled lubricant shall be completely cleaned up.

J. Protection While Pulling: Cable-pulling tensions, speeds, lubricants, and other pertinent factors in connection with pulling and handling shall be in accordance with the cable manufacturer's recommendations. A drawing-in cable protector shall be fitted in the end of the duct during any pulling operation, in order to prevent damage to the cable. While cables are being pulled into conduit, they shall be protected by underground cable feeder straighteners and rollers. Where more than a single cable is being pulled in, all cables shall be pulled simultaneously into the duct from the shipping spools or reels on which they were received. Cable grips shall be designed for the purpose and shall not cut or otherwise damage the cable. No cable shall be pulled with ends open. A rubber tape seal shall be maintained at all times. The cable shall be continuously inspected during installation and any cuts, abrasions or other damage shall be brought to the attention of the Owner and repaired or replaced as directed.

K. Supporting Cable: Cable shall be racked, trained and supported in the following locations:

1. Telecommunications rooms

L. Damaged Cable: Great care shall be exercised in handling the cable, in pulling the cable in innerducts and conduits, and in placing the cable in steam tunnels to prevent damage to the cable sheath. Any length of cable damaged shall be replaced with cable of the same size, make, type and quality, at no additional expense to the Owner.

M. Duct Seals: Utilize duct plugs and/or duct sealing compound to seal all telecommunications conduits at service entrance points and at all underground conduit fee outlet boxes.

3.4 INTERIOR TELECOMMUNICATIONS CABLING

A. Each telecommunications equipment room shall be equipped with terminal blocks, which shall be arranged as follows:

1. The Main Distribution Facility (MDF) for the building shall be equipped with one or more columns of wall-mount terminal blocks for terminating service entrance cross-connects.
2. The MDF shall also be equipped with one or more columns of terminal blocks for terminating the riser cable to each Intermediate Distribution Facility (IDF).
3. Each Intermediate Distribution Facility (IDF) shall be equipped with one or more patch panels for terminating the riser cable.
4. The Main Distribution Facility (MDF) and each Intermediate Distribution Facility (IDF) shall be equipped with one or more patch panels for terminating the horizontal station cable originating therein and patch cords for activating outlet jacks for voice service**.**
5. The layout for the patch panels in each telecommunications room shall be a filled, rectangular block pattern, with no short columns or rows and no holes. If one column requires three terminal blocks, all columns in that room shall have three terminal blocks, regardless of whether the additional terminal blocks in a given column would otherwise be required.

B. Mount fiber optic patch panels, patch panels, wire-management hardware and other rack-mounted equipment in equipment racks as indicated. Each LIU and each patch panel shall have a retaining trough mounted immediately below it for organizing patch cords.

C. The Main Distribution Facility (MDF) and each Intermediate Distribution Facility (IDF) shall be equipped with rack-mounted patch panels for terminating the horizontal station cable originating therein.

D. The Main Distribution Facility (MDF) and each Intermediate Distribution Facility (IDF) shall also be equipped with rack-mounted patch panels for terminating patch cords for activating outlet jacks for voice service. The riser cables shall terminate to the back of said equipment.

E. Riser cables shall extend from the Main Distribution Facility (MDF) to each Intermediate Distribution Facility (IDF) in uninterrupted continuous runs, without intermediate splices. Cables shall be free from shorts or grounds.

F. Horizontal station cables shall extend from the telecommunications room (whether MDF or IDF) to the outlet locations in uninterrupted continuous runs, without intermediate splices. Cables shall be free from shorts or grounds. Station cables shall terminate on the back side of patch panels in the equipment racks. Maximum station cable length shall not exceed 91 m (300 ft). Maximum total length including patch cords shall not exceed 99 m (326 ft).

G. Cables shall be routed so as to maintain a separation of at least 610 mm (24 in) from all heat sources and from ballasts, transformers, dimmers and other sources of electromagnetic interference. Avoid exposed cables in occupied areas or in areas where they might be damaged as a result of normal use of the area. Where two (2) or more cables run in parallel, they shall be bundled with cable ties.

H. Cables run exposed in ceiling cavities shall be supported by means of suitable cable support devices from the building structure. They shall not lie upon the ceiling, nor shall they be supported from the ceiling frame, ceiling suspension wires, conduits, pipes, ductwork or lights. Supports shall be spaced no further apart than 1.5 m (5 ft) on center.

I. Care shall be exercised during cable installation not to damage cable insulation. Damaged cables shall be removed and replaced. Over tightening of tie wraps is unacceptable. Type and spacing of supports shall ensure that cable will not kink, sag or distort. The minimum bend radius recommended by the cable manufacturer shall be observed in all cases.

J. Cable shall be neatly dressed in the telecommunications equipment rooms, without excessive slack. Route cable close to ceiling, floor or corners to preserve backboard space for both current and future termination blocks and other wall-mounted equipment. Cable path shall offer minimum obstruction to future installation. Avoid cables crossing horizontally through the areas just above or below riser sleeve or cable tray penetrations. Cable connections to patchpanels on wall-mounted racks shall be adequate in length and installed with sufficient flexibility to permit the hinged rack frame to swing open for access to the termination blocks on the back without requiring excessive force and without pinching cables.

K. In each cable that terminates at the central equipment rack, provide 3 m (10 ft) of slack cable, neatly coiled, to facilitate future modifications. Provide an additional 1.8 m (6 ft) of unsheathed fiber, neatly coiled in the lightguide distribution unit, for each optical fiber terminated therein.

L. In each cable that terminates at an outlet, provide 305 mm (12 in) of slack cable, neatly coiled, to facilitate future modifications.

M. Terminations shall be made in a neat and workmanlike manner. Terminate each horizontal station cable on a dedicated telecommunications outlet. Unless otherwise indicated, do not create multiple appearances of the same cable at several distribution points, referred to as bridged taps. Maintain the twist of horizontal station cable pairs and riser cable pairs up to the point of termination. In no case shall wire be untwisted beyond 13 mm (½ in).

3.5 MOUNTING HEIGHTS

A. Back boxes shall be mounted at the heights indicated on the drawings. Where not otherwise indicated, telecommunications outlets shall be mounted at the same height as the adjacent receptacle outlets.

3.6 IDENTIFICATION

A. The cable sheath ends at termination panels in MDFs, and IDFs shall be labeled with color-coded adhesive labels. Labels shall be machine printed, self-laminating, adhesive type, and shall be of a durable nature with legible print type and size.

B. Each cable terminated at a protector panel, terminal block, patch panel or LIU shall be provided with a label. Labels shall be machine printed, of a durable nature with legible print type and size.

C. Workstation identification will include IDF or MDF identification, LIU or patch panel identification, and port identification. The MDF workstation ID numbers shall start with “1-”. IDF workstation ID numbers shall start with “2-”, “3-”, “4-”, etc., in accordance with the numbering scheme reflected on the drawings. Example: For a workstation fed from IDF #1, Patch panel #4 and Port #9, the workstation ID number would be I1.04:9. This number shall become part of the Certification Record and shall also appear on the record drawings in the proper location.

D. Labeling of ports at MDF and IDF(s) shall match workstations.

E. Arrangement and labeling of the ports shall follow a numerical sequence from room to room.

3.7 TESTING

A. Notify the Owner’s Representative and the Architect’s Consultant at least one (1) week in advance of the date of each test, to allow witnessing of the tests.

B. Supply tools, instruments, gauges, testing equipment, protective devices and safety equipment for testing.

C. During testing, carefully record all test results, including expected test results, actual test results, and corrective actions taken. Records shall be included in the Operating & Maintenance Manuals. A summary of the test results shall be submitted to the Architect's Consultant.

D. Test all system multi-pair riser cable after installation and prior to connection to equipment. Tests to be performed shall include, but not be limited to, the following:

1. Termination order
2. Conductor continuity
3. Freedom from shorts and grounds
4. D.C. insulation resistance
5. Shield ground continuity

E. Test all system multi-pair horizontal station cable after installation and prior to connection to equipment. Test procedures shall be based on TIA-568-B1.2-1 UTP tests and shall be performed using a commercial Level 5e cable pair tester, equipped with compact flash memory (e.g. Wire Scope tester with latest upgrade). The tester shall capture full data plots up to 500 MHz. Data collected shall be downloaded and stored in database format for ready comparison to future standards. All 4-pair UTP cable must meet all Category 6 UTP performance parameters per TIA-568-B1.2-1. Tests to be performed shall include, but not be limited to, the following:

1. Termination order (wiremap)

2. Conductor continuity
3. Freedom from shorts and grounds
4. Impedance (length)
5. Attenuation
6. Near-end crosstalk (NEXT)
7. Power sum near-end crosstalk (PSNEXT)
8. Equal-level far-end crosstalk (ELFEXT)
9. Power sum equal-level far-end crosstalk (PSELFEXT)
10. Return loss (RL)
11. Propagation delay (PD)
12. Delay skew (DS)
13. Longitudinal Conversion Loss (LCL)
14. Longitudinal Conversion Transmission Loss (LCTL)

F. Test all system multi-mode fiber-optic cable after installation and prior to connection to equipment, using the correct connectors and adapters. Tests shall be conducted using an OTDR (Optical Time Domain Reflector). Multi-mode attenuation measurements shall be made in accordance with either EIA-455-61A (Measurement of Fiber or Cable Attenuation using an OTDR) or with EIA-455-59 (Generic Description of Optical Time Domain Reflectometry). Tests to be performed shall include, but not be limited to, the following:

1. Polarity
2. Length of cable
3. Attenuation

G. Each multi-mode fiber shall meet the following performance level for the graded parameters of attenuation and information capacity:

1. Using a wavelength of 850 nm, the maximum attenuation of 3.7 dB/kilometer shall not be exceeded. The fiber shall have information transmission bandwidth of 200 MHz-kilometer minimum.
2. Using a wavelength of 1300 nm, the maximum attenuation of 1.5 dB/kilometer shall not be exceeded. The fiber shall have information transmission bandwidth of 1000 MHz-kilometer minimum.

H. Test all system single-mode fiber-optic cable after installation and prior to connection to equipment, using the correct connectors and adapters. Tests shall be conducted using an Optical Time Domain Reflectometer (OTDR). Single-mode attenuation measurements shall be made in accordance with EIA-526-7 (Optical Fiber Standard Test Procedure, Measurement of Optical Power Loss of Installed Single-mode Fiber Cable Plant). Attenuation uniformity measurements shall be made in accordance with EIA-455-59 (Generic Description of Optical Time Domain Reflectometry). Attenuation variation measurements shall be made in accordance with EIA-455-78 (Spectral Attenuation Cutback Measurement for Single-Mode Optical Fibers). Tests to be performed shall include, but not be limited to, the following:

1. Polarity
2. Length of cable
3. Attenuation
4. Attenuation uniformity
5. Attenuation variation

I. Each single-mode fiber shall meet the following performance level for the graded parameters of attenuation, attenuation discontinuity and attenuation variation:

1. Using a wavelength of 1310 nm, the maximum attenuation of 0.7 dB/kilometer shall not be exceeded. The attenuation discontinuity shall not exceed 0.1 dB throughout the cable length. The attenuation variation shall be less than 0.1 dB/km for wavelengths between 1285 nm and 1330 nm compared to the attenuation at 1310 nm.
2. Using a wavelength of 1550 nm, the maximum attenuation of 0.7 dB/kilometer shall not be exceeded. The attenuation discontinuity shall not exceed 0.1 dB throughout the cable

length. The attenuation variation shall be less than 0.5 dB/km for wavelengths between 1525 nm and 1575 nm compared to the attenuation at 1550 nm.

J. Correct any deficiencies discovered as a result of the above testing, and completely retest the work affected by such corrections, with no additional compensation.

END OF SECTION 27 15 00

SECTION 28 23 00 – VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Description: IP-Based Building Closed Circuit Television (CCTV) System consisting of, but no limited to, cameras, and mounts, cabling, network video recorder and related equipment. System shall be a completely native IP environment.

B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

1.2 SUBMITTALS

A. Product Data

1. Provide Product Data submittals on all products proposed to be provided under this Section.

B. Shop Drawings:

1. Provide Shop Drawings showing equipment locations and routing of cables and wiring in conduits and raceways.
2. Shop drawings shall indicate cable types and sizes, routing, connection points, equipment locations, equipment addresses; and other such information.
3. Shop drawing floor plans shall be prepared using a standard architectural scale. Preferable scale of floor plans for Shop Drawings shall be 1/8" = 1'
4. Approved Shop drawings shall be used as plan for system installation.
5. Provide 4 sets of shop drawings to A/E.

C. Project Record Drawings

1. The purpose of Project Record Drawings is to provide factual information regarding all aspects of the closed-circuit television system, to enable future service, modifications, and additions.
2. Project Record Drawings shall include documentation of all work, including the documentation of equipment, wiring, conduits, cable trays, and raceways that are related to the work but are provided under other Sections.
3. Contractor shall maintain the working set of Project Record Drawings at the project site throughout the course of the work. The working set shall be updated on a daily basis as the work progresses.
4. Project Record Drawings shall accurately show the physical placement of the following:
   a. Equipment and devices.
   b. Wire and cable runs.
   c. Conduits, cable trays, and raceways.
   d. Junction and pull box locations.
   e. End-of-line resistor locations. (where applicable)
   f. Interfaces to external equipment.
   g. Connections to power circuits.

1.3 WARRANTY

A. Contractor warrants that all Work furnished (material and labor) under this Contract will be of good quality, free from faults and defects, and in conformance with the Project Drawings and Specifications.

B. Contractor shall provide parts and labor guarantee on all Work. Unless otherwise specified herein, Contractor's guarantee shall be for a period of one (1) year from date of Substantial Completion, except where any specific guarantees from a supplier or equipment manufacturer extends for a longer time. All camera manufacturer warranties shall be for a (3) year period of time. If standard manufacturer warranty period is less than a 3-year period, an extended warranty shall be provided in the base bid to provide warranty coverage of 3-years.

C. Contractor's guarantee shall cover all costs associated with troubleshooting, repair, and replacement of defective Work, including costs of labor, transportation, lodging, materials, and equipment.

D. Contractor shall promptly respond to owner requests for service during the guarantee period. Contractor shall provide repair service as soon as reasonably possible upon request from the owner, but in no case shall service response exceed 8 hours from time of request.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. CCTV camera equipment shall be from a major manufacturer with at least 15 years of experience in the manufacturer, installation and programming of equipment. Manufacturer shall provide a minimum 3-year factory endorsed warranty. Approved Camera manufacturer is Panasonic. Bosch and Sony are accepted as approved alternates

2.2 CAMERA

A. The camera shall be manufactured with a domed vandal-resistant enclosure.

B. The camera shall be equipped with a progressive scan megapixel sensor, a varifocal lens with automated iris functionality and remote zoom and focus capabilities.

C. High sensitivity with true Day/Night functionality providing images down to 0.3 lux (color) and 0.05 lux (B/W) at F1.6(wide).

D. The camera shall be equipped with a 10BASE-T/100BASE-TX Ethernet-port, and shall include support for Power over Ethernet according to IEEE 802.3af.

E. The camera shall support 720p images up to 30 frames per second.

F. The H.264 implementation shall include both unicast and multicast functionality and support Constant Bit Rate (CBR) as well as Variable Bit Rate (VBR).

G. The camera shall be equipped a SD/SDHC card slot to support local storage of video.

H. The camera shall support both static IP addresses and addresses from a DHCP-server, and shall support both IPv4 and IPv6. The camera shall incorporate support for Quality of Service (QoS).

I. The camera shall contain a built-in web server making video and configuration available in a standard browser environment using HTTP.

J. Panasonic WV-SW355

2.3 NETWORK VIDEO RECORDER

A. System shall include a Network Video Recorder (NVR). The NVR shall support MPEG-4 and JPEG recording with up to 64 cameras connected and recorded simultaneously

B. Shall provide multiple display modes and flexible playback controls.

C. System shall include a built-in network interface to support remote monitoring and operation via the Ethernet network and a hard drive capacity of 3TB.

D. Provide rack mount accessories.

E. Panasonic WJ-ND400/3000

2.4 SOFTWARE

A. Provide system management and live monitoring software for NVR. The software shall support up to 100 recorders, 64 encoders and 256 directly connected cameras.

B. Image resolution shall dynamically change based on screen mode: VGA for quad screen and QVGA for 16 split screens

C. Software shall provide pop-up notification and messaging and shall operate on a Windows-based platform.

D. Panasonic WV-ASM100L

2.5 WIRE AND CABLE

A. All Category 6 horizontal cabling required for the installation and operation of the specified CCTV cameras shall be provided under Section 27 11 00 Telecommunication Cabling System.

B. Provide all other cabling required for a complete and operation system in compliance with equipment manufacturer's installation requirements.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide all labor, tools, supplies, materials, and equipment required for the design, installation, configuration, programming and testing of a complete and operational building closed circuit television system.

B. Install all equipment where shown on the drawings and in accordance with manufacturer's instructions and approved Shop Drawings.

C. Coordinate field of view requirements with owner for each camera during the initial setup and programming of the DVR.

3.2 CAMERAS

A. Cameras shall be configured to record upon motion. Motion recording window configuration settings shall be selected with the owner when configuring final field of view settings of the cameras. Coordinate recording by other means, such as contact inputs with owner prior to programming software.

B. Exterior camera set-up shall mask out areas of excessive unchanging movement such as trees to avoid recording non-applicable items.

C. All cameras shall be mounted with tamper resistance Torx TR screws. Provide owner with bit for screws.

3.3 CABLING

A. Neatly dress and tie all cabling, do not obstruct access to terminal strips and configuration jumpers.

B. Label all inputs and outputs with a machine printed label.

3.4 COORDINATION

A. Coordinate work with owner and existing contractor's on site.

3.5 TRAINING

A. The Owner shall receive 12 hours of instruction in (3) 4-hour segments. The Owner shall also receive training in configuring and inputting information to the NVR software to the Owner’s satisfaction and until the initial database is complete and all camera configurations are complete.

B. Training shall cover all aspects of the CCTV system, software configuration and masking capabilities.

3.6 ACCEPTANCE

A. In order to ensure the Owner and all contracting parties are in agreement, a formal acceptance procedure has been established for the closed-circuit television system. The acceptance of the system is based upon the successful completion of the testing requirements and is therefore not open for punch list items only. It is understood that the tests may be conducted over a period of time and therefore each test may be accepted individually. Final acceptance and release will be when all tests are completed and accepted. Failure of a test requires that a specific test be re-run, but does not affect any test already accepted with the exception of the Integrated Test. Failure of the integrated test may require the retest of one or more individual tests.

3.7 FINAL ACCEPTANCE

A. After Work is completed, and prior to requesting the Acceptance test, Contractor shall conduct a final inspection, and pre-test all equipment and system features. Contractor shall correct any deficiencies discovered as the result of the inspection and pre-test.

B. Contractor shall submit a request for the Acceptance test in writing to Hargis Engineers using an approved "Request for Security Systems Acceptance Test" form. Such request shall be submitted to Hargis Engineers no less than twenty-one days prior to the requested test date. The request for Acceptance test shall constitute a certification from Contractor that all Work is complete and in compliance with the Contract Documents; all systems have been tested; and that all corrections have been made.

C. Acceptance test shall be scheduled during a period when the building is unoccupied and a complete system test can be accomplished. Contractor shall provide the services of no fewer than two (2) technicians to perform the Acceptance Test. Technicians performing the Acceptance test shall have been involved in the installation of this project and shall be

thoroughly familiar with all aspects of the Work. Technicians shall be equipped with portable two-way radios that will be used during the test.

D. Contractor shall provide all ladders, tools, test equipment, and other facilities needed to accomplish the Acceptance test.

E. During Acceptance test, Contractor shall demonstrate all equipment and system features to the owner's security staff. Contractor shall fully cooperate with the owner's security staff and provide assistance with the inspection and test. Contractor shall remove and reinstall covers, open and restore wiring connections, operate equipment, and perform other reasonable work as requested for inspection purposes.

F. Any portions of the Work found to be deficient or not in compliance with the Contract Documents will be rejected. The owner's security staff and Hargis Engineers will prepare a list of any such deficiencies observed during the Acceptance test. A copy of such list will be provided to Contractor. Contractor shall promptly correct all deficiencies.

3.8 WARRANTY

A. Contractor warrants that all Work furnished (material and labor) under this Contract will be of good quality, free from faults and defects, and in conformance with the Project Drawings and Specifications.

B. Contractor shall provide parts and labor guarantee on all Work. Unless otherwise specified herein, Contractor's guarantee shall be for a period of one (1) year from date of Acceptance, except where any specific guarantees from a supplier or equipment manufacturer extends for a longer time.

C. Contractor's guarantee shall cover all costs associated with troubleshooting, repair, and replacement of defective Work, including costs of labor, transportation, lodging, materials, and equipment.

D. Contractor shall promptly respond to owner requests for service during the guarantee period. Contractor shall provide repair service as soon as reasonably possible upon request from the owner, but in no case shall service response exceed 8 hours from time of request.

END OF SECTION 28 23 00

SECTION 28 31 11 – FIRE DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:

1. Division 28: "Basic Electrical Materials and Methods."
2. Division 28: "Wiring Methods."
3. Division 21: "Fire Protection".
4. Division 23: "HVAC Systems".

C. The system and all associated operations shall be in accordance with the following:

1. Requirements of the following Model Building Code: IBC, 2015 Edition
2. Requirements of the following Model Fire Code: IFC, 2015 Edition
3. Requirements of the following Model Mechanical Code: 2015 Edition
4. NFPA 72, National Fire Alarm Code, 2013 Edition
5. NFPA 70, National Electrical Code, 2014 Edition
6. NFPA 101, Life Safety Code, 2015 Edition
7. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems, 2015 Edition
8. ANSI/ASME A17.1 / CSA B44, Safety Code for Elevators and Escalators, 2013 Edition
9. ICC/ANSI A117.1 Accessible and Useable Buildings and Facilities, 2015 Edition
10. Local Jurisdictional Adopted Codes and Standards
11. ADA Accessibility Guidelines

1.2 SUMMARY

A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.

B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.

C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:

1. Fire alarm system detection and notification operations.
2. Control and monitoring of elevators, smoke control equipment, door hold-open devices, emergency power systems, and other equipment as indicated in the drawings and specifications.

1.3 DEFINITIONS

A. ADA: Americans with Disabilities Act

B. AHJ: Authority Having Jurisdiction

C. ANSI: American National Standards Institute

D. ASME: American Society of Mechanical Engineers

E. FACU: Fire Alarm Control Unit

F. FM: Factory Mutual

G. IBC: International Building Code

H. ICC: International Code Council

I. IDC: Initiating Device Circuit

J. IEEE: Institute of Electrical and Electronic Engineers

K. IFC: International Fire Code

L. IMC: International Mechanical Code

M. IRI: Industrial Risk Insurers

N. LED: Light-emitting diode.

O. NAC: Notification Appliance Circuit

P. NFPA: National Fire Protection Association

Q. NICET: National Institute for Certification in Engineering Technologies.

R. RAC: Releasing Appliance Circuit

S. SLC: Signaling Line Circuit

T. UL: Underwriters Laboratories

U. ULC: Underwriters Laboratories, Canada

1.4 SYSTEM DESCRIPTION

A. General: Provide a complete, non-coded addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.

B. Power Requirements

1. The control unit shall receive AC power via a dedicated fused disconnect circuit.
2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 5 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
3. All circuits requiring system-operating power shall be 24 VDC nominal voltage and shall be individually fused at the control unit.
4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously at the user interface while incoming power is present.
5. The system batteries shall be supervised so that a low battery or a depleted battery condition, or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.
6. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
7. Loss of primary power shall sound a trouble signal at the FACU. FACU shall indicate when the system is operating on an alternate power supply.

C. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary.

1. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation.
2. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory.
3. Panels shall be capable of full system operation during new site specific configuration download, master exec downloads, and slave exec downloads.

4. Panels shall automatically store all program changes to the panel's non-volatile memory each time a new program is downloaded. Panels shall be capable of storing the active site-specific configuration program and no less than 9 previous revisions in reserve. A compare utility program shall also be available to authorized users to compare any two of the saved programs. The compare utility shall provide a deviation report highlighting the changes between the two compared programs.
5. Panels shall provide electronic file storage with a means to retrieve a record copy of the site-specific software and up to 9 previous revisions. Sufficient file storage shall be provided for other related system documentation such as record drawings, record of completion, owner's manuals, testing and maintenance records, etc.
6. The media used to store the record copy of site-specific software and other related system documentation shall be electrically supervised. If the media is removed a trouble shall be reported on the fire alarm control unit.

D. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.

E. Required Functions: The following are required system functions and operating features:

1. Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
2. Transmission to an approved Supervising Station: Automatically route alarm, supervisory, and trouble signals to an approved supervising station service provider, under another contract.
3. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACU and the remote annunciator, indicating the type of device, the operational state of the device (i.e. alarm, trouble or supervisory) and shall display the custom label associated with the device.
4. Selective Alarm: A system alarm shall include:
    a. Indication of alarm condition at the FACU and the annunciator(s).
    b. Identification of the device /zone that is the source of the alarm at the FACU and the annunciator(s).
    c. Operation of audible and visible notification appliances until silenced at FACU.
    d. Closing doors normally held open by magnetic door holders.
    e. Unlocking designated doors.
    f. Shutting down supply and return fans building wide.
    g. Closing smoke dampers on system building wide.
    h. Transmission of signal to the supervising station.
    i. Initiation of elevator Phase I functions (recall, shunt trip, illumination of indicator in cab, etc.) in accordance with ANSI/ASME A17.1 / CSA B44, Safety Code for Elevators and Escalators, when specified detectors or sensors are activated, as appropriate.
5. Supervisory Operations: Upon activation of a supervisory device such as a low air pressure switch, and tamper switch, the system shall operate as follows:
    a. Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.
    b. Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
    c. Record the event in the FACU historical log.
    d. Transmission of supervisory signal to the supervising station.

e. Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.

6. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible and visible alarm signals shall cease operation.
7. Priority Two Operations: Upon activation of a priority two condition gas detection,, the system shall operate as follows:
   a. Activate the system priority two audible signal and illuminate the LED at the control unit and the remote annunciator.
   b. Pressing the Priority 2 Acknowledge Key will silence the audible signal while maintaining the Priority 2 LED "on" indicating off-normal condition.
   c. Record the event in the FACU historical log.
   d. Transmission of priority two signal to the supervising station.
   e. Restoring the condition shall cause the Priority 2 LED to clear and restore the system to normal.
8. System Reset
   a. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
   b. Should an alarm condition continue, the system will remain in an alarmed state.
9. WALKTEST: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:
   a. The city circuit connection and any suppression release circuits shall be bypassed for the testing group.
   b. Control relay functions associated with one of the 8 testing groups shall be bypassed.
   c. The control unit shall indicate a trouble condition.
   d. The alarm activation of any initiating device in the testing group shall cause the audible notification appliances assigned only to that group to sound a code to identify the device or zone.
   e. The unit shall automatically reset itself after signaling is complete.
   f. Any opening of an initiating device or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.
10. Install Mode: The system shall provide the capability to group all non-commissioned points and devices into a single "Install Mode" trouble condition allowing an operator to clearly identify event activations from commissioned points and devices in occupied areas.
    a. It shall be possible to individually remove points from Install Mode as required for phased system commissioning.
    b. It shall be possible to retrieve an Install Mode report listing that includes a list of all points assigned to the Install Mode. Panels not having an install mode shall be reprogrammed to remove any non-commissioned points and devices.

F. Analog Smoke Sensors:

1. Monitoring: FACU shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall

determine the condition of each sensor by comparing the sensor value to the stored values.

2. Environmental Compensation: The FACU shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 selectable sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACU.
4. Sensitivity Testing Reports: The FACU shall provide sensor reports that meet NFPA 72 calibrated test method requirements.
    a. Reports shall be capable of being printed for annual recording and logging of the calibration maintenance schedule.
    b. Where required, reports shall be accessible remotely through:
        1) A Fire Panel Internet Interface using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3. The Fire Panel Internet Interface shall be capable of automatically scheduling email reports to individual user accounts on a weekly, bi-weekly, or monthly schedule
        2) A PC Annunciator using an RS232-C connection to the FACU or a PC Annunciator Client using a TCP/IP communications protocol connection to the PC Annunciator server compatible with IEEE Standard 802.3.
5. The FACU shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACU as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "DIRTY SENSOR" condition shall be indicated at the FACU and subsequently a system trouble is reported to the Supervising Station. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.
6. The FACU shall continuously perform an automatic self-test on each sensor that will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.
8. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.
9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.

G. Fire Suppression Monitoring:

1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.

3. Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.

H. Audible Alarm Notification: By horns in areas as indicated on drawings.

I. Addressable Notification Appliances (Applies only where addressable notification is provided):

1. Monitoring: The FACU shall monitor individual addressable notification appliances for status, condition, type of appliance, and configured appliance settings. A fault in any individual appliance shall automatically report a trouble condition on the FACU.
2. Individual Appliance Custom Label: Each addressable appliance shall have its own 40 character custom label to identify the location of the appliance and to aid in troubleshooting fault conditions.
3. Individual Appliance Information Display:
   a. The FACU shall be capable of calling up detailed information for each addressable appliance including the appliance location, status, condition, type of appliance, and configured appliance settings.
   b. Notification appliances that are not capable of communicating and reporting their individual location, status, condition, type of appliance, and configured appliance settings to the FACU shall not be accepted.
4. Programmable Appliance Settings:
   a. The selectable operation of each addressable notification appliance shall be capable of being configured by the FACU without having to replace or remove the appliance from the wall or ceiling.
   b. Programmable appliance settings for applicable addressable notification appliances shall include:
      1) Operation:
         a) General Evac
      2) Candela Selections:
         a) Indoor: 15, 30, 75, 110, 135, or 185 cd (per UL1971)
         b) UL Weatherproof: 15 or 75 cd (per UL1971), and 75 or 185 cd (per UL1638)
      3) Horn Volume:
         a) Hi
         b) Low
      4) Horn Cadence:
         a) Temporal 3
   c. Systems that require replacement or removal of the appliances from the wall or ceiling to change their applicable operation or settings shall not be accepted.
5. Programmable Notification Zones:
   a. Changing the notification zone assigned to a notification appliance shall be configurable by the FACU and shall not require additional circuits or wiring.
   b. Systems that require additional circuits and wiring to change the notification zone assigned to a notification appliance shall not be accepted.
6. Addressable Notification Appliance Automated Self-Test:
   a. The fire alarm control unit shall be capable of performing an automated functional self-test of all self-test notification appliances and meet the requirements in NFPA 72, 2013 Edition, 14.2.8 Automated Testing and Table 14.4.3.2 testing requirements.
   b. Test results for each self-test notification appliance shall be stored in non-volatile memory at the fire alarm control unit.

c. The fire alarm control unit shall be capable of running a functional automated test for all self-test notification appliances in a general alarm group or for all self-test appliances within a specific notification zone.
d. The duration required to complete the automated functional test for all self-test notification appliances shall be accomplished in 2 minutes or less.
e. The automated test results for all self-test notification appliances shall be available from the fire alarm control unit within 4 minutes from the start of the test.
f. If any notification appliance fails its automated functional self-test an audible and visual trouble signal shall be annunciated at the fire alarm control unit.
1) The self-test trouble signal shall be a latching trouble signal which requires manual restoration to normal.

7. Addressable Notification Appliance Reports:
a. The fire alarm control unit shall maintain configuration and test data for each self-test addressable notification appliance.
b. The fire alarm control unit shall be capable of generating configuration, self-test, and deficiency reports, that can be viewed through the fire alarm control unit user interface or printed via the fire alarm control unit service port.
1) At minimum, the configuration report shall include the following information applicable for each addressable notification appliance:
a) Point ID
b) Custom Label
c) Device Type
d) Candela Setting
2) At minimum, the self-test report shall include the following information applicable for each self-test notification appliance:
a) Point ID
b) Custom Label
c) Time and Date of last test
d) Pass / Fail results of last visual test
e) Pass / Fail results of last audible test
c. The fire alarm control unit shall also be capable of providing a deficiency report that includes a list of all self-test notification appliances that have failed self-test.

8. Magnet test: When the control unit is in diagnostic mode, the appliances shall be capable of being tested with a magnet. The magnet diagnostics shall:
a. Pulse the appliance LED to indicate appliance address, and
b. briefly sound the individual horn to confirm the audible appliance operation
c. briefly flash the individual strobe to confirm visible appliance operation

1.5 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
2. Wiring diagrams from manufacturer.
3. Shop drawings showing system details including location of FACU, all devices, circuiting and details of graphic annunciator.

4. System power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate in accordance with the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, SLC, NAC, relay, sensor, and auxiliary control circuits.
6. Operating instructions for FACU.
7. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
8. Product certification signed by a certified representative of the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
9. Record of field tests of system.

B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions, if required, to make clarifications or revisions to obtain approval.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A factory authorized installer is to perform the work of this section.

B. Each and every item of the Fire Alarm System shall be listed under the appropriate category by a Nationally Recognized Testing Laboratory and shall bear the respective "NRTL" label.

1.7 MAINTENANCE SERVICE

A. Warranty Maintenance Service: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives

B. Basic Services: Routine maintenance visits on an “as needed” basis at times scheduled with the Owner. Respond to service calls within 24 hours of notification of system trouble either by customer visit or other customer contact as necessary. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.

C. Maintenance Service Contract: No later than 60 days prior to the expiration of the warranty maintenance services, deliver to the Owner a proposal to provide contract maintenance and repair services for an additional one-year term. As an option with this proposal, deliver to the Owner a proposal to provide scheduled inspection and testing services for a one-year term. Owner will be under no obligation to accept maintenance service contract proposal or inspection and testing proposal.

1.8 EXTRA MATERIALS

A. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:

1. Notification Appliances: Furnish quantity equal to 10 percent of each type and number of units installed, but not less than one of each type.
2. Smoke Detectors or Sensors, Fire Detectors, and Flame Detectors: Furnish quantity equal to 10 percent of each type and number of units installed but not less than one of each type.

3. Detector or Sensor Bases: Furnish quantity equal to 2 percent of each type and number of units installed but not less than one of each type.

PART 2 - PRODUCTS

2.1 ACCEPTABLE EQUIPMENT AND SERVICE PROVIDERS

A. Manufacturers: The equipment and service described in this specification are those supplied and supported by Tyco SimplexGrinnell and represent the base bid for the equipment.

1. Subject to compliance with the requirements of this specification, provide products by one of the following:
   a. Simplex, a Tyco Company
   b. Approved equal

B. Being listed as an acceptable Manufacturer in no way relieves obligation to provide all equipment and features in accordance with these specifications.

C. Alternate products must be submitted to the Engineer two weeks prior to bid for approval. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.

D. The equipment and service provider shall be a nationally recognized company specializing in fire alarm and detection systems. This provider shall employ factory trained and NICET Level II certified technicians, and shall maintain a service organization within 100 miles of this project location. The equipment and service provider shall have a minimum of 10 years' experience in the fire protective signaling systems industry.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Verified automatic alarm operation of smoke detectors.
6. Automatic sprinkler system water flow.
7. Heat detectors in elevator shaft and pit.
8. Fire standpipe system.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
8. Activate stairwell and elevator-shaft pressurization systems.
9. Close smoke dampers in air ducts of designated air-conditioning duct systems.
10. Recall elevators to primary or alternate recall floors.
11. Activate emergency lighting control.
12. Activate emergency shutoffs for gas and fuel supplies.
13. Record events in the system memory.
14. Record events by the system printer.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.
3. Elevator shunt-trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal AC voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer where provided.

2.3 FIRE ALARM CONTROL UNIT (FACU)

A. General: Comply with UL 864, "Control Units and Accessories for Fire Alarm Systems".

B. The following FACU hardware shall be provided:

1. Power Limited base panel with platinum cabinet and door, 120 VAC input power.
2. Capability to support up to 1,000 addressable devices and up to 254 addressable notification appliances.
3. 2000 points of annunciation where one (1) point of annunciation equals:
   a. 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
   b. 1 LED on panel or 1 switch on panel.
4. 6 Amp Power Supply minimum with temperature compensated, dual-rate battery charger capable of charging up to 110 Ah batteries without a separate external battery charger. Battery charger voltage and amperage values shall be accessible on the FACU LCD display.
5. 2 Amp Auxiliary Power output with electronic overload protection, automatic restoral, and programmable operation for four-wire detector reset operation.
6. One Auxiliary Relay with Form C contact rated for 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
7. Two (2) Class B or Class A addressable notification appliance Signaling Line Circuits (SLC; rated 3A @ 29VDC, resistive). Addressable notification SLC's shall maintain a constant 29 volts during full alarm, trouble, or standby battery operation. Up to 127 addressable notification appliances shall be supported on each SLC.
8. One (1) "simple" NAC shall be provided for 24VDC auxiliary power or to be used to power audible devices where strobe synchronization is not required.
9. Four (4) form "C" Auxiliary Relay Circuits (Form C contacts rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory of other fire response functions. Relays shall be capable of switching up to ½ A @ 120VAC, inductive.
10. Remote Unit Interface: supervised Class B (Style 4) or Class X (Style 7) signaling line circuit (SLC) for control and monitoring of remotely located annunciators and I/O panels.
11. Programmable DACT for per Point Reporting.

12. Voltage Regulator Module, 22.8 to 26.4 VDC (25 VDC nominal); isolated and resettable output; include earth detection circuit and trouble output for status monitoring.
13. Alarm Relay Module shall provide three Form C relays that are used for Alarm, Trouble, and Supervisory, rated 2 A resistive @ 32 VDC.

C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure.

2.4 ADDRESSABLE INITIATING

A. ADDRESSABLE MANUAL PULL STATIONS

1. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
2. Description: Addressable double-action type, red LEXAN. Station shall mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units. Station shall be pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit. Where double-action stations are provided, the mechanism shall require two actions push top activation door to initiate an alarm.
3. Provide with a front showing red LED showing that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the station LED shall be on steady.
4. Indoor Protective Shield: Where required, or as indicated on the drawings, provide a factory-fabricated, tamperproof, clear LEXAN enclosure shield and red frame that easily fits over manual pull stations which shall be hinged at the top to permit lifting for access to initiate a local alarm. Unit shall be NRTL listed. Lifting the cover shall actuate an integral battery-powered audible horn intended to discourage false-alarm operation. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.
5. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

B. ADDRESSABLE ANALOG SMOKE SENSORS

1. General Requirements for System Smoke Detectors:
   a. Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
   b. Factory Nameplate: Serial number and type identification.
   c. Operating Voltage: 24 VDC, nominal and shall be two-wire type.
   d. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
   e. Quick Connect Arrangement: Photoelectric sensor and electronics in a single piece construction which shall twist-lock onto a mounting base that attaches to a standard electrical box. Provide terminals in the fixed base for connection to building wiring. Sensors shall include an internal communication transmitter and receiver in the sensor having a unique identification and capability for status reporting to the FACU. Integral Addressable Module shall be arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit. Each sensor shall contain an integral visual-indicating LED that will flash to provide power-on status each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor LED shall be on steady. Sensor

and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base.

f. Each sensor base shall contain a magnetically actuated test switch to provide for easy pre-certification alarm testing at the sensor location.

g. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.

h. Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit. Provide multiple levels of detection sensitivity for each sensor.

i. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACU.

j. The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI. Removal of the sensor head for cleaning shall not require the setting of addresses.

k. Bases: CO Sensor, relay output, sounder and isolator bases shall be supported alternatives to the standard base.

2. Addressable Sensor Bases

a. Standard base - Twist lock addressable base with address selection DIP switch accessible from front with sensor removed. Integral red LED for power-on (pulsing), or alarm or trouble (steady on). Locking anti-tamper design mounts on standard outlet box.

b. Sensor Base with remote device connection - All standard base features with wired connection for either a Remote LED alarm indicator or remote relay (relay is unsupervised and requires separate 24VDC)

c. Supervised Relay Bases - All standard base features and shall be available in either a 4-Wire Sensor Base to use with remote or locally mounted relay; requires separate 24 VDC, or as a 2-Wire Sensor Base to use with remote or locally mounted relay; no separate power required. Supervised relay operation shall be programmable and shall be manually operated from control panel.

d. Sensor base with built-in electronic alarm sounder - All standard base features and piezoelectric sounder shall provide high output (88 dBA) with low current requirements (20 mA). Sounder shall be synchronized via SLC communications or by the NAC if NAC powered, sounder shall operation shall be programmable and shall be manually operated from control panel.

e. 520 Hz Sensor base with built-in electronic low frequency sounder - All standard base features and piezoelectric sounder shall provide a low frequency 520 Hz Square Wave (85 dBA) with nominal current requirements (115 mA). Sounder shall be synchronized via SLC communications or by the NAC if NAC powered, sounder operation shall be programmable and shall be manually operated from control panel.

1) Emitted tone shall be a 520Hz Square Wave signal in compliance with the requirements of the 2010 edition of NFPA 72 for sleeping areas.

2) The 520Hz Sounder base shall be listed to UL 268 and UL464, Audible Signal Appliances.

C. ADDRESSABLE DUCT SMOKE SENSOR

1. Standard Addressable Duct Smoke Sensor Unit. Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Duct housing shall include relay or relay driver as required for fan shutdown.
    a. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACU.
    b. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable independent of the sensor head for activation by other alarm initiating devices within the fire alarm system. Relay shall be mounted within 3 feet of HVAC control circuit.
    c. Duct Housing shall provide a magnetic test area and Red sensor status LED and Duct Housing shall provide a relay control Yellow LED trouble indicator.
    d. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
    e. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
    f. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
    g. Each duct smoke sensor shall be provided with a Remote Test Station with an alarm LED and test switch.
    h. Where indicated provide a NEMA 4X weatherproof duct housing enclosure that shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

D. ADDRESSABLE HEAT SENSORS

1. General Requirements for Heat Detectors: Comply with UL 521.
2. Thermal Sensor Combination type: Fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
3. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag. Selectable rate compensated, fixed temperature sensing with or without rate-of-rise operation.
4. Mounting: Twist-lock base interchangeable with smoke-sensor heads.
5. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
6. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACU for either 15-deg F or 20-deg F per minute.
7. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.
8. Unless otherwise indicated, sensors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for temperature by fire-alarm control unit.
    a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.

b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).

E. ADDRESSABLE CO SENSOR

1. Addressable CO Sensor
   a. The CO Sensor shall be an addressable carbon monoxide (CO) sensing module providing both CO toxic gas detection and enhanced fire detection, and shall be listed to UL 268, Smoke Detectors for Fire Alarm Signaling Systems and UL 2075, Gas and Vapor Detectors and Sensors; allowing systems to be listed to UL 2034, Single and Multiple Station Carbon Monoxide Alarms.
   b. The CO Sensor shall include CO sensor element mounted in the sensor base which can be easily replaced without replacing the complete sensor base assembly.
   c. The CO Sensor base shall provide address selection in the base allowing the address to remain with its location when the sensor is removed for service or type change.
   d. The CO Sensor base shall include an integral red LED to indicate the power-on, trouble, test mode or alarm status.
   e. CO sensor shall provide enhanced fire detection with the addition of two selectable modes of operation: Nuisance Alarm Reduction Mode and Faster Fire Detection.
   f. The CO Sensor shall provide a 10 year life expectancy before replacement is necessary or required.
   g. The CO Sensor base shall report the following CO Sensor troubles: Communication loss, Disabled, Almost Expired 12 Months, Almost Expired 6 Months, Expired (End of Life), and Sensor Missing/Failed.

F. ADDRESSABLE CIRCUIT INTERFACE MODULES

1. Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of AHU systems.
2. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.
3. There shall be the following types of modules:
   a. Type 1: Monitor Circuit Interface Module:
      1) For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACU.
      2) For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACU.
   b. Type 2: Line Powered Monitor Circuit Interface Module
      1) This type of module is an individually addressable module that has both its power and its communications supplied by the two wire signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACU.

2) This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.

c. Type 3: Single Address Multi-Point Interface Modules

1) This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions (normal, open, current limited, and short). The input circuits and output relay operation shall be controlled independently and disabled separately.

2) This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.

3) This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The two-wire signaling line circuit shall supply power and communications to the module.

d. Type 4: Line Powered Control Circuit Interface Module

1) This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.

4. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACU. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.5 ADDRESSABLE NOTIFICATION

A. ADDRESSABLE ALARM NOTIFICATION APPLIANCES

1. Addressable Notification Appliances: The Contractor shall furnish and install Addressable Notification Appliances and accessories to operate on compatible signaling line circuits (SLC).

a. Addressable Notification appliance operation shall provide power, supervision and separate control of horns and strobes over a single pair of wires. The controlling channel (SLC) digitally communicates with each appliance and receives a response to verify the appliance's presence on the channel. The channel provides a digital command to control appliance operation. SLC channel wiring shall be unshielded twisted pair (UTP), with a capacitance rating of less than 60pf/ft and a minimum 3 twists (turns) per foot.

b. All Notification Appliances shall operate as a completely independent device allowing for specific location alerting of both fire alarm and Mass Notification functions. Each visible device (both clear fire alarm and amber mass notification) shall be capable of operating on multiple notification zones or completely separate from all other notification devices, this allows

"On the fly" program operation changes for Mass Notification alerting and fire alarm notification.

c. All Notification Appliances shall operate as a completely independent device allowing for appliances in handicap accessible rooms and other locations to operate on the same SLC and to activate individually based on an alarm condition in a room or as part of a general alarm condition where all appliances activate together.

d. Individual Notification Appliances shall be able to be grouped into zones (or operational groups) by central programming at the main fire alarm control unit.

e. Notification Appliances shall provide for "unobtrusive" testing. Each Notification Appliance shall be tested for audible and visible operation on an individual basis at the device or from the main fire alarm control unit, allowing for minimal invasive impact.

f. Class B (Style 4) notification appliances shall be wired without requiring traditional in/out wiring methods; addressable "T" Tapping shall be permitted. Up to 127 addresses can be supported on a single channel.

g. Each Addressable notification appliance shall contain an electronic module and a selectable address setting to allow it to occupy a unique location on the channel. This on-board module shall also allow the channel to perform appliance diagnostics that assist with installation and subsequent test operations. A visible LED on each appliance shall provide verification of communications and shall flash with the appliances address setting when locally requested using a magnetic test tool.

h. Each addressable notification appliance shall have electrical test point access without removing the device cover.

i. Both wall mount and ceiling mount devices shall be available.

2. Addressable Horn: Addressable horn shall be listed to UL 464. Horn shall support Temporal Code 3, March Time (20, 60, or 120 BPM), Continuous, and Temporal Code 4 coding patterns. Horn appliances shall have a High/Low Setting, programmable by channel from the addressable controller or by appliance from the host FACU. The horn shall have a minimum sound pressure level of 83 or 89 dBA for steady) or of 79 or 85 dBA for coded operation. The horn device shall consist of three pieces; appliance, cover and mounting plate. For ease of installation the mounting plate shall mount directly to a standard single gang, double gang or 4" square electrical box, without the use of special adapter or trim rings. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control unit. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot.

3. Addressable Visible/Only: Addressable strobe shall be listed to UL 1971. The V/O device shall consist of a xenon flash tube and associated lens/reflector system, cover and mounting plate. For ease of installation the mounting plate shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control unit. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The V/O appliance shall be provided with multiple minimum flash intensities of 15cd, 30cd, 75cd, 110cd, 135cd and 185cd. The Candela levels shall be settable from the fire alarm control unit or by using a hardware selector on the appliance.

4. Addressable Audible/Visible: Addressable combination Audible/Visible (A/V) Notification Appliances shall be listed to UL 1971 and UL 464. The strobe device shall consist of a xenon flash tube and associated lens/reflector system, cover and mounting plate. For ease of installation audible/visible mounting plate shall mount directly to standard single gang, double gang or 4" square electrical box, without

the use of special adapters or trim rings. The strobe shall provide multiple minimum flash intensities of 15cd, 30cd, 75cd, 110cd, 135cd and 185cd. The Candela levels shall be settable from the fire alarm control unit or using a hardware selector on the appliance. The Horn shall support Temporal Code 3, March Time (20, 60, or 120 BPM), Continuous, and Temporal Code 4 coding patterns. The horn shall have a minimum sound pressure level of 83 or 89 dBA for steady or 79 or 85 dBA for coded operation. When the appliance is connected to an active circuit, the front cover of the appliance shall be removable without causing a trouble indication on the fire alarm control unit. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. The appliance shall be capable of two-wire synchronization with one of the following options:

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.

B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:

1. Factory trained and certified personnel.
2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
3. Personnel licensed or certified by state or local authority.

3.2 EQUIPMENT INSTALLATION

A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, Ethernet drops, and all other necessary material for a complete operating system.

B. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.

C. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

D. Install manual station with operating handle 48 inches (1.22 m) above floor. Install wall mounted audible and visual notification appliances not less than 80 inches (2.03 m) above floor to bottom of lens and not greater than 96 inches (2.44 m) above floor to bottom of lens.

E. Mount outlet box for electric door holder to withstand 80 pounds pulling force.

F. Make conduit and wiring connections to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control units, duct smoke detectors.

G. Automatic Detector Installation: Conform to NFPA 72.

H. Ethernet Drop: A standard RJ-45 Ethernet connection to the owner’s Ethernet network shall be provided at each fire alarm control unit as part of the contract.

3.3 CONNECTIONS

A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Smoke dampers in air ducts of designated air-conditioning duct systems.
2. Supervisory connections at valve supervisory switches.
3. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
4. Supervisory connections at elevator shunt trip breaker.

3.4 WIRING INSTALLATION

A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).

B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.6 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:

1. Factory trained and certified.
2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
3. International Municipal Signal Association (IMSA) fire alarm certified.
4. Certified by a state or local authority.
5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.

C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

D. Inspection:

1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.

E. Acceptance Operational Tests:

1. Perform operational system tests to verify conformance with specifications:
    a. Each alarm initiating device installed shall be operationally tested. Each device shall be tested for alarm and trouble conditions. Contractor shall submit a written certification that the Fire Alarm System installation is complete including all punch-list items. Test battery operated emergency power supply. Test emergency power supply to minimum durations specified. Test Supervising Station Signal Transmitter. Coordinate testing with Supervising Station monitoring firm/entity.
    b. Test each Notification Appliance installed for proper operation. Submit written report indicating sound pressure levels at specified distances.
    c. Test Fire Alarm Control Unit and Remote Annunciator.
2. Provide minimum 10 days notice of acceptance test performance schedule to Owner, and local Authority Having Jurisdiction.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Use NFPA 72 Forms for documentation.

H. Final Test, Record of Completion, and Certificate of Occupancy:

1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy. Provide completed NFPA 72 Record of Completion form to Owner and AHJ.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

3.9 TRAINING

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.

1. Schedule training with the Owner at least seven days in advance.

END OF SECTION 28 31 11

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Remove surface debris.

B. Clear site of plant life and grass.

C. Remove trees and shrubs.

D. Remove root system of trees and shrubs.

1.02 RELATED SECTIONS

A. Section 31 23 16 - Excavation.

B. Section 32 93 00 - Plants.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable code for disposal of debris.

B. Coordinate clearing Work with utility companies.

C. Obtain Necessary Permits.

PART 2 PRODUCTS

2.01 FILTER FABRIC FOR SILT FENCE

A. Mirafi 100x.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that existing vegetation, trees to be retained, features, and clearing limits are tagged and identified. Do not use spray paint.

B. Coordinate and locate areas with Owner and Architect.

3.02 TEMPORARY EROSION CONTROL PLAN

A. Install silt fence or straw bales to intercept all runoff which passes through the construction site prior to starting clear/grub or earthwork operations.

B. Install storm water control and collection system as soon as possible.

C. Inspect temporary erosion control system after each heavy rainfall. Clean accumulated

material from catch basins and behind silt fences or straw bales. Repair all damage.

D. Complete earthwork as soon as possible after ground has been disturbed. Install paving gravel or plant vegetation as soon as weather permits.

E. Siltation control is the Contractor's responsibility. Any additional siltation control measures required to control siltation shall be provided without additional cost to the owner.

3.03 CLEARING

A. Clear areas required for access to site and execution or fill of Work.

B. Remove trees and shrubs within marked areas. Remove stumps and main root ball.

C. Clear undergrowth and deadwood.

D. Rake site clean with dozer.

3.04 REMOVAL

A. Remove debris, rock, and extracted vegetation from site.

3.05 BURNING

A. Obtain all permits required for burning vegetation.

B. Do not burn tires, plastics, asphaltic materials, etc.

C. Persons contracted to perform burning are solely responsible for fire control.

END OF SECTION

SECTION 31 22 13

ROUGH GRADING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Remove topsoil and stockpile for later reuse.

B. Grade and rough contour site.

C. Rock Removal.

1.02 RELATED WORK

A. Section 31 22 19 - Finish Grading: Finish grading with topsoil to contours.

B. Section 31 23 16 - Excavation: Building excavation.

C. Section 31 23 23.13 - Backfill: Building and site backfilling.

D. Section 31 23 16.13 - Trenching: Trenching and backfilling for utilities.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: Excavated material, graded and screened free of roots, rocks larger than three inches, subsoil, debris, and weeds. Topsoil to be reused must meet imported topsoil standards as specified in Section 31 22 19 – Finish Grading.

B. Subsoil: Excavated material, graded free of lumps larger than 6 inches, rocks larger than 3 inches, and debris.

PART 3 EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Identify known below grade utilities. Stake and flag locations.

C. Identify and flag above grade utilities.

D. Maintain and protect existing utilities remaining which pass through work area.

E. Notify utility company to locate and or relocate utilities.

F. Upon discovery of unknown utility or concealed conditions, discontinue affected work; notify Architect, Owner and utility company.

3.02 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, re-landscaped, or regraded. Stockpile in area designated on site. Remove excess topsoil not being reused from site.

B. Stockpile topsoil. Cover to protect from erosion.

3.03 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be re-landscaped or regraded and remove excess subsoil not being reused from site.

B. Stockpile subsoil and protect from erosion.

3.04 ROCK REMOVAL

A. Remove and dispose of oversize rocks not kept for landscaping purposes.

END OF SECTION

SECTION 31 22 19

FINISH GRADING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Finish grade subsoil and proof roll.

B. Place, level, and compact topsoil.

C. Rockeries

1.02 RELATED WORK

A. Section 01 33 26 – Source Quality Control Reporting: Compaction requirements of backfill.

B. Section 31 22 13 - Rough Grading: Subsoil contouring.

C. Section 31 23 23.13 - Backfill: Backfilling and compacting fill.

D. Section 31 23 16.13 - Trenching: Excavation, backfill, and compacting fill in trenches.

E. Section 32 12 16.13 – Plant Mixed Asphalt Paving: Paving grade.

F. Section 32 93 00 - Plants: Topsoil fill for trees, plants, and ground cover.

PART 2 PRODUCTS

2.01 MATERIALS

A. Existing topsoil shall be used. If insufficient, use Topsoil Imported: friable loam; free of subsoil, roots, grass, excessive amount of weeds, stone, and foreign matter; acidity range (pH) of 6 to 7; containing a minimum of 4 percent and a maximum of 25 percent organic matter.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify site conditions and note irregularities affecting work of this Section (Finish grades must be approved by landscape architect prior to any planting or sodding).

B. Beginning work of this Section means acceptance of existing conditions.

3.02 SUBSOIL PREPARATION

A. Eliminate uneven areas and low spots, so that there is no “ponding”. Remove debris, roots, branches, stones, in excess of 1 inch in size. Remove subsoil contaminated with petroleum products.

B. Scarify subgrade to depth of 3 inches where topsoil is scheduled. Scarify in

areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.03 PLACING TOPSOIL

A. Place topsoil in areas where sodding, and planting is scheduled.

B. Use topsoil in relatively dry state. Place during dry weather.

C. Fine grade topsoil eliminating rough or low areas. Maintain levels, profiles, and contours of subgrade.

D. Remove stone, roots, grass, weeds, debris, and foreign material while spreading.

E. Manually spread topsoil around trees, plants and buildings to prevent damage.

F. Roll placed topsoil.

G. Remove surplus subsoil and topsoil from site.

H. Leave stock pile area and site clean and raked, ready to receive landscaping.

3.04 TOLERANCES

A. Top of Topsoil: Plus or minus 1 inch. In sodded areas, finish grade 1/2" below walks, curbs, and other mowing edges.

3.05 SCHEDULE OF LOCATIONS

A. The following paragraphs identify compacted topsoil thicknesses for various locations.

1. Sod: 4 inches.

2. Shrub Beds: 6 inches.

3. Seasonal flower Beds: 8 inches.

4. Seed: 4 inches.

END OF SECTION

SECTION 31 23 16

EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavation for building foundations.

B. Excavation for slabs-on-grade and paving.

C. Excavation for site structures.

1.02 RELATED SECTIONS

A. Section 01 33 26 – Source Quality Control Reporting: Inspection of bearing surfaces.

B. Section 31 22 13 - Rough Grading: Topsoil, subsoil and rock removal from site surface.

C. Section 31 23 23.13 - Backfill.

D. Section 31 23 16.13 - Trenching: Excavation for utility trenches.

1.03 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 EXCAVATION

A. Underpin adjacent structures to remain which may be damaged by excavation work, including buildings, utilities, signage, trees and pipe chases.

B. Excavate subsoil required to accommodate building foundations, slabs-on-grade, paving, site structures, and construction operations.

C. Machine slope banks as specified by soils engineer.

D. Excavation cut not to interfere with normal 45 degree bearing splay of foundation of adjacent structures.

E. Grade top perimeter of excavation to prevent surface water from draining into excavation.

F. Hand trim excavation. Remove loose matter.

G. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume.

H. Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

I. Correct unauthorized excavation at no extra cost to Owner.

J. Correct areas over-excavated by error as directed by Architect/Engineer and at no extra cost to owner.

K. Stockpile excavated material in area designated on site and remove excess material not being reused, from site.

3.02 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01 33 26.

B. Provide for visual inspection by soils engineer and architect of bearing surfaces and cut slopes.

3.03 PROTECTION

A. Protect excavations and soils by methods required (i.e. visqueen, etc.) to prevent cave-in, erosion or loose soil from falling into excavation.

B. Protect bottom of excavations and soil adjacent to and beneath foundation, from freezing.

C. Protect open excavations left unattended and left open for any period of time.

D. Ensure that proper care and safety measures are in place.

3.04 FIELD QUALITY CONTROL

A. Provide for inspection of bearing surfaces under provisions of Section 01 33 26.

END OF SECTION

SECTION 31 23 17

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavate trenches for utilities from buildings to municipal utilities.

B. Compacted bedding under fill over utilities to subgrade elevations.

C. Excavation for footings.

D. Backfilling and compaction requirements.

1.02 RELATED SECTIONS

A. Section 01 33 26 – Source Quality Control Reporting: Testing fill compaction.

B. Section 31 22 13 - Rough Grading: Topsoil, subsoil and rock removal from site surface.

C. Section 31 22 19 - Finish Grading: Filling of topsoil over backfilled trenches to finish grade elevation.

D. Section 31 23 16 - Excavation: General building excavation.

E. Section 31 23 23.13 - Backfill: General backfilling.

F. Section 33 00 00 - Utilities: Water, power, cable and phone.

G. Section 33 40 00 - Storm Drainage Utilities: Building perimeter tile drainage, filter aggregate filter fabric, granular cover and connecting to storm drainage utility.

H. Section 33 30 00 - Sanitary Sewerage Utilities: Sewer piping from buildings to municipal sewer.

1.03 TESTS

A. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D1557 under provisions of Section 01 33 26.

1.04 PROTECTION

A. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation. Contractor responsible for all construction safety means and practices for on-site personnel and equipment.

B. Underpin adjacent structures which may be damaged by excavation work, including service utilities, pipe chases, roadways, signage, etc.

C. Notify Architect/Engineer of unexpected subsurface conditions and discontinue work in affected area until notification to resume work.

D. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

E. Grade excavation top perimeter to prevent surface water run-off into excavation.

1.05 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the Work are as shown on Drawings. Notify Architect/Engineer if disturbed.

PART 2 PRODUCTS

2.01 SELECT BED AND FILL MATERIALS

A. Types as specified in Section 31 23 23.13 - Backfill.

Type A- Gravel, Pit Run
Type B- Pea Gravel, Washed Type C- Sand
Type D- Bedding Material

2.02 COMMON FILL MATERIALS

A. Subsoil: Native Material used for fill must be approved by the Soils Engineer.

PART 3 EXECUTION

3.01 EXCAVATION

A. Excavate subsoil required for storms sewer, sanitary sewer, water, and electrical conduits to municipal and private utilities.

B. Cut trenches sufficiently wide to enable installation of utilities and allow inspection.

C. Excavation shall not interfere with normal 45 degree bearing splay of foundations.

D. Hand trim excavation. Remove loose matter.

E. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd, measured by volume.

F. Correct unauthorized excavation at no cost to Owner.

G. Fill over-excavated areas with Type A fill and compact to 95 percent.

3.02 BEDDING

A. Support pipe and conduit during placement and compaction of bedding fill.

3.03 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01 51 00.

B. Recompact fills subjected to vehicular traffic as required by soils engineer.

END OF SECTION

SECTION 31 23 23

BACKFILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building perimeter and site structure backfilling to subgrade elevations.

B. Site filling and backfilling.

C. Fill under slabs-on-grade and paving.

D. Consolidation and compaction.

E. Fill for over-excavation.

1.02 RELATED SECTIONS

A. Section 01 33 26 – Source Quality Control Reporting: Testing Fill compaction.

B. Section 31 22 19 - Finish Grading: Filling of topsoil to finish grade elevation.

C. Section 31 23 16 - Excavation.

D. Section 31 23 16.13 - Trenching: Backfilling of utility trenches.

E. Section 33 40 00 – Storm Drainage Utilities: Filter aggregate and filter fabric over building perimeter tile drainage.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 23.

B. Samples: Submit sample in size required of each type of fill to testing laboratory, in air-tight containers, when required by governmental agency or soils engineer.

1.04 REGULATORY REQUIREMENTS

A. Construct all work on private drives in accordance w/ Washington Public Works Standards and the Requirements of Spokane County Public Works.

PART 2 PRODUCTS

2.01 SELECT FILL MATERIALS

A. Type A - Gravel: Pit run; free of shale, clay, friable material, sand, debris; graded in accordance with ANSI/ASTM C136 within the following limits (per soils report):

Sieve Size	Percent Passing
6 inches	100
No. 200	10 maximum

B. Type B - Pea Gravel: washed, free of clay, shale, organic matter; 1/2 inch minimum to 3/4 inch

maximum size; graded in accordance with ANSI/ASTM C136. (see soils report)

C. Type C - Sand: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, or organic matter; graded in accordance with ANSI/ASTM C136 within the following limits (see soils report):

Sieve Size	Percent Passing
No. 4	100
No. 14	10 to 100
No. 50	5 to 90
No. 100	4 to 30
No. 200	0 TO 10

D. Type D - Blended Material: Sand and small gravel or crushed rock. All material shall be clean and free of organic material; graded in accordance with ANSI/ATSM C136 with the following limits (see soils report):

Sieve Size	Percent Passing
3/4"	100
3/8"	95-100
No. 8	0-10
No. 200	0-8

2.02 COMMON FILL MATERIALS

A. Subsoil: Native material used for fill must be approved by the Architect/Soils Engineer. (see soils report)

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify stockpile fill materials to be reused are acceptable and approved by Soils Engineer and applicable utility companies.

B. Verify foundation perimeter drainage installation has been inspected.

C. Verify areas to be backfilled are free of debris, snow ice, water and ground surfaces are not frozen.

3.02 PREPARATION

A. Generally, compact subgrade to density requirements for subsequent backfill materials.

B. Cut out soft areas of subgrade not capable of suitable compaction. Backfill with Type A fill or suitable structural fill and compact to density equal to or greater than requirements for subsequent backfill material.

C. Prior to placement of aggregate base course material at paved areas, compact subsoil to 95 percent of its maximum dry density in accordance with ANSI/ASTM D698.

3.03 BACKFILLING

A. Perform all work in accordance with soils report, and recommendations by Soils Engineer.

B. Backfill areas to contours and elevations with unfrozen materials.

C. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or unsuitable subgrade surfaces.

D. Place and compact select fill materials in continuous layer not exceeding 8 inches loose depth, or as specified by soils engineer to reach specified compaction requirements.

E. Place and compact common fill materials in continuous layers not exceeding 12 inches loose depth, or as specified by soils engineer to reach specified compaction requirements.

F. Employ a placement method that does not disturb or damage foundation perimeter drainage, foundation dampproofing, foundation waterproofing and utilities in trenches.

G. Maintain optimum moisture content of backfill materials to attain required compaction density.

H. Backfill against supported foundation walls.

I. Backfill simultaneously and equally on each side of unsupported foundation walls.

J. Slope grade away from building minimum 2 inches in 10 ft (2%), unless noted otherwise.

K. Make changes in grade gradual. Blend slopes into level areas.

L. Remove surplus backfill materials from site.

M. Leave fill material stockpile areas completely free of excess fill materials.

3.04 COMPACTION REQUIREMENTS

A. Compact all backfill to 95 percent of ASTM D698 or as specified by soils engineer.

3.05 TOLERANCES

A. Top Surface of Backfilling: Plus or minus one inch from required elevations.

3.06 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 3326.

B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D698 and with Section 01400.

C. Compaction testing will be performed in accordance with ANSI/ATSM D698 and with Section 01 33 26.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner until accepted compaction is achieved.

3.07 PROTECTION OF FINISHED WORK

A. Protect finished work under provisions of Section 01 51 00.

B. Recompact fills subjected to vehicular traffic as required by soils engineer.

.

END OF SECTION

SECTION 32 12 16

PLANT-MIX ASPHALT PAVING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Asphalt paving.

B. Base Course; pit run subbase as necessary.

C. Soil Sterilizing.

D. Painted Pavement Marking.

1.02 RELATED WORK

A. Section 31 22 13 - Rough Grading: Preparation of site for paving.

B. Section 31 23 23.13 - Backfill: Compacted fill for paving.

C. Section 32 13 00 - Site Concrete Paving: Paving.

D. Section 33 40 00 - Storm Drainage Utilities: Manholes and Catch Basins.

1.03 QUALITY ASSURANCE

A. Perform work in accordance with design procedures and general specifications on asphalt paving bulletin #3-1971 published by the Asphalt Paving Association of Washington, Inc.

1.04 REGULATORY REQUIREMENTS

A. Conform to Local Governing Design Standard and Specifications for paving work on public property.

B. Work on public and private property - obtain all permits and required inspections; pay all fees.

C. Construct all work on private drives in accordance with Washington Public Works Standard and Requirements of Spokane County Public Works.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when base surface temperature is less than 40 degrees F, nor during fog, rain, or other unsuitable conditions.

1.06 WARRANTY

A. Repair any areas that settle or break up within one (1) year of acceptance without cost to owner, under provisions of Section 01 77 19.

PART 2 PRODUCTS

2.01 MATERIALS

A. Primer: Homogeneous medium curing liquid asphalt.

B. Tack Coat: Emulsified Asphalt.

C. Asphalt Cement: ASTM D946.

D. Ballast for Road Stabilization and Maintenance is to consist of crushed, partially crushed, or naturally-occurring granular material.

Required Gradation:

U.S. STANDARD SIEVE SIZE	PERCENT PASSING BY WEIGHT
2-1/2”	100
2”	65-100
1”	50-80
1/4”	30-50
No. 40	16 max.
No. 200	9.0 max.

E. Sub-Base is to consist of crushed rock free from wood, roots, and other extraneous materials.

Required Gradation:

U.S. STANDARD SIEVE SIZE	PERCENT PASSING BY WEIGHT
1-1/4”	100
5/8”	50-80
1/4”	30-50
No. 40	3-18
No. 200	7.5 max.

F. Asphalt paving to be free from wood, roots, and other extraneous material.

Required Gradation:

U.S. STANDARD SIEVE SIZE	PERCENT PASSING BY WEIGHT
5/8”	100
1/2”	90-100
3/8”	75-90
1/4”	55-75
No. 10	32-48
No. 40	11-24
No. 80	6-15
No. 200	3-7
Mineral Filler	0-2
Asphalt % of total mixture	4.0-7.5

G. Mineral Filler: Finely ground particles of limestone, hydrated lime, or other approved mineral dust, free of foreign matter.

H. Traffic Paint. Color for all parking stall striping and symbols shall be white. Fire lane striping and lettering shall be yellow and/or red at locations as directed by fire Dept.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify compacted granular base in dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

C. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

A. Apply specified sterilizer over entire area to be paved.

B. Apply primer in accordance with manufacturer's instructions.

C. Use clean sand to blot excess primer.

D. Apply primer to contact surfaces of curbs and gutters.

E. Coat surfaces of manhole catch basin frames with oil to prevent bond with asphalt paving.

F. Thoroughly clean areas where striping will be applied and locate all striping and symbols where indicated on drawings.

3.03 PLACING ASPHALT PAVEMENT

A. Place binder course within 24 hours of priming base surfaces.

B. Place each course to compacted thickness identified in schedule at end of Section.

C. Place topping course within two hours of placing and compacting binder course.

D. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

E. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.04 CURBS

A. Provide extruded concrete curbs as detailed on Drawings.

3.05 PAINTING

A. Numbers, strips, symbols, etc. shall be white unless otherwise noted.

B. Use minimum 2" strip for lines between stalls. Verify minimum width and length of stalls.

C. Paint all symbols as noted on the plans and required by local authorities, including fire lane striping.

3.06 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Compacted Scheduled Thickness: Within 1/4 inch of design thickness.

C. Verify that all pavement slopes to drain. Correct any areas that do not drain.

3.07 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01 33 26.

3.08 PROTECTION

A. Immediately after placement, protect pavement under provisions of Section 01 51 00 from mechanical injury for 2 days.

3.09 SCHEDULE

		Asphalt - Paving Thickness	Sub Base Thickness
A.	Parking areas	Per Plans	Per Plans
B.	On-Site Drives	Per Plans	Per Plans

C. Public Roads per off street per off street drawing details drawing details.

D. Refer to pavement recommendations in soils report.

.

END OF SECTION

SECTION 32 13 00

SITE CONCRETE PAVING

PART 1 GENERAL

1.01 WORK INCLUDED

A. On & off site concrete sidewalks, steps, curbs, and gutters.

B. Patios.

C. Pool Deck(s).

D. Reinforcement.

E. Surface finish.

F. Curing.

1.02 RELATED WORK

A. Section 31 22 13 - Rough Grading: Preparation of site for paving.

B. Section 31 23 23.13 - Backfill: Compacted fill for paving.

C. Section 32 12 16.13 – Plant-Mix Asphalt Paving: Paving.

D. Section 33 40 00 - Storm Drainage Utilities: Manholes.

E. Section 33 30 00 - Sanitary Sewage Utilities: Manholes, and catch basins.

1.03 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Obtain materials from same source throughout.

1.04 REGULATORY REQUIREMENTS

A. Conform with all applicable sections of Local Governing Authority Design Standards and Specifications for all work on public property.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C150 Air Entraining - Type IIIA, Portland type.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: potable.

2.02 FORM MATERIALS

A. Conform to ACI 301.

2.03 REINFORCEMENT

A. Reinforcing Steel: ASTM A615; 40 ksi yield grade; deformed billet steel bars, uncoated finish.

B. Welded Steel Wire Fabric: Plain type, ANSI/ASTM A185; in flat sheets; uncoated finish.

C. Tie Wire: Annealed steel, minimum 16 gauge size.

D. Dowels: ASTM A615; 40 ksi yield grade, plain steel, uncoated finish.

2.04 ACCESSORIES

A. Liquid Surface Sealer: Industrial Concrete Sealer.

B. Preformed Joint: Asphalt Impregnated Expansion Joint.

2.05 ADMIXTURES

A. Air Entrainment: ASTM C260. 4 1/2% to 6 1/2%

B. Chemical Admixture: ASTM C494 use in appropriate conditions.

2.06 CONCRETE MIX

A. Mix concrete in accordance with ASTM C94.

B. Mix concrete to proportions as shown on plans.

C. Provide concrete for each of the following characteristics:

1. Compressive Strength at 28 days: 3,000 psi unless otherwise specified.

D. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.

E. Use set-retarding admixtures during hot weather only when approved by Architect/Engineer.

F. Add air entraining agent to concrete mix for concrete work exposed to weather.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify compacted subgrade is ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Moisten base and forms to minimize absorption of water from fresh concrete.

3.03 FORMING

A. Place and secure forms adequately to correct location, dimension, and profile.

B. Assemble form work to permit easy stripping and dismantling without damaging concrete.

C. Place joint fillers vertical in position, in straight lines. Secure to form work during concrete placement.

3.04 REINFORCEMENT

A. Place reinforcement at mid-height of slabs-on-grade or as otherwise shown on drawing.

B. Interrupt reinforcement at control joints.

C. Provide dowelled joints at interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement.

D. Verify all clearances and maintain all coverages as outlined on drawing and structural notes.

3.05 FORMED JOINTS

A. Place control joints at 5 foot intervals to correct elevation and profile. Align curb, gutter, and sidewalk joints.

B. Place joint filler between paving components and building or other appurtenances.

3.06 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.

B. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.

C. Place concrete continuously between predetermined construction joints.

3.07 FINISHING

A. Concrete Areas calling for exposed aggregate finishes shall be 3/8" pea gravel finish. No pocketing or kicking out of pebbles will be allowed.

B. Sidewalk Paving and Patios: Light broom, radiused and trowel joint edges.

C. Curbs and Gutters: Light broom.

D. Cabana Pool Deck Area: broom finish.

E. All other areas as shown on Drawings.

3.08 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01 33 26.

3.09 PROTECTION

A. Immediately after placement, protect concrete under provisions of Section 01 51 00 from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION

SECTION 32 31 00

FENCES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Pool fences.

B. Screening fences.

1.02 RELATED SECTIONS

A. -

1.03 SYSTEM DESCRIPTION

A. Provide all equipment and materials necessary for a complete installation approved by Architect/Owner.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Perimeter Fence: Design and materials as shown on Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fences as to conditions and materials detailed and shown on Drawings.

3.02 SCHEDULE

A. For additional information refer to Drawings.

END OF SECTION

SECTION 32 92 00

TURF AND GRASSES

PART 1 GENERAL

1.01 WORK INCLUDED (Replace existing as required by Site Demolition)

A. Preparation of subsoil.

B. Placing topsoil.

C. Fertilizing.

D. Sod installation.

E. Seeding.

F. Mulching.

1.02 RELATED WORK

A. Section 31 22 19 - Finish Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this Section.

B. Section 32 84 00 – Planting Irrigation: Underground sprinkler system (existing to remain)

C. Section 32 93 00 - Plants.

1.03 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perrenial Sorrel, and Brome Grass.

1.04 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.05 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

B. Sod Producer: Company specializing in sod production and harvesting with minimum five years experience, and certified by the State of Washington.

C. Installer: Company approved by the sod producer.

D. Sod: Minimum age of 18 months, with root development that will support its own weight, without tearing, when suspended vertically by holding the upper two corners.

E. Submit sod certification for grass species and location of sod source.

1.06 TESTS

A. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01 66 00.

B. Store and protect products under provisions of Section 01 66 00.

C. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

D. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

E. Deliver sod on pallets in rolls. Protect exposed roots from dehydration.

F. Do not deliver more sod than can be laid within 48 hours.

1.08 WARRANTIES

A. Provide a warranty on work of this Section for a minimum of one year from date of final completion.

1.09 MAINTENANCE SERVICE

A. Maintain seeded areas until Final Completion Date.

PART 2 PRODUCTS

2.01 SEED MIXTURE

A. Seed Mixture is the following, or as indicated by Owner/Architect:

1. Merion Blue Grass: 10 percent max.
2. Kentucky Blue Grass: 10 percent max.
3. Creeping Red Fescue Grass: 40 percent max.
4. Streambark Wheat: 0 percent.
5. Red Top: 5 percent max.
6. Norlea Perennial Rye: 10 percent.
7. Clover: 0 percent.
8. Chewings Fescue: 40 percent max.

B. Sod: ASPA Certified Nursery grown grade; cultivated grass sod; type indicated in plant schedule on Drawings with strong fibrous root system, free of stones, burned or bare spots; containing no more than 5 weeds per 1000 square feet.

2.02 ACCESSORIES

A. Mulching Material: Hemlock or Firs species wood cellulose fiber, dust form, free of growth or germination inhibiting ingredients.

B. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

C. Erosion Fabric: Jute matting, open weave.

D. Herbicide: As required for minimum adequate control of affected site with material acceptable to D.O.E.

E. Stakes: Softwood lumber, chisel pointed.

F. String: Inorganic fiber.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify that prepared soil base and topsoil is ready to receive the work of this Section.

B. Beginning of installation means acceptance of existing site conditions.

3.02 PREPARATION OF SUBSOIL

A. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds, and undesirable plants and their roots. Remove contaminated subsoil.

3.03 PLACING TOPSOIL

A. Place topsoil during dry weather and on dry unfrozen subgrade.

B. Remove vegetable matter and foreign non-organic material while spreading.

C. Grade to eliminate rough, low, or soft areas, and to ensure positive drainage.

3.04 Hydroseeding

A. Apply hydroseed in accordance with manufacturer's instructions.

B. Planting Season: Weather permitting per local conditions, as determined by Architect/Owner.

3.05 LAYING SOD

A. Lay in accordance with producer instruction.

END OF SECTION

SECTION 32 93 00

PLANTS

PART 1 GENERAL

Replace to match existing with new as required by site demolition.

END OF SECTION

SECTION 33 00 00

UTILITIES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Domestic Water.

B. Fire Line Service and Hydrants.

C. Electrical Power.

D. Telephone.

E. Cable T.V.

F. Sanitary Sewer.

G. Storm Sewer and Drainage.

H. Natural Gas.

1.02 RELATED WORK

A. Section 31 23 16 - Excavation.

B. Section 31 23 23.13 - Backfill: Backfilling and compacting fill.

C. Section 31 23 16.13 - Trenching: Trenching for utilities.

D. Section 33 40 00 - Storm Drainage Utilities.

E. Section 33 30 00 - Sanitary Sewage Utilities.

1.03 SUBMITTALS

A. Submit project record documents under provisions of Section 01 77 19.

1.04 REGULATORY REQUIREMENTS

A. Comply with all local, state and federal codes regarding the installation of work of this section.

1.05 WARRANTY

A. Provide warranties for all work included in this section under provisions of general condition of the contract.

1.06 PERMITS

A. Water: Contractor shall notify owner of connection and water meter fees. Owner will pay for these fees.

B. Plumbing: Owner shall pay for all plumbing permits.

C. Sanitary/Storm Sewer: Owner shall pay for all sanitary/storm sewer permits and

connection fees.

D. Electrical Power: Contractor shall notify Owner of all connection fees and permits for site work of electrical utility. Owner will pay for these fees.

E. Electrical: Owner shall research and pay for all electrical permits for buildings.

F. Telephone: Owner shall pay for all telephone permit fees.

1.07 SYSTEM DESCRIPTION

A. Domestic water: Provide and install all trenching, piping, valves and structures necessary to form a complete domestic water system. Contractor shall provide and install water meter(s) sized to provide adequate water service to the building fixtures as shown. Stub supply lines to within 5'-0" from building exterior. Contractor shall coordinate and verify the location of water meters with the governing utility prior to installation. Contractor shall include all demolition, restoration, boring, etc. required to form a complete system.

B. Fire line service and hydrants: Provide and install all trenching, piping, valves, hydrants and other related items necessary to form a complete approved fire line services system as illustrated on the Drawings, as specified herein and as required to meet local, state, and federal standards, specifications and requirements. Verify location of existing water lines prior to submitting bid and shall include all demolition, restoration, boring, etc. as required. Fire line to building is to be stubbed up in riser room.

C. Power: The Contractor shall arrange and coordinate the power service with Local Provider.

1. The Contractor shall verify location of transformers and meters with Local Provider. The Contractor shall provide all trenching, conduit, structures including power vaults, transformer pads and guard posts as required to form a complete system. The work shall include all demolition, restoration, borings, etc. as required.

2. The Owner shall pay for all standard connection charges and permit fees.

D. Telephone:

1. Exterior: Provide and install all trenching, conduit and structures including pole risers, pull boxes, and handholds required to provide telephone service to each building. Contractor shall coordinate and verify the location of all conduit and structures with the governing utility company and architect prior to installation. Contractor shall include all demolition, restoration, boring, etc. required to form a complete system.

2. Interior: Installed by General Contractor with pull line as approved by the telephone company. Provide a 4' x 4' sheet of plywood for telephone equipment in locations to be determined by Architect/Owner. Verify locations of telephone equipment boards with Architect/Owner prior to installation. Contractor shall be responsible for arranging and coordinating telephone pre-wiring of building by Telephone Company.

E. Cable T.V.: The Contractor shall arrange and coordinate cable service with local cable service. Contractor shall provide all trenching, conduit and related items necessary for a complete installation. Verify location of cable control boxes, with Architect/Owner prior to installation.. Refer to Drawings for location of cable

outlets in units.

F. Sanitary Sewer: Contractor shall provide all trenching, piping, structures, etc. necessary to form a complete approved sanitary sewer system. Contractor shall include all demolition, restoration, boring, etc. as required. Stub side sewers to within 5'-0" from building exterior. Provide clean out where side sewer meets building. The Owner shall pay for all standard connection and permit fees.

G. Storm Sewer and Drainage: Contractor shall supply and install all trenching, piping, structures, etc. necessary to form a complete approved storm water collection and retention system. Contractor shall include all demolition, restoration, boring etc. as required. Downspouts shall be tied into storm water system with tight lines as shown on Civil Drawings.

H. Natural Gas: Contractor shall supply and install all trenching, piping, structures, etc. necessary to form a complete approved natural gas system. Locations as shown on the civil and mechanical plans.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all work in accordance with local, state and federal codes.

B. Coordinate installation with the local governing utility, or agency or service.

C. The Contractor shall take suitable care of all public utilities and municipal services encountered in connection with the work. He shall send notices, make all necessary arrangements and provide all services required for the care of gas mains, water pipes, sanitary and storm pipes, telephones and telegraph conduits, cables and other equipment of property, assuming all responsibility and paying all costs for which the Owner may be liable.

D. The Contractor shall examine the site and consult all the public service companies and municipal records to fully inform himself of the locations and extent of all utilities.

E. Any indications of dimensions on the Drawings showing elevations of locations of pipes, manholes, poles, etc. are taken from the most reliable information available but the Contractor shall assume full responsibility for checking the correctness of this information. Service for adjoining buildings shall be maintained without interruption until other or new services are provided.

F. Contractor responsible to notify "Call Before You Dig" organization prior to excavation or trenching.

END OF SECTION

SECTION 33 31 00

SANITARY SEWERAGE UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary drainage piping, fittings, and accessories.

B. Connection of buildings sanitary drainage systems to municipal sewers.

C. Manhole access, and cleanout access.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 03 11 13 – Structural Cast In Place Concrete Forming: Installation of pipe sleeves for placement in concrete foundation walls.

1.03 RELATED SECTIONS

A. Section 31 23 23.13 - Backfill: Backfilling over piping up to subgrade elevation.

B. Section 31 23 16.13 - Trenching: Excavating subsoil for sewer system piping.

C. Section 33 40 00 - Storm Drainage Utilities.

D. Section 03 11 13 – Structural Cast In Place Concrete Forming: Sleeved concrete work for storm drainage piping.

E. Section 03 31 13 – Heavyweight Structural Concrete: Concrete type for manhole base pad construction.

1.04 REGULATORY REQUIREMENTS

A. Conform to Local Authority Design Standards and Specifications for materials and installation of the Work of this Section.

B. Construct all work on private drives in accordance with Washington Public Works Standards and the Requirements of Spokane City Public works.

1.05 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Section 01 77 19.

B. Accurately record location of pipe runs, connections, manholes, cleanouts, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Plastic Pipe: ANSI/ASTM D3033, Type PSP, polyvinyl chloride (PVC) material; bell and spigot style solvent sealed end joints.

B. Plastic Pipe: ANSI/ASTM D3034, type PSM, polyvinyl chloride (PVC) material; bell and spigot style solvent sealed end joints.

2.02 PIPE ACCESSORIES

A. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required 'T', bends, elbows, cleanouts, reducers, traps, and other configurations required.

2.03 MANHOLES AND CLEANOUTS

A. Manhole Type: As noted in plans and specified by local governing authority.

2.04 FILL MATERIAL

A. Refer to Section – 31 23 23.13 - Backfill.

1. Type D - Bedding Material; fill for over excavation.

2. Type A - Gravel; fill material.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that trench cut is ready to receive work, and excavations, dimensions, and elevations are as indicated on drawings.

B. Verify that prior to installation waste lines from building will meet invert of side sewer for each building.

C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with Type D fill material.

B. Remove large stones or other hard matter which could damage drainage tile or impede consistent backfilling or compaction.

3.03 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ANSI/ASTM D2321. Seal joints watertight.

B. Pipe bedding per plans.

C. Lay pipe to slope gradient noted on drawings with maximum variation from true slope of 1/8 inch in 10 feet.

D. Increase compaction of each successive lift. Refer to Section 31 23 23.13 - Backfill for compaction requirements. Do not displace or damage pipe when compacting.

E. Connect to building sewer outlet and municipal sewer system.

3.04 INSTALLATION - MANHOLES AND CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverted for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.05 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01 33 26.

3.06 PROTECTION

A. Protect finished installation under provisions of Section 01 51 00.

B. Protect pipe from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 41 00

STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Storm drainage piping, fittings, and accessories.

B. Connection of building storm water drainage system to storm sewage system.

C. Catch basins, yard drains, patio drains, manholes, and site surface drainage.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 03100 - Concrete Formwork: Installation of pipe sleeves for placement in concrete foundation walls.

1.03 RELATED SECTIONS

A. Section 31 23 23.13 - Backfill: Backfilling over piping up to subgrade elevation.

B. Section 31 23 16.13 - Trenching: Excavating subsoil for sewerage system piping.

C. Section 33 30 00 - Sanitary Sewerage Utillities.

D. Section 03 11 13 – Structural Cast-In-Place Concrete Forming: Sleeved concrete work for storm drainage piping.

E. Section 03 31 13 – Heavyweight Structural Concrete: Concrete type for manhole construction.

F. Section 22 10 00 – Plumbing Pipes and Pumps: Downspout connection.

1.04 REGULATORY REQUIREMENTS

A. Conform to local governing authority for Standard Plans and Specifications for materials and installation of the Work of this Section.

B. Construct all work on private drives in accordance with Washington Public Works Standards and Requirements of Spokane County Public Works.

1.05 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Section 01 77 19.

B. Accurately record location of pipe runs, connections, catch basins, manholes, cleanouts, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Corrugated Aluminum Pipe: ANSI/ASTM B745.

B. Plastic Pipe: ANSI/ASTM D3033, Type PSM, polyvinyl chloride (PVC) material; bell and spigot style solvent sealed end joints.

2.02 PIPE ACCESSORIES

A. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required 'T', bends, elbows, cleanouts,

B. Filter Fabric: Pervious Black Polyolefin.

2.03 CATCH BASINS, MANHOLES AND DRAINS

A. Catch Basin: Type and size as noted in plans.

B. Manholes: Type and size as noted in plans.

C. Yard Drains: Square or round plastic with plastic grate.

D. Trench Drains: Size and type per Drawings.

E. Patio/Deck/Cabana Drains: Size and type per Civil Drawings.

2.04 FILL MATERIAL

Refer to Section 31 23 23.13 - Backfill.

A. Type D - Bedding Material; fill for over excavation.

B. Type A - Gravel; fill Material.

C. Type E - Coarse filter aggregate; fill around perforated pipe.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that trench cut is ready to receive work, and excavations, dimensions, and elevations are as indicated on drawings.

B. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with Type C fill material.

B. Remove large stones or other hard matter which could damage drainage tile or impede consistent backfilling or compaction.

3.03 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ANSI/ASTM D2321.Seal joints watertight.

B. Pipe bedding per plans.

C. Lay pipe to slope gradients noted on Drawings, with maximum variation from true slope of 1/8 inch in 10 feet.

D. Increase compaction of each successive lift. Refer to Section 31 23 23.13 - backfilling for compaction requirements. Do not displace or damage pipe when compacting.

E. Connect to Municipal Sewer System.

3.04 INSTALLATION - CATCH BASINS, MANHOLES, AND CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.05 INSTALLATION OF DRAINS

A. Install yard drains per plan and protect from clogging until landscaping is in place.

B. Contractor is responsible for positive site drainage. Areas not specifically noted on the plans shall be field adjusted. Install yard drains when necessary to accommodate positive drainage.

3.06 PROTECTION

A. Protect finished installation under provisions of Section 01 51 00.

B. Protect pipe and filter aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION