



PROJECT MANUAL

SEISMIC IMPROVEMENT AND ROOFING REPLACEMENT

BEAVERTON SCHOOL DISTRICT MCKINLEY ELEMENTARY SCHOOL

April 22, 2022
Outline Specifications – Roofing Replacement

PREPARED FOR:

BSD – McKinley Elementary School | 22-002
1500 NW 185th Avenue
Beaverton, OR 97006

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

SECTION 00 01 02 - PROJECT INFORMATION

PROJECT IDENTIFICATION

Project Name: Beaverton School District McKinley Elementary School, located at 1500 NW 185th Ave., Beaverton, OR 97006.

The Owner, hereinafter referred to as Owner: Beaverton School District (BSD)

Owner's Project Manager: Chris Hansen.

Beaverton School District: Facilities Development.

Address: 16550 SW Merlo Road.

City, State, Zip: Beaverton, OR 97003.

Phone/Fax: 503-356-4321.

E-mail: Christopher_Hansen@beaverton.k12.or.us.

PROJECT DESCRIPTION

Summary Project Description: Seismic Improvements and Roofing Replacement.

Seismic Improvements: address the seismic performance of both the primary structural system and non-structural elements such as walls, roofs, and ceilings. In addition to interior work, there will be a complete re-roof and roof-level seismic strengthening. Where devices, furnishings, and other equipment must be removed to provide access to the work, those items will be salvaged and protected for reinstallation whenever possible. All new finishes will be selected to match or complement the existing adjacent finishes. Additionally, there will be nonstructural seismic upgrades in bracing tall narrow and fall prone contents, ceilings, pipes, ducts, lights, and equipment in the building.

Roofing Replacement: remove and replace the existing low-slope built up roof assembly per roofing assessment recommendations with new built up roof assembly with added insulation. Work includes new associated flashings, gutters, downspouts, splash blocks, fascia's, curbs and counter-flashing for mechanical equipment, roof top supports (conduit, pipes), new skylights, roof access ladder, roof hatch guardrail and contractor designed fall restraint system identified on plans. Contractor to replace existing roof systems damaged from water intrusion as required for new scope of work including, but not limited, to sheathing, insulation, curbs, blocking, roof flashing, etc.

Contract Scope: demolition and renovation.

Contract Terms: Lump sum (fixed price, stipulated sum).

Per ORS 279C and as defined in Division 49 of the Model Rules. The contract forms shall be the BSD's Construction Contract and General Conditions.

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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

GENERAL REQUIREMENTS

A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:

Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.

Limit each request to a single proposed substitution item.

RESOLUTION

Architect will notify Contractor in writing of decision to accept or reject request.

ACCEPTANCE

Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

ELECTRONIC DOCUMENT SUBMITTAL SERVICE

All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.

Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.

Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.

Cost: The cost of the service will be paid by Owner.

REQUESTS FOR INTERPRETATION (RFI)

Definition: A request seeking one of the following:

An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.

A resolution to an issue which has arisen due to field conditions and affects design intent.

Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.

Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.

Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.

Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.

Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.

Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs

received after 12:00 noon will be considered as having been received on the following regular working day.

Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.

Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.

Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

SUBMITTAL SCHEDULE

Submit to Architect for review a schedule for submittals in tabular format.

SUBMITTALS FOR REVIEW

Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

Submittal review does not include the following:

Accuracy and completeness of other details other than the Architect's details.

Accuracy of dimensions.

Quantities.

Substantiating instructions for installation or performance of equipment or systems.

Review of the above items is solely the responsibility of the Contractor.

The Architect's review does not constitute the approval of safety precautions or of any construction means, methods, techniques, sequences or procedures.

The Architect's approval of a specific items does not indicate approval of an assembly of which the item is a component.

Samples will be reviewed for aesthetic, color, or finish selection.

After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

SUBMITTALS FOR INFORMATION

Submit for Architect's knowledge as contract administrator or for Owner.

SUBMITTALS FOR PROJECT CLOSEOUT

Record Drawings

Submit for Owner's benefit during and after project completion.

NUMBER OF COPIES OF SUBMITTALS

Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.

After review, produce duplicates.

Retained samples will not be returned to Contractor unless specifically so stated.

SUBMITTAL PROCEDURES

General Requirements:

Use a separate transmittal for each item.

Transmit using approved form.

Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.

Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.

Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.

Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.

Provide space for Contractor and Architect review stamps.

When revised for resubmission, identify all changes made since previous submission.

Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.

SECTION 01 40 00 - QUALITY REQUIREMENTS

MOCK-UPS

SECTION 01 41 00 - REGULATORY REQUIREMENTS

SUMMARY OF REFERENCE STANDARDS

Regulatory requirements applicable to this project are the following:

29 CFR 1910 - Occupational Safety and Health Standards; current edition.

State of Oregon amendments to some or all of the following.

City of Beaverton amendments to some or all of the following.

Zoning Code: Beaverton, OR Development Code.

ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

NFPA 1 - Fire Code; 2015.

NFPA 101 - Life Safety Code; 2015.

NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Fire Code: 2019 Oregon Fire Code (OFC).

Building Code: 2019 Oregon Structural Specialty Code (OSSC).

Plumbing Code: 2021 Oregon Plumbing Specialty Code (OPSC).

Mechanical Code: 2019 Oregon Mechanical Specialty Code (OMSC).

Electrical Code: 2021 Oregon Electrical Specialty Code (OESC).

Energy Code: 2021 Oregon Energy Efficiency Specialty Code (OEESC).

Construction standards: ASHRAE Standard 90.1-2019

SECTION 01 45 33 - CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.

Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.

Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

Special Inspection Agency shall:

Verify samples submitted by Contractor comply with the referenced standards and the approved Contract Documents.

Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.

Perform specified sampling and testing of products in accordance with specified reference standards.

Ascertain compliance of materials and products with requirements of Contract Documents.

Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.

Perform additional tests and inspections required by Architect.

Submit reports of all tests or inspections specified.

SECTION 01 57 13 - TEMPORARY EROSION AND SEDIMENT CONTROL

SCOPE OF PREVENTIVE MEASURES

In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

Linear Sediment Barriers: Made of silt fences.

Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:

Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.

Straw bale row blocking entire inlet face area; anchor into pavement.

Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.

Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.

Mulching: Use only for areas that may be subjected to erosion for less than 6 months.

Temporary Seeding: Use where temporary vegetated cover is required.

SECTION 01 60 00 - PRODUCT REQUIREMENTS

QUALITY ASSURANCE

EXISTING PRODUCTS

Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

NEW PRODUCTS

Provide new products unless specifically required or permitted by Contract Documents.

PRODUCT OPTIONS

Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

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

SECTION 01 78 00 - CLOSEOUT SUBMITTALS

ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

Where systems involve more than one specification section, provide separate tabbed divider for each system.

Prepare instructions and data by personnel experienced in maintenance and operation of described products.

Prepare data in the form of an instructional manual.

Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

WARRANTIES AND BONDS

Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

CONTRACT CLOSEOUT CHECKLIST

Please complete the following "CONTRACT CLOSEOUT CHECKLIST" as part of the project closeout documentation.

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

DEMONSTRATION - GENERAL

Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

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DIVISION 02 - EXISTING CONDITIONS

SECTION 02 41 00 - DEMOLITION

GENERAL PROCEDURES AND PROJECT CONDITIONS

Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

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DIVISION 03 - CONCRETE

SECTION 03 05 16 - UNDERSLAB VAPOR BARRIER

MATERIALS

Underslab Vapor Barrier:

Water Vapor Permeance: Not more than 0.010 perms (0.6 ng/(s m² Pa)), maximum.

Complying with ASTM E1745 Class A.

Thickness: 15 mils (0.4 mm).

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

SECTION INCLUDES

FORMWORK - GENERAL

Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

WOOD FORM MATERIALS

Form Materials: At the discretion of the Contractor.

EARTH FORMS

Earth forms are not permitted.

SECTION 03 20 00 - CONCRETE REINFORCING

REINFORCEMENT

Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).

Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars.

Reinforcing Steel: Deformed bars, ASTM A996/A996M Grade 40 (280), Type A.

Reinforcing Steel: Plain or deformed bars; ASTM A1035/A1035M, Grade 100 (100,000 psi) (690 MPa), Type CL.

Reinforcing Steel Mat: ASTM A704/A704M, using ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa) steel bars or rods, unfinished.

Stirrup Steel: ASTM A1064/A1064M steel wire, unfinished.

Steel Welded Wire Reinforcement (WWR): Galvanized, deformed type; ASTM A1064/A1064M.

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

FORMWORK

Comply with requirements of Section 03 10 00.

Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

REINFORCEMENT MATERIALS

Comply with requirements of Structural Notes on Structural Drawing in addition to:

Comply with requirements of Section 03 20 00.

Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.

CONCRETE MATERIALS

Comply with requirements of Structural Notes on Structural Drawing in addition to:

Cement: ASTM C150/C150M, Type I - Normal Portland type.

Fine and Coarse Aggregates: ASTM C33/C33M.

Lightweight Aggregate: ASTM C330/C330M.

Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

ACCESSORY MATERIALS

Underslab Vapor Retarder: Sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.

Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

CURING MATERIALS

Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.

Water: Potable, not detrimental to concrete.

CONCRETE MIX DESIGN

Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

Proportioning Structural Lightweight Concrete: Comply with ACI 211.2 recommendations.

Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

Normal Weight Concrete:

Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days:
3,000 pounds per square inch (20.7 MPa).

Structural Lightweight Concrete:

Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days:
3,000 pounds per square inch (20.7 MPa).

PLACING CONCRETE

Place concrete in accordance with ACI 304R.

Place concrete for floor slabs in accordance with ACI 302.1R.

DIVISION 05 - METALS

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

MATERIALS

Comply with requirements of Structural Notes on Structural Drawing in addition to:

Steel Angles and Plates: ASTM A36/A36M.

Rolled Steel Structural Shapes: ASTM A992/A992M.

Steel Shapes, Plates, and Bars: ASTM A242/A242M high-strength, corrosion-resistant structural steel.

Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.

Hot-Formed Structural Tubing: ASTM A501/A501M, seamless or welded.

Steel Bars: ASTM A108.

Steel Plate: ASTM A514/A514M.

Steel Sheet: ASTM A1011/A1011M, Designation SS, Grade 30 hot-rolled, or ASTM A1008/A1008M, Designation SS, Grade 30 cold-rolled.

Pipe: ASTM A53/A53M, Grade B, Finish black.

Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M, Class C.

High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.

Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

SECTION 05 50 00 - METAL FABRICATIONS

MATERIALS - STEEL

Comply with requirements of Structural Notes on Structural Drawing in addition to:

Steel Sections: ASTM A36/A36M.

Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

Plates: ASTM A283/A283M.

Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

MATERIALS - ALUMINUM

Comply with requirements of Structural Notes on Structural Drawing in addition to:

Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.

Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.

Bolts, Nuts, and Washers: Stainless steel.

Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

FABRICATION

Fit and shop assemble items in largest practical sections, for delivery to site.

Fabricate items with joints tightly fitted and secured.

FINISHES - STEEL

Prime paint steel items.

FINISHES - ALUMINUM

Exterior Aluminum Surfaces: Class I natural anodized.

Interior Aluminum Surfaces: Class I natural anodized.

SECTION 05 51 33 - METAL LADDERS

MATERIALS - STEEL

Steel Sections: ASTM A36/A36M.

Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

Plates: ASTM A283/A283M.

Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

Bolts, Nuts, and Washers: ASTM A307, plain.

Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

FABRICATION

Fit and shop assemble items in largest practical sections, for delivery to site.

Fabricate items with joints tightly fitted and secured.

FINISHES - STEEL

Prime paint steel items.

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

SECTION 06 10 00 - ROUGH CARPENTRY

GENERAL REQUIREMENTS

Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.

Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

DIMENSION LUMBER FOR CONCEALED APPLICATIONS

Sizes: Nominal sizes as indicated on drawings, S4S.

Moisture Content: S-dry or MC19.

Stud Framing (2 by 2 through 2 by 6 (50 by 50 mm through 50 by 150 mm)):

Species: Any allowed under referenced grading rules.

Grade: No. 2.

Small Beam Framing (2 by 6 through 4 by 16 (50 by 150 mm through 100 by 400 mm)):

Species: Any allowed under grading rules.

Grade: No. 2.

Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

Lumber: S4S, No. 2 or Standard Grade.

Boards: Standard or No. 3.

TIMBERS

Sizes: Nominal sizes as indicated on drawings, S4S.

Moisture Content: S-dry (23 percent maximum).

Ledgers 5 inches (125 mm) and over in thickness:

Species: Douglas Fir-Larch.

Grade: Select Structural.

CONSTRUCTION PANELS

Comply with requirements of Structural Notes on Structural Drawing in addition to:

Roof Sheathing: Any PS 2 type, rated Structural I Sheathing.

Wall Sheathing: Any PS 2 type.

Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

FACTORY WOOD TREATMENT

Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

FRAMING INSTALLATION

Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

Install structural members full length without splices unless otherwise specifically detailed.

SECTION 06 20 00 - FINISH CARPENTRY

FINISH CARPENTRY ITEMS

Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

LUMBER MATERIALS

Hardwood Lumber: Maple or Birch species, plain sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

SHEET MATERIALS

Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1, Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

PLASTIC LAMINATE MATERIALS

Plastic Laminate: NEMA LD 3; color as indicated.

HARDWARE

Hardware: Comply with BHMA A156.9.

WOOD TREATMENT

Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

FABRICATION

Shop assemble work for delivery to site, permitting passage through building openings.

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07 01 50.19 - PREPARATION FOR RE-ROOFING

COMPONENTS

Refer to following sections for additional information on components relating to this work:

Replacement and removal of existing roofing system in preparation for new roof membrane system, refer to Section 07 52 00.

Remove existing flashing and counterflashings in preparation for replacement of these materials as part of this work, refer to Section 07 62 00 for material requirements.

MATERIALS

Temporary Roofing Protection Materials:

Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

Use materials capable of maintaining a weatherproof exterior building enclosure.

MATERIAL REMOVAL

Remove only existing roofing materials that can be replaced with new materials as the weather will permit.

Remove metal gutters and downspouts as indicated on drawings.

Remove roofing membrane, perimeter roof base flashings, cant strips and flashings around roof protrusions as indicated on drawings.

Remove asphalt shingles, underlayment, vents and flashings around roof protrusions as indicated on drawings.

Replace existing roof systems damaged from water intrusion as required for new scope of work including but not limited insulation, blocking, sheathing and fasteners.

Replace existing metal cap flashings, copings and fasteners as required for new scope of work.

INSTALLATION

Coordinate scope of this work with requirements for installation of new roofing system, refer to Section 07 52 00 for additional requirements.

SECTION 07 21 00 - THERMAL INSULATION

FOAM BOARD INSULATION MATERIALS

Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.

Water Vapor Permeance: 1.2 perm (68 ng/(Pa s sqm)), maximum, at 1 inch (25 mm) thickness, and when tested in accordance with ASTM E96/E96M, desiccant method.

Board Size: 48 inch by 96 inch (1220 mm by 2440 mm).

Board Thickness: 3.0 inch (76 mm).

Board Edges: Square.

BATT INSULATION MATERIALS

Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.

Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.

Thermal Resistance: R-value (RSI-value) of 19 (3.34).

Thickness: 4.5 inch (114.3 mm).

FOAM INSULATION MATERIALS

Foamed-in-Place Sealant - Low Pressure Type: semi-flexible soft, single-component polyurethane sealant, to ASTM E2112; and having the following properties:

ACCESSORIES

SECTION 07 25 00 - WEATHER BARRIERS

WEATHER BARRIER ASSEMBLIES

Air Barrier:

On outside surface of sheathing of exterior walls use air barrier sheet, self-adhesive type.
As indicated in drawings.

Interior Vapor Retarder:

On inside face of studs of exterior walls, under cladding, use mechanically fastened vapor retarder sheet.
As indicated in drawings.

AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

Air Barrier Sheet, Self-Adhered:

Air Permeance: 0.004 cfm/sq ft (0.02 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.

Water Vapor Permeance: 10 perms (572 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure A (Desiccant Method) at 73.4 degrees F (23 degrees C).

Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M (modified).

Manufacturers:

VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

Vapor Retarder Sheet: ASTM D4397 polyethylene film reinforced with glass fiber square mesh, clear.

ACCESSORIES

Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

SECTION 07 46 46 - FIBER-CEMENT SIDING

FIBER-CEMENT SIDING

Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.

Texture: Smooth.

Length (Height): 96 inches (2400 mm), nominal.

Width: 48 inches (1220 mm).

Thickness: 5/16 inch (8 mm), nominal.

Finish: Factory applied primer.

Warranty: 30 year limited; See Warranty.

SECTION 07 52 16 - STYRENE-BUTADIENE-STYRENE MODIFIED BITUMINOUS ROOFING (SBS)

ROOFING SYSTEM DESCRIPTION

Roofing System: Styrene-butadiene-styrene modified bituminous membrane.

Membrane and Attachment: Mineral granule surfaced cap sheet, and base sheet, hot asphalt applied.

Granule Color: White.

Warranty: Full system warranty; Firestone 30 year Platinum Limited Warranty covering membrane, roof insulation, and membrane accessories.

Roofing System Components: Listed in order from the top of the roof down:

Insulation Cover Board: Gypsum-based board, 1/2 inch (12 mm) thick; asphalt attached.

Insulation:

Maximum Board Thickness: 3 inches (75 mm); use as many layers as necessary; stagger joints in adjacent layers.

Tapered: Slope as indicated; provide minimum R-value (RSI-value) at thinnest point; place tapered layer on bottom.

Total R-value (RSI-value): 30 (5.28), minimum.

Top Layer: Polyisocyanurate foam board, non-composite; asphalt attached.

Intermediate Layer(s), If Any: Polyisocyanurate foam board, non-composite; asphalt attached.

Bottom Layer: Polyisocyanurate foam board, non-composite; mechanically fastened.

Vapor Retarder: One layer SBS modified bitumen base sheet; cold adhesive attached.

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

SHEET MATERIALS

Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239 inch) (0.61 mm) thick base metal.

Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.

Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) (0.81 mm) thick; anodized finish of color as selected.

Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) (0.81 mm) thick; plain finish shop pre-coated with modified silicone coating.

Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 26 gage, 0.019 inch (0.48 mm) thick; smooth No. 4 - Brushed finish.

FABRICATION

General Metal Fabrication: Shop-fabricate work to greatest extent possible. Field measure site conditions prior to fabricating work. Comply with details shown and with applicable requirements of "SMACNA" Architectural Sheet Metal Manual" and other recognized industry practices.

Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work.

Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems. All flashing & sheet metal colors selected by architect or as noted on drawings.

Form sections true to shape, accurate in size, square, and free from distortion or defects.

Form pieces in longest possible lengths.

Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

ACCESSORIES

Fasteners: Stainless steel, with soft neoprene washers.

Underlayment: Polyethylene, 6 mils (0.15 mm) thick.

Slip Sheet: Rosin sized building paper.

SECTION 07 71 00 - ROOF SPECIALTIES

COMPONENTS

Control and Expansion Joint Covers: Composite construction flexible extruded rubber flashing of black color with closed cell urethane foam backing, each edge seamed to stainless steel sheet metal flanges, designed for joints of varying widths. Include special formed corners, tees, intersections, and wall flashings, each sealed watertight.

Roofing Vents: Formed galvanized steel ____ inch (____ mm) thick, with watertight construction to allow construction below roof membrane to breathe; with attachment flanges ____ inch (____ mm) wide.

Pipe and Penetration Flashing: Base of Stainless Steel, compatible with Styrene-butadiene-styrene modified bituminous membrane roof systems, and capable of accommodating pipes sized between 3/8 inch (9.5 mm) and 12 inch (305 mm).

Material : Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 26 gage, 0.019 inch (0.48 mm) thick; smooth No. 4 - Brushed finish.

FINISHES

PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

SECTION 07 71 23 - MANUFACTURED GUTTERS AND DOWNSPOUTS

MATERIALS

Pre-Finished Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch (0.6 mm) thick base metal.

Finish: Shop pre-coated with PVDF (polyvinylidene fluoride) coating.

COMPONENTS

Gutters: Profile as indicated.

Downspouts: Profile as indicated.

Anchors and Supports: Profiled to suit gutters and downspouts.

Fasteners: Stainless steel, with soft neoprene washers.

FABRICATION

Form gutters and downspouts of profiles and size indicated.

Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

FABRICATION

Form gutters and downspouts of profiles and size indicated.

Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

FINISHES

Fluoropolymer Coating: High Performance Organic Finish, 1; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

SECTION 07 72 00 - ROOF ACCESSORIES

ROOF HATCHES AND VENTS

Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.

Safety Railing System: Roof hatch safety rail system mounted directly to curb without penetration of roofing system.

NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES

Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.

Design Loadings and Configurations: As required by applicable codes.

Pipe Supports: Provide attachment fixtures complying with MSS SP-58 and as indicated.

SECTION 07 92 00 - JOINT SEALANTS

JOINT SEALANT APPLICATIONS

Scope:

Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.

- Wall expansion and control joints.

- Joints between door, window, and other frames and adjacent construction.

- Joints between different exposed materials.

- Openings below ledge angles in masonry.

- Other joints indicated below.

Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.

- Joints between door, window, and other frames and adjacent construction.

- In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.

 - Exception: Such gaps and openings in gypsum board finished stud walls and suspended ceilings.

 - Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.

- Other joints indicated below.

Do not seal the following types of joints.

- Intentional weepholes in masonry.

- Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.

- Joints where sealant is specified to be provided by manufacturer of product to be sealed.

- Joints where installation of sealant is specified in another section.

- Joints between suspended panel ceilings/grid and walls.

Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.

- Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.

- Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.

- Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.

- Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.

- Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.

- Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.

- Wall, Ceiling, and Floor Joints Where Tamper-Resistance is Required: Non-sag, elastomeric STPU joint sealant.

- Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.

- In Sound-Rated Assemblies: Acrylic emulsion latex sealant.

- Narrow Control Joints in Interior Concrete Slabs: Self-leveling polyurea sealant.

- Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.

Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

- All existing walls with accoustic insulation.

Areas Where Tamper-Resistance is Required: All of the areas within the reach of students and young children, both interior and exterior.

JOINT SEALANTS - GENERAL

Sealants and Primers: Provide products with levels of volatile organic compound (VOC) content as indicated in Section 01 61 16.

Colors: As indicated on drawings.

DIVISION 08 - OPENINGS

SECTION 08 12 13 - HOLLOW METAL FRAMES

PERFORMANCE REQUIREMENTS

Refer to Door and Frame Schedule on the drawings for frame sizes, fire ratings, sound ratings, finishing, door hardware to be installed, and other variations, if any.

Door Frame Type: Provide hollow metal door frames with integral casings.

Interior Doors: Use frames with integral casings.

Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.

Zinc Coating: Components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise.

Frames Wider than 48 Inch (1219 mm): Reinforce with steel channel fitted tightly into head of frame, flush with top.

HOLLOW METAL DOOR FRAMES WITH INTEGRAL CASINGS

Frame Finish: Factory primed and field finished.

Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.

Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

Level 3 - Extra Heavy-duty.

Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.

Frame Metal Thickness: 14 gage, 0.067 inch (1.7 mm), minimum.

Zinc Coating: Manufacturer's standard coating thickness; ASTM A653/A653M.

FINISHES

Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

ACCESSORIES

Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

SECTION 08 62 00 - UNIT SKYLIGHTS

SKYLIGHTS

Skylights: Factory-assembled glazing in aluminum frame, free of visual distortion, and weathertight.

Shape: Square and rectangular domes.

Glazing: Double.

Operation: None; fixed.

Roof Slope: As indicated on drawings.

Nominal Size: As indicated on drawings.

COMPONENTS

Double Glazing: Acrylic plastic; factory sealed.

Outer Glazing: Clear transparent.

Inner Glazing: White translucent.

Frames: ASTM B221 (ASTM B221M) Extruded aluminum thermally broken, reinforced and welded corner joints, integral curb frame mounting flange and counterflashing to receive roofing flashing system, with integral condensation collection gutter, glazing retainer; clear anodized finish.

Support Curbs: Sheet aluminum ASTM B209/B209M, sandwich construction; 1 inch (25 mm) wide, 4 inches (100 mm) high; glass fiber insulation; with integral flange for anchorage to roof deck.

DIVISION 09 - FINISHES

SECTION 09 05 61 - COMMON WORK RESULTS FOR FLOORING PREPARATION

QUALITY ASSURANCE

Moisture and alkalinity (pH) testing will be performed by an independent testing agency employed and paid by Owner.

Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

CONCRETE SLAB PREPARATION

Perform following operations in the order indicated:

Existing concrete slabs (on-grade and elevated) with existing floor coverings:

Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.

Removal of existing floor covering.

Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:

Do not attempt to remove coating or penetrating material.

Do not abrade surface.

Preliminary cleaning.

Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.

Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.

Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.

Specified remediation, if required.

Patching, smoothing, and leveling, as required.

Other preparation specified.

Adhesive bond and compatibility test.

Protection.

Remediations:

Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.

Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.

Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

BOARD MATERIALS

Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

Application: Use for vertical surfaces, unless otherwise indicated.

At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.

Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.

Application: Vertical Surfaces in restrooms, janitor's and behind sinks.

At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
Type: Regular and Type X, in locations indicated.

Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

Application: Ceilings, unless otherwise indicated.

GYPSON WALLBOARD ACCESSORIES

Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced.

Fill wall cavity with insulation (i.e., 4" batt in a 4" metal stud wall cavity, 6" batt in a 6" metal stud wall cavity).

Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

Joint Compound: Drying type, vinyl-based, ready-mixed.

Joint Compound: Setting type, field-mixed.

Finishing Compound: Surface coat and primer, takes the place of skim coating.

SECTION 09 51 00 - ACOUSTICAL CEILINGS

PERFORMANCE REQUIREMENTS

Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category D, E, or F and complying with the following:

Local authorities having jurisdiction.

ACOUSTICAL UNITS

Acoustical Units - General: ASTM E1264, Class A.

Acoustical Panels, Type ACT-1: Painted mineral fiber, with the following characteristics:

Application(s): As scheduled.

Classification: ASTM E1264 Type III.

Form: 2, water felted.

Pattern: "C" - perforated, small holes.

Pattern: "D" - fissured.

Size: 24 by 48 inch (610 by 1219 mm).

Thickness: 5/8 inches (16 mm).

Acoustical Panels, Type ACT-2: Painted mineral fiber, with the following characteristics:

Application(s): As scheduled.

Classification: ASTM E1264 Type III.

Form: Match Existing.

Pattern: Match Existing.

Size: Custom 30 by 60 inches (762 by 1524 mm). VIF

Thickness: Match Existing.

SUSPENSION SYSTEM(S)

Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

Materials:

Steel Grid: ASTM A653/A653M, G40 coating, unless otherwise indicated.

Seismic Performance: Suspension system to withstand the effects of earthquake motions determined according to ASCE/SEI 7.

Exposed Suspension System, Type for Acoustical Panels: Hot-dipped galvanized steel grid with cap.

Application(s): Seismic.

Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.

Concealed Suspension System, Type for Gypsum Board: Hot-dipped galvanized steel grid, double web construction with cap.

Application(s): Seismic.

Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.

SECTION 09 51 53 - DIRECT-APPLIED ACOUSTICAL CEILINGS

MATERIALS

Acoustic Tile: Mineral fiber, ASTM E1264 Type ACT-3.

Size: 12 by 12 inches (300 by 300 mm).

Thickness: 1/2 inches (12.7 mm).

Surface Color: White.

Surface Finish: washable.

Adhesive: Waterproof, gun grade; type recommended by tile manufacturer.

SECTION 09 65 00 - RESILIENT FLOORING

TILE FLOORING

Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.

Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.

Size: 12 by 12 inch (305 by 305 mm).

Thickness: 0.125 inch (3.2 mm).

Pattern: As indicated on drawings.

Color: As indicated on drawings.

Feature Strips: Of same material as tile, ____ inch (____ mm) wide.

RESILIENT BASE

Resilient Base - Type RB-1: ASTM F1861, Type TV, vinyl, thermoplastic; top set Style B, Cove.

Height: 4 inch (100 mm).

Thickness: 0.125 inch (3.2 mm).

Finish: As indicated on drawings.

Color: As indicated on drawings.

SECTION 09 68 16 - SHEET CARPETING

CARPET

Carpet: Tufted, nylon.

Color: As indicated on drawings.

Pattern: As indicated on drawings.

Primary Backing:

Material: Polypropylene.

Secondary Backing:

Material: Jute.

SECTION 09 72 00 - WALL COVERINGS

WALL COVERINGS

General Requirements:

Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

Wall Covering: Rigid vinyl panel.
Panel Size: 4 feet by 8 feet (1219 mm by 2438 mm).
Rigid Vinyl Thickness: 30 mils (0.030 inch) (0.76 mm).
Panel Edge Treatment: Square.
Trim: Manufacturer's standard trim shapes; vinyl, match face panel color.
Color: match existing.
Pattern: match existing.
Surface Texture: match existing.

Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

SECTION 09 91 13 - EXTERIOR PAINTING

SECTION INCLUDES

Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

Exposed surfaces of steel lintels and ledge angles.

Do Not Paint or Finish the Following Items:

Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.

Items indicated to receive other finishes.

Items indicated to remain unfinished.

Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.

Non-metallic roofing and flashing.

Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.

Floors, unless specifically indicated.

Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.

Glass.

Concrete masonry units in enclosure at generator spaces.

Concealed pipes, ducts, and conduits.

MANUFACTURERS

PAINTS AND FINISHES - GENERAL

Colors: To be selected from manufacturer's full range of available colors.

PAINT SYSTEMS - EXTERIOR

Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including primed wood and primed metal.

Top Coat(s): Exterior Latex.

Top Coat(s): Exterior Light Industrial Coating, Water Based.

Primer: As specified under "PRIMERS" below.

PRIMERS

Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

Rust-Inhibitive Water Based Primer.

Latex Primer for Exterior Wood.

SECTION 09 91 23 - INTERIOR PAINTING

SECTION INCLUDES

Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.

Mechanical and Electrical:

In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.

In finished areas, paint shop-primed items.

Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

Do Not Paint or Finish the Following Items:

Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.

Items indicated to receive other finishes.

Items indicated to remain unfinished.

Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.

Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.

Floors, unless specifically indicated.

Ceramic and other tiles.

Brick, architectural concrete, cast stone, integrally colored plaster and stucco.

Glass.

Acoustical materials, unless specifically indicated.

Concealed pipes, ducts, and conduits.

MANUFACTURERS

PAINTS AND FINISHES - GENERAL

Colors: As indicated on drawings.

PAINT SYSTEMS - INTERIOR

Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, and shop primed steel.

Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.

Primer: As specified under "PRIMERS" below, with recommendation approval of top coat manufacturer for specific substrate.

Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:

Top Coat(s): High Performance Architectural Interior Latex; MPI #139, 140, or 141.

Primer: As specified under "PRIMERS" below, with recommendation approval of top coat manufacturer for specific substrate.

Paint I-OP-MD-WC - Medium Duty Vertical and Overhead: Including gypsum board, concrete, concrete masonry units, uncoated steel, shop primed steel, and galvanized steel.

Top Coat(s): Interior Epoxy-Modified Latex; MPI #215.

Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.

Primer: As specified under "PRIMERS" below, with recommendation approval of top coat manufacturer for specific substrate.

Paint WI-OP-3L - Wood, Opaque, Latex, 3 Coat:

Paint CI-OP-3L - Concrete/Masonry, Opaque, Latex, 3 Coat:

Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:

Paint MI-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:

Paint MGI-OP-3L - Galvanized Metals, Latex, 3 Coat:

Paint Mal-OP-3L - Aluminum, Unprimed, Latex, 3 Coat:

Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:

Paint FI-OP-3A - Fabrics/Insulation Jackets, **Latex**, 3 Coat:

PRIMERS

Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

Interior Institutional Low Odor/VOC Primer Sealer.

Interior/Exterior Latex Block Filler (**Porous**); MPI #4.

Concrete, Precast, or Smooth Masonry Primer.

Products:

Rodda First Coat Bonding Primer, 501601. (MPI #3)

Interior Rust-Inhibitive Water Based Primer; MPI #107.

Latex Primer for Interior Wood; MPI #39.

SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The provisions of This Section, Common Work Results for Plumbing, apply to all sections in Division 22.
- C. All Sections of Division 22 are interrelated. When interpreting any direction, material, and method specified in any section of Division 22 consider it within the entirety of Work in Division 22.

1.02 SUMMARY

- A. The intent of Division 22 Specifications and the accompanying Drawings is to provide a complete and workable facility with complete systems as shown, specified and required by applicable codes. Include all work specified in Division 22 and shown on the accompanying Drawings, including appurtenances, connections, etc., in the finished job.
- B. The Division 22 Specifications and the accompanying Drawings are complementary and what is called for by one shall be as binding as if called for by both. Items shown on the Drawings are not necessarily included in the Specifications and vice versa. Specifications shall supersede drawings in case of conflict.
- C. Imperative language is frequently used in Division 22 Specifications. Except as otherwise specified, requirements expressed imperatively are to be performed by the Contractor.
- D. The Drawings that accompany the Division 22 Specifications are diagrammatic. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Offsets and transitions shall be assumed at a minimum at each duct crossing, structural penetrations through shear walls or beams, structural grids where ceiling heights are restricted, and at piping mains. Follow the Drawing as closely as is practical to do so and install additional bends, offsets and elbows where required by local conditions from measurements taken at the Building, subject to approval, and without additional cost to the Owner. The right is reserved to make any reasonable changes in fixture location prior to roughing-in, without cost impact.

1.03 RELATED WORK

- A. The General and Supplemental Conditions apply to this Division, including but not limited to:
 - 1. Drawings and specifications.
 - 2. Public ordinances, permits.
 - 3. Include payments and fees required by governing authorities for work of this Division.
- B. Division 1, General Requirements, applies to this Division.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. All products and equipment shall be prohibited from containing pentabrominated, octabrominated and decabrominated diphenyl ethers. Where products or equipment within this specification contain these banned substances, provide complying products and equipment from approved manufacturers with equal performance characteristics.
 - 2. General: All work and materials shall conform to the local and State codes, and all Federal, State, and other applicable laws and regulations.
 - 3. Contractor responsible for obtaining and payment for all permits, licenses, and inspection certificates required in accordance with provisions of Contract Documents.
- B. Materials and equipment shall be new. Work shall be of good quality, free of faults and defects and in conformance with the Contract Documents.

- C. Apparatus shall be built and installed to deliver its full rated capacity at the efficiency for which it was designed.
- D. The entire plumbing system and apparatus shall operate at full capacity without objectionable noise or vibration.
- E. All equipment shall be installed level and true. Housekeeping pads and curbs shall account for floor or roof slope.
- F. Materials and Equipment:
 - 1. Each piece of equipment furnished shall meet all detailed requirements of the Drawings and Specifications and shall be suitable for the installation shown. Equipment not meeting all requirements will not be acceptable, even though specified by name along with other manufacturers.
 - 2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer. Component parts of the entire system need not be products of same manufacturer.
 - 3. Furnish all materials and equipment of size, make, type, and quality herein specified.
 - 4. Equipment scheduled by performance or model number shall be considered the basis of the design. If other specified manufacturer's equipment is provided in lieu of the basis of design equipment the contractor is responsible for all changes and costs which may be necessary to accommodate this equipment, including different sizes and locations for connections, different electrical characteristics, different dimensions, different access requirements or any other differences which impact the project.
- G. Workmanship:
 - 1. General: All materials shall be installed in a neat and professional manner.
 - 2. Manufacturer's Instructions: Follow manufacturer's directions where they cover points not specifically indicated. If they are in conflict with the Drawings and Division 22 Specifications, obtain clarification before starting work.
- H. Cutting and Patching:
 - 1. Cutting, patching, and repairing for the proper installation and completion of the work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting shall be performed by skilled craftsmen of each respective trade in conformance with the appropriate Division of Work.
 - 2. Additional openings required in building construction shall be made by drilling or cutting. Use of jackhammer is specifically prohibited.
 - 3. Fill holes which are cut oversize so that a tight fit is obtained around the sleeves passing through.
 - 4. Beams or columns shall not be pierced without permission of Architect and then only as directed.
 - 5. All new cut or damaged shall be restored to its original condition. Where alterations disturb lawns, paving, walks, etc., the surfaces shall be repaired, refinished, and left in condition existing prior to commencement of work.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. The Contract Drawings indicate the general layout of the piping, and various items of equipment. Coordination with other trades and with field conditions will be required. For this purpose, prepare Shop Drawings of all piping, and equipment installations. Shop Drawings shall be new drawings prepared by Contractor and not reproductions or tracings of Architect's Drawings. Overlay drawings with shop drawings of other trades and check for conflicts. All drawings shall be same size as Architect's Drawings with title block similar to Contract Drawings and identifying Architect's Drawing number or any reference drawings. All drawings shall be fully dimensioned including both plan and elevation dimensions. Shop drawings cannot be used to make scope changes.
 - 2. Shop drawings shall be prepared in three-dimensional format.

3. Shop drawings shall include but are not limited to:
 - a. Plumbing site plan drawn to same scale as Site Plan.
 - b. Complete floor plans with plumbing to a minimum of 1/4-inch equals 1'-0" scale.
 - c. Plumbing in mechanical rooms to a minimum of 1/2-inch equal 1'-0" scale.
 - d. Sections of congested areas to a minimum of 1/2-inch = 1'-0" scale.
 - e. Superplot plans of above ground work with a colored overlay of all trades including, but not limited to, HVAC piping, HVAC equipment, plumbing piping and equipment, sprinklers, lighting, lighting controls, cable tray, fire alarm devices, electrical power conduit, and ceiling system to a minimum of 1/2" = 1'-0" scale.
 - f. Beam penetration drawings indicating beam penetrations meeting the requirements indicated on the floor plans and on the structural drawings to a minimum of 1/4" = 1'-0" scale.
 4. Submit shop drawings for review prior to beginning fabrication. Additional shop drawings may be requested when it appears that coordination issues are not being resolved in the field or when there is a question as to whether contract documents are being complied with or the design intent is being met.
- B. Product Data:
1. In general, submit product data for review on all scheduled pieces of equipment, on all equipment requiring electrical connections or connections by other trades, and as required by each specification section or by Drawing notes. Include manufacturer's detailed shop drawings, specifications, and data sheets. Data sheets shall include capacities, RPM, BHP, pressure drop, design and operating pressures, temperatures, and similar data. Manufacturer's abbreviations or codes are not acceptable.
 2. List the name of the motor manufacturer and service factor for each piece of equipment.
 3. Indicate equipment operating weights including bases and weight distribution at support points.
 4. In the case of equipment such as wiring devices, time switches, valves, etc., specified by specific catalog number, a statement of conformance will suffice.
- C. Submission Requirements:
1. Shop Drawings and Product Data:
 - a. Refer to Division 1 for additional requirements related to submittals.
 - b. Submit electronic copies of shop drawings and product data for Work of Division 22 in PDF format with each item filed under a folder and labeled with its respective specification section number, article, and paragraph and mark, if applicable.
 - c. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.
 - d. The bulk of the shop drawings and product data, excepting Controls and Instrumentation, shall be included with the original submittal. Controls and Instrumentation submittals may lag but shall be complete when submitted. Partial submittals will not be accepted. Other stragglers submitted after return of the original binder shall include a tab similar to that originally submitted. Upon receipt of the returned late submittal, insert them in the previously submitted binder.
- D. Contractor Responsibilities: It shall be the Contractor's responsibility to:
1. See that all submittals are submitted at one time and are in proper order.
 2. Ensure that all equipment will fit in the space provided.
 3. Assure that all deviations from Drawings and Specifications are specifically noted in the submittals. Failure to comply will void review automatically.

1.06 OPERATING AND MAINTENANCE MANUAL, PARTS LISTS, AND OWNERS INSTRUCTIONS

- A. Refer to Division 1 for additional requirements.

- B. Submit three bound copies of manufacturer's operation and maintenance instruction manuals and parts lists for each piece of equipment or item requiring servicing. Literature shall be on 8-1/2"x11" sheets or catalogs suitable for side binding. Submit data when the work is substantially complete, packaged separately, and clearly identified in durable 3-ring binder. Include name and contact information for location of source parts and service for each piece of equipment. Clearly mark and label in each submittal, the piece of equipment provided with the proper nameplate and model number identified. Provide wiring diagrams for all electrically powered equipment.
- C. Instruct Owner thoroughly in proper operation of equipment and systems, in accordance with manufacturer's instruction manuals. Operating instructions shall cover all phases of control.
- D. Furnish competent engineer knowledgeable in this building system for minimum of five 8-hour days to instruct Owner in operation and maintenance of systems and equipment. Contractor shall keep a log of this instruction including dates, times, subjects, and those present and shall present such log when requested by Architect.

1.07 PROJECT CONDITIONS

- A. Existing Conditions: Prior to bidding, verify and become familiar with all existing conditions by visiting the site, and include all factors which may affect the execution of this Work. Include all related costs in the initial bid proposal.
- B. Coordinate exact requirements governed by actual job conditions. Check all information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.
- C. Coordinate shutdown and start-up of existing, temporary, and new systems and utilities. Notify Owner, City and Utility Company.

1.08 WARRANTY

- A. Provide a written guaranty covering the work of this Division (for a period of one calendar year from the date of acceptance by the Owner) as required by the General Conditions.
- B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a period of one year from the date of Owner acceptance of Work of this Division.
- C. Correct warranty items promptly upon notification.

1.09 PROVISIONS FOR LARGE EQUIPMENT

- A. Contractor shall make provisions for the necessary openings in building to allow for admittance of all equipment.

1.010 TEST REPORTS AND CERTIFICATES

- A. Contractor shall submit one copy of all test reports and certificates specified herein to the Architect.

1.011 SUBSTITUTIONS

- A. Contractor shall submit any requests for product substitutions in accordance with the Instructions to Bidders and the General and Supplemental Conditions.

PART 2 PRODUCTS

2.01 ACCESS PANELS

- A. Furnish under this Division as specified in 08 31 13 Access Doors and Frames.

2.02 PIPE SLEEVES

- A. Interior Wall and Floor Sleeves: 18-gauge galvanized steel, or another pre-approved system.
- B. Interior Wall and Floor Sleeves (fire rated): Fire rated and water tight system approved by Authority Having Jurisdiction and Owners Insurance underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size, and service.

- C. Exterior Wall Sleeves Above Grade: Cast iron.

2.03 FLOOR, WALL, AND CEILING PLATES

- A. Furnish stamped split type plates as follows:
1. Floor Plates: Cast brass, chromium plated.
 2. Wall and Ceiling Plates: Spun aluminum.

2.04 MACHINERY GUARDS

- A. Furnish guards for protection on all rotating and moving parts of equipment. Provide guards for all metal fan drives and motor pulleys, regardless of being enclosed in a metal cabinet.
- B. Provide shaft holes in guards for easy use of tachometers at pulley centers. Guards shall be easily removable for pulley adjustment or removal and changing of belts.
- C. All guards shall meet OSHA requirements including back plates.

PART 3 EXECUTION

3.01 ACCESS PANELS

- A. Install in accord with manufacturer's recommendations, coordinated with architectural features.
- B. Provide 2-hour fire rated doors where required bearing the U.L. label.
- C. Furnish 18x18-inch panels for ceilings and for access to equipment in soffits and shafts, and 12x12-inch for walls unless indicated otherwise.
- D. Furnish where indicated and where required to access valves, trap primers, shock arresters, and other appurtenances requiring operation, service, or maintenance. Submit proposed locations for review prior to installation.

3.02 SLEEVES

- A. Interior Floor and Wall Sleeves: Provide sleeves large enough to provide 3/4-inch clearances around pipe or ductwork. Where pipe or ductwork is insulated, insulation shall pass continuously through sleeve with 3/4-inch clearance between insulation and sleeve. Penetrations through mechanical room and fan room floors shall be made watertight by packing with safin insulation and sealing with Tremco Dymeric Sealant or approved system.
- B. Sleeves Through Rated Floors and Walls: Similar to interior sleeves except install fire rated system approved by Authority Having Jurisdiction and Owners insurance underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size, and service.
- C. Exterior Wall Sleeves Above Grade: Similar to interior wall sleeves except caulk outside with Tremco Dymeric Sealant.
- D. Layout work prior to concrete forming. Do all cutting and patching required. Reinforce sleeves to prevent collapse during forming and pouring.
- E. All floor sleeves shall maintain a water barrier by providing a water tight seal or they shall extend 1-inch above finished floor except through mechanical equipment room floors and shafts where sleeves shall extend 2 inches above finished floor level. Sleeves through roof shall extend 8 inches above roof. Wall sleeves shall be flush with face of wall unless otherwise indicated. Waste stacks using carriers shall have sleeves flush with floor and sealed. Sleeves through planters shall extend 8 inches above planter base.
- F. Do not support pipes by resting pipe clamps on floor sleeves. Supplementary members shall be provided so pipes are floor supported.
- G. Special sleeves detailed on drawings shall take precedence over this section.

3.03 CLEANING

- A. General: Clean plumbing equipment, fixtures and piping of stampings and markings (except those required by codes), iron cuttings, and other refuse.
- B. Painted Surfaces: Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.

- C. Additional requirements are specified under specific Sections of this Division.

3.04 EQUIPMENT PROTECTION

- A. Keep pipe and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, conduit, fixtures, equipment, and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore damaged or contaminated fixtures, equipment, or apparatus to original conditions or replace at no cost to the Owner.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.
- C. Cover or otherwise suitably protect equipment and materials stored on the job site.

3.05 ACCESSIBILITY

- A. General: Locate valves, thermometers, cleanout fittings and other indicating equipment or specialties requiring frequent reading, adjustments, inspection, repairs, and removal or replacement conveniently and accessibly with reference to the finished building.
- B. Thermometers and Gauges: Install thermometers and gauges so as to be easily read from the floors, platforms, and walkways.

3.06 FLOOR, WALL, AND CEILING PLATES

- A. Install on piping and ductwork passing through finished walls, floors, ceilings, partitions, and plaster furrings. Plates shall completely cover opening around pipe.
- B. Secure wall and ceiling plates to pipe, insulation, or structure.
- C. Plates shall not penetrate insulation vapor barriers.
- D. Plates not required in mechanical rooms or unfinished spaces.

3.07 PAINTING

- A. General: Coordinate painting of mechanical equipment and items with products and methods in conformance with the appropriate Division of Work, Painting. All exposed work under this division shall receive either a factory painted finish or a field prime coat finish, except:
 - 1. Exposed copper piping.
 - 2. Aluminum jacketed outdoor insulated piping.
- B. Equipment Rooms and Finished Areas:
 - 1. Insulation: Not painted.
 - 2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Structural Steel Stands, Uninsulated Tanks, and Equipment Bases: Paint one coat of black enamel.
 - 3. Steel Valve Bodies and Bonnets: One coat of black enamel.
 - 4. Brass Valve Bodies: Not painted.
 - 5. Equipment: One coat of grey machinery enamel. Do not paint nameplates.
- C. Concealed Spaces (above ceilings, not visible):
 - 1. Insulation: Not painted.
 - 2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Valve Bodies and Bonnets: Not painted.
- D. Exterior Steel: Wire brush and apply two coats of rust-inhibiting primer and one coat of grey exterior machinery enamel.
- E. Exterior Black Steel Pipe: Wire brush and apply two coats of rust-inhibiting primer and one coat of exterior enamel. Painting schemes shall comply with ANSI A13.1.

3.08 ADJUSTING AND CLEANING

- A. Before operating any equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made accordingly and that recommended lubricants have been used.

- B. Use particular care in lubricating bearings to avoid damage by over lubrication and blowing out seals. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment as approved or replace with new equipment.

3.09 ELECTRICAL EQUIPMENT

- A. Piping for plumbing systems not serving electrical space shall not be installed in any switchgear room, transformer vault, telephone room, or electric closet except as indicated.
- B. Piping for plumbing systems shall not pass over switchboards or electrical panelboards. Where conflicts exist, bring to attention of Architect.

3.010 EQUIPMENT CONNECTIONS

- A. Make final connections to equipment specified in sections other than Division 22 of the specifications and Owner furnished equipment in accordance with manufacturer's instructions and shop drawings furnished and as indicated.
- B. Piping:
 - 1. Connections shall include hot and cold water, natural gas, lab air, sanitary waste and vent, lab waste and vent.
 - 2. Provide valves and specialties as specified and as detailed on the Drawings. Provide increasers, reducers, and any other fittings required for complete installation.
 - 3. All piping connections shall be independently supported to prevent undue strain on equipment.

END OF SECTION

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SECTION 22 05 29
HANGERS, SUPPORTS AND ANCHORS FOR PLUMBING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The provisions of Section 22 05 00, Common Work Results for Plumbing apply to work specified in this Section.

1.02 SUMMARY

- A. This Section includes Supports and anchors for piping systems and equipment.
- B. Related Sections include:
 - 1. Section 22 05 48 Vibration and Seismic Controls for Plumbing Piping and Equipment.

1.03 SUBMITTALS

- A. Submit the following:
 - 1. Shop Drawings of contractor fabricated piping support structures.
 - 2. No other submittals required under this section.

PART 2 PRODUCTS

2.01 SUPPORTS, ANCHORAGE AND RESTRAINT

- A. General: Provide pipe and equipment hangers and supports in accordance with the following:
 - 1. When supports, anchorages, and seismic restraints for equipment, and supports and seismic restraints for conduit, piping, and ductwork are not shown on the Drawings, the contractor shall be responsible for their design.
 - 2. Seismic restraints and anchorages shall resist seismic forces as specified in the latest edition of the International Building Code for the seismic zone in which the project is constructed.
 - a. Emergency Shelter Requirements:
 - 1) Seismic restraints and anchorages for potable water and waste systems in areas noted to be included as part of the resiliency plan (or emergency shelter) shall be designed to resist seismic forces per category IV requirements of the currently adopted Oregon Structural Specialty Code (OSSC). These areas include:
 - a) Commons 103
 - b) Kitchen 158
 - c) Student Restroom BR101 and GR101 (adjacent to Commons)
 - b. All other systems and areas to be designed per Category III requirements of the currently adopted Oregon Structural Specialty Code (OSSC).
 - 3. Seismic restraint shall not introduce excessive stresses in the piping caused by thermal expansion or contraction.
 - 4. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
 - 5. Seismic restraints shall be in accordance with the latest edition of the SMACNA "Seismic Restraint Manual - Guidelines for Mechanical Systems" for the Seismic Hazard Level corresponding to the seismic zone in which the project is constructed.
 - 6. Seismic restraints shall be in accordance with the applicable code.
 - 7. Seismic restraints shall follow the provisions described in Section 22 05 48 Vibration and Seismic Controls for Plumbing Piping and Equipment.
- B. Engineered Support Systems: The following support systems shall be designed, detailed, and bear the seal of a professional engineer registered in the State having jurisdiction.
 - 1. Supports and seismic restraints for suspended piping and equipment.

2. Support frames such as pipe racks or stanchions for piping and equipment which provide support from below.
3. Equipment and piping support frame anchorage to supporting slab or structure.

2.02 SUPPORTS, GENERAL

- A. Fabricate support members from welded standard structural shapes, pipe, and plate to carry the necessary rollers, hangers, and accessories as required. Support piping less than 4-inch pipe size from or by prefabricated roll-formed channels with necessary accessories to adequately support piping system.
- B. Acceptable Manufacturers: Unistrut, Superstrut, Powerstrut and Kinline, B-Line Systems, AnvilStrut.
- C. Supports and Accessories: Preformed roll-formed channels and accessories with matching compatible accessories as shown, as specified, and as required.
- D. Dissimilar Metal Protection: Hydra-Zorb cushions or Cush-a-strip.
- E. Clamps: Super Strut Series 700 through 702 or AnvilStrut Series 1000 through 1200.

2.03 PIPE ATTACHMENTS

- A. Acceptable Manufacturers: Anvil as noted or equivalent products by Superstrut, B-Line Systems, Tolco, Michigan Hanger.
- B. Uninsulated Horizontal Copper Piping:
 1. 2-inch and Smaller: Anvil CT-65, CT-69, CT-99C.
 2. Larger than 2-inch: Anvil 260 field or factory copper plated, plastic coated or other recognized industry methods. Electricians' tape is unacceptable.
- C. Insulated Horizontal Copper Pipe with Hangers Inside of Insulation: Same as Uninsulated Horizontal Copper Pipe.
- D. Insulated Horizontal Copper Pipe with Hangers Outside of Insulation:
 1. 2-inch and Smaller: Anvil 65, 70, 104 or 260.
 2. Larger than 2-inch: Anvil 260.
- E. Other Uninsulated Horizontal Pipe:
 1. 2-inch and Smaller: Anvil 65, 70, 104 or 260.
 2. Larger than 2-inch: Anvil 260.
- F. Other Insulated Horizontal Pipe with Hangers Inside of Insulation:
 1. 2-inch and Smaller: Anvil 65, 70, 104, 260 or 300.
 2. Larger than 2-inch: Anvil 260.
- G. Other Insulated Horizontal Pipe with Hangers Outside of Insulation:
 1. 2-inch and Smaller: Anvil 65, 70, 104 or 260.
 2. Larger than 2-inch: Anvil 260.
- H. Riser Clamps Copper Pipe:
 1. 4-inch and Smaller: Anvil CT-121, CT-121C or 261C.
 2. Larger than 4-inch: Anvil 261C.
- I. Riser Clamps Other Piping: Anvil 261.

2.04 PIPE ROLLERS, INSULATION PROTECTION SHIELDS AND INSULATION PROTECTION SADDLES

- A. Acceptable Manufacturers: Anvil as noted or equivalent Super Strut, B-Line Systems, Tolco, Michigan Hangers.
- B. Pipe Rollers: Anvil 174 or 274 as required. Size for pipe plus insulation for insulated pipe.
- C. Insulation Protection Shields: Anvil 167.
- D. Insulation Protection Saddles: Anvil 160 through 166A as required. Saddles for copper pipe, factory, or field copper plated.

2.05 BUILDING ATTACHMENTS

- A. Acceptable Manufacturers: Anvil as listed or equivalent products by Elcen, Superstrut, B-Line Systems, Tolco, Michigan Hangers.
- B. Beam Hangers:
 - 1. On piping 6-inch and smaller: Anvil 86 with retaining clip Fig. 89.
 - 2. On piping larger than 6-inch: Anvil 228, or 292.
- C. Inserts: Anvil 152 malleable iron or 281 steel inserts. Inserts sized for required rod to support load being carried.
- D. Expansion Plugs: Similar and equal to Phillips "red-head" self-drilling flush shell selected for safety factor of 4.
- E. Powder actuated fasteners with silencers as approved by Architect.

PART 3 EXECUTION

3.01 HANGERS AND SUPPORTS

- A. General:
 - 1. Install all support systems as detailed and in accordance with manufacturer's recommendations. Provide pipe racks, pipe stands, trapeze hangers, etc., as required and as detailed on the Drawings.
 - 2. Provide adjustable hangers for all pipes complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., except where specified otherwise.
 - 3. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping and do not support piping from other piping.
 - 4. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
 - 5. Install all cast iron piping in accordance with Cast Iron Soil Pipe Industry (CISPI) Standards.
 - 6. Support all piping within 2 feet of each change of direction on both sides of fitting.
- B. Insulated Piping Systems:
 - 1. See Section 22 07 00 for insulation requirements.
 - 2. Insulated Piping Systems with Vapor Barrier Insulation:
 - a. Install hangers outside of insulation.
 - b. On piping 1-1/2-inch and larger, provide insulation protection shields at each support location.
 - 3. Insulated Piping Systems with Non-Vapor Barrier Insulation:
 - a. At the contractor's option, hangers may be installed inside or outside of insulation for piping 2-inch and smaller.
 - b. If hangers are installed outside of insulation, provide insulation protection shields at all support locations on piping 1-1/2-inch and larger.
 - c. On piping larger than 2-inch, provide insulation saddles at each support location.
 - 4. Insulation Protection:
 - a. Band insulation protection shields firmly to insulation to prevent slippage.
 - b. Tack weld insulation protection saddles to steel pipe. Braze saddles to copper pipe.
- C. Vertical Piping:
 - 1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
 - 2. Riser clamps on steel pipe to be directly welded to pipe. Riser clamps on copper pipe to be installed directly under fitting.
 - 3. Risers that are not subject to thermal change to be supported at each floor of penetration.

4. Risers that are subject to thermal change require engineered supports. Size supports to carry all forces exerted by piping system when in operation. Riser supports shall follow the provisions described in Section 22 05 48, Vibration and Seismic Controls for Plumbing Piping and Equipment.
- D. Horizontal Piping:
1. Trapeze Hangers: Multiple pipe runs where indicated shall be supported on channels with rust resistant finish. Provide all necessary rods and supporting steel.
 2. Support Spacing: Provide support at minimum spacing per MSS SP-69-1996 Pipe Hangers and Supports - Selection and Application:
 - a. Support piping within 2 feet of each change in direction.
 - b. Steel Pipe, Copper Tubing:

Minimum Pipe Size	Max. Span Steel	Max. Span Copper	Rod Size
1-inch and smaller	7 feet	5 feet	1/4-inch
1-1/4-inch to 2-inch	8 feet	8 feet	3/8-inch
2-1/2-inch to 3-inch	11 feet	9 feet	1/2-inch
4-inch to 5-inch	14 feet	12 feet	1/2-inch
6-inch	17 feet	14 feet	1/2-inch
8-inch or larger	19 feet	16 feet	5/8-inch
 - c. Plumbing Piping: Support in accordance with local plumbing code.
 - d. Piping provided with acoustical lagging wrap shall be supported a maximum of 5 feet on center. Install hangers outside of acoustical lagging.
- E. Building Attachments:
1. Fastening or attaching to steel deck (without concrete fill) is prohibited. It will be necessary to support all piping from structural members, beams, joists, or provide intermediate angle iron supporting members between joists. Supports may be attached to concrete filled steel deck with load limitations shown on the structural drawings or otherwise obtained from the structural engineer.
 2. Provide horizontal bracing on all horizontal runs 1-1/2 inch and larger and exceeding 50-feet in length at 75-foot intervals and as required to provide stabilized piping systems.
 3. Provide all additional structural steel angles, channels, or other members required to support piping where structures do not occur as required for proper support.
 4. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points.

END OF SECTION

SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes:
 - 1. Neoprene Waffle Pad, Type 1
 - 2. Restrained Neoprene Mount, Type 2
 - 3. Springs, Type 3
 - 4. Springs with Restraints, Type 4
 - 5. Base with Springs, Type 5
 - 6. Inertia Base with Springs, Type 6
 - 7. Isolating Spring Hangers, Type 7
 - 8. Isolating Neoprene Hangers, Type 8
 - 9. Isolating Sleeves
 - 10. Seismic Restraints
 - 11. Flexible Sphere Connector
 - 12. Flexible Hose Connector
 - 13. Expansion Joint/Seismic Connector

1.02 RELATED SECTIONS

- A. Division 01, General Requirements
- B. Division 22, Plumbing
- C. Section 22 05 29 Hangers, Supports and Anchors for Plumbing

1.03 QUALITY ASSURANCE

- A. Select a single manufacturer and furnish isolation required, except packaged equipment with integral isolators meeting all the isolation and seismic requirements of this specification.
- B. Isolation performance requirements are indicated in the specifications. All deflections indicated are nominal static deflections for specific equipment supported.
- C. Isolator Stability and Rated Capacity:
 - 1. Spring diameters not less than 0.8 of the compressed height of the spring at rated load.
 - 2. Springs have a minimum additional travel to solid equal to 50 percent of the rated deflection.
- D. Seismic Restraints:
 - 1. Restraint of equipment and piping to be in accordance with the current state and local Building Code.
 - 2. Calculations in accordance with current state and local Building Code.

1.04 SUBMITTALS

- A. Submit the following:
 - 1. Submit Shop Drawings showing complete details of construction for steel and concrete bases including:
 - a. Equipment mounting holes.
 - b. Dimensions
 - c. Isolation selected for each support point
 - d. Details of mounting brackets for isolator
 - e. Weight distribution for each isolator
 - f. Code number assigned to each isolator
 - 2. Submit product data and calculation sheets for isolators, showing:
 - a. Size, type, load rating, and rated deflection of each required isolator.
 - b. Percent of vibration transmitted based on the lowest disturbing frequency of the equipment.

- B. Installation report as specified in PART 3 of this Section.
- C. Operation and maintenance data.

1.05 EQUIPMENT VIBRATION ISOLATION

- A. Provide a balanced set of vibration isolators for each piece of equipment listed in the Equipment Schedules.
- B. Isolation work to include, but not necessarily be limited to, the following:
 - 1. Isolation support of motor-driven equipment.
 - 2. Inertia base frames in conjunction with isolation.
 - 3. Isolation support of piping and piping risers.
 - 4. Penetration isolation of pipework and conduits through walls, floors, or ceilings.
 - 5. Flexible connections of piping to equipment.
- C. Each piece of rotating equipment must meet a reasonable criterion for maximum vibration levels at each bearing, while in operation. The criteria for varying operating speeds are given as follows:
 - 1. Rotating equipment operating peak vibration velocities must not exceed 0.08 in./sec.
 - 2. If it is discovered that the operating vibration velocities exceed this criteria, the equipment repaired or replaced at no expense to the owner until approval of the equipment is given by the engineer.
- D. Provide components or materials not specially mentioned herein, but necessary to the proper vibration isolation of the equipment.

1.06 CONTRACTOR RESPONSIBILITY

- A. Vibration isolation devices, including auxiliary steel bases and pouring forms, designed and furnished by a single manufacturer or suppliers.
- B. Adequately restrain equipment and piping to resist seismic forces. Design and select restraint devices to meet seismic requirements as defined in the latest issue of the International Building Code under Earthquake Design and applicable state and local codes.
- C. Selection, installation, adjustment, and performance of vibration isolators which will meet the requirements given on the plans or in the specifications.
- D. Provide Engineering drawings, details, supervision, and instruction to assure proper installation and performance.
- E. Provide whatever assistance necessary to ensure correct installation and adjustment of the isolators.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. General:
 - 1. Amber Booth
 - 2. Mason Industries, Inc.
 - 3. Kinetics Noise Control
 - 4. Vibrex
 - 5. Approved equal, meeting the conditions and requirements specified herein.
- B. Neoprene Waffle Pad, Type 1:
 - 1. Mason Type Super W or Super WM
 - 2. HG Grommet; Similar Amber-Booth
 - 3. Kinetics Noise Control
- C. Restrained Neoprene Mount, Type 2:
 - 1. Mason Type BR
- D. Springs, Type 3:
 - 1. Mason Type SLF
 - 2. Amber-Booth Type SW

- 3. Kinetics Noise Control
- 4. Vibrex
- E. Springs with Restraints, Type 4:
 - 1. Mason type SSLR or SLRS with seismic restraints
 - 2. Amber-Booth
 - 3. Kinetics Noise Control Model FYS
 - 4. Vibrex
- F. Base with Springs, Type 5:
 - 1. Mason
 - 2. Amber-Booth
 - 3. Kinetics Noise Control
 - 4. Vibrex
- G. Inertia Base with Springs, Type 6:
 - 1. Mason
 - 2. Amber-Booth
 - 3. Kinetics Noise Control
 - 4. Vibrex
- H. Isolating Spring Hangers, Type 7:
 - 1. Mason 30N
 - 2. Amber-Booth
 - 3. Kinetics Noise Control
 - 4. Vibrex
- I. Isolating Neoprene Hangers, Type 8:
 - 1. Mason HD
 - 2. Amber-Booth
 - 3. Kinetics Noise Control
 - 4. Vibrex
- J. Isolating Sleeves:
 - 1. Potter-Roemer PR Isolators
 - 2. Grinnell Semco Trisolators
- K. Flexible Sphere Connector:
 - 1. Mason Type SFU, SFDEJ or SFEJ
- L. Flexible Hose Connector:
 - 1. Mason Type BSS, FFL, MN, CPS or CPSB
 - 2. HCl
 - 3. Metraflex

2.02 NEOPRENE WAFFLE PAD, TYPE 1

- A. 3/4-inch thick neoprene waffle pads with pattern repeating on 1/2-inch centers.
- B. Select Duro rating for maximum deflection at average load rating.
- C. Include load distribution steel plate as required.
- D. Include anchor bolt grommet as required.

2.03 RESTRAINED NEOPRENE MOUNT, TYPE 2

- A. Bridge-bearing neoprene mountings have a minimum static deflection of 0.2-inches and all directional seismic capability.
- B. Ductile iron casting containing two separated and opposing molded neoprene elements.
- C. Prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation.
- D. Compound shock absorbing neoprene materials to bridge-bearing specifications.

2.04 SPRINGS, TYPE 3

- A. Free standing springs without housings.
- B. 1/4-inch thick molded neoprene cup with steel reinforcement washer or neoprene acoustical friction pads between base plate and support.
- C. Leveling bolt mounting with height saving brackets.
- D. Springs mounted outboard of channels.
- E. Attach baseplate screws using neoprene bushings and washers.
- F. Spring diameters not less than 0.8 of the compressed height of the spring at rated load.

2.05 SPRINGS WITH RESTRAINTS, TYPE 4

- A. Same as springs except housing with seismic restraints to be added.
- B. Seismic restraint with molded all directional neoprene bushings an integral part of isolator.
- C. Seismic restraint selected for minimum safety factor of 2 from ultimate seismic capacity.
- D. Spring mount must have neoprene cup or pad inside the seismic housing to allow anchoring of the housing baseplate without short circuiting pad.

2.06 BASE WITH SPRINGS, TYPE 5

- A. Steel Isolating Frame:
 - 1. Mason WFSL with WF steel beams with a minimum depth of 10 percent of the span between supports.
 - 2. Provide external height saving brackets.

2.07 INERTIA BASE WITH SPRINGS, TYPE 6

- A. Inertia Bases:
 - 1. Mason BMK or KSL with 1/2-inch square bar reinforcing, integral height saving brackets and steel templates with anchor bolts sleeves.
 - 2. Bases must be sized to fit stanchions for pump elbows or suction diffusers.
 - 3. Depth of base equal to 8 percent of the span between supports, 6-inch minimum.

2.08 ISOLATING SPRING HANGERS, TYPE 7

- A. Combination rubber-in shear and steel spring isolators installed on the hanger rods.
- B. Proper deflection to allow the piping to deflect as a unit with the pump isolators.
- C. Hangers designed for 30 degree angular movement.
- D. Minimum Deflection: 1-inch

2.09 ISOLATING NEOPRENE HANGERS, TYPE 8

- A. Double deflection neoprene hangers, minimum static deflection of 0.35-inches.
- B. Provide projecting bushing to prevent steel to steel contact.

2.010 ISOLATING SLEEVES

- A. Provided for piping through walls and floors of penthouses and chiller room.
- B. Size for piping as required.

2.011 SEISMIC RESTRAINTS

- A. General Requirements:
 - 1. Provide for equipment and piping, both supported and suspended.
 - 2. Bracing of piping in accordance with the code and with the provisions set forth in the SMACNA seismic restraint manual.
 - 3. Structural requirements for the restraints, including their attachment to the building structure, reviewed and approved by the structural engineer.
 - 4. Attachments to supported or suspended equipment must be coordinated with the equipment manufacturer.

- B. Supported Equipment:
1. All-directional seismic snubbers consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene.
 2. Replaceable bushing and a minimum of 1/4-inch thick. Rated loadings not to exceed 1000 psi.
 3. Incorporate an air gap of 1/4-inch be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces.
 4. Removable snubber end caps to allow inspection of internal clearances. Neoprene bushings rotated to ensure no short circuits exist before systems are activated.
 5. Snubber Mason Industries, Inc. Type Z-1225
- C. Bracing of Pipes:
1. Provide seismic bracing of all piping as detailed below to meet the building code requirements:
 - a. Exception:
 - 1) Piping suspended by individual hanger's 12-inches or less in length, as measured from the top of the pipe to the bottom of the support where the hanger is attached, need not be braced where the following criteria are met.
 - a) Seismic braces are not required on high deformability piping when the $I_p=1.0$ and provisions are made to avoid impact with larger pipe or mechanical components or to protect the pipe in the event of such impact and the nominal pipe size is 3-inches diameter or less.
 - b) Seismic braces are not required on high deformability piping when the $I_p=1.5$ and provisions are made to avoid impact with larger pipe or mechanical components or to protect the pipe in the event of such impact and the nominal pipe size is 1-inch diameter or less.
 2. Seismic braces for pipes on trapeze hangers may be used.
 3. Provide flexibility in joints where pipes pass through building seismic joints or expansion joints, or where pipes connect to equipment.
 4. Cast iron pipe of all types, glass pipe, and any other pipe jointed with a shield and clamp assembly, where the top of the pipe is 12-inches or more from the supporting structure, braced on each side of a change in direction of 90 degrees or more. Riser joints on unsupported sections of piping braced or stabilized between floors.
 5. Vertical Risers:
 - a. Laterally supported with a riser clamp at each floor.
 - b. For buildings greater than six stories high or for piping subject to thermal change risers engineered individually.
- D. Suspended Equipment and Piping:
1. Seismic cable restraints consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint.
 2. Pre-stretch cable to achieve a certified minimum modulus of elasticity. Cable end connections steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement.
 3. Cable Assemblies: Mason Industries, Inc. Type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod and the clevis or SCBV if clamped to a beam.
 4. Steel angles, sized to prevent buckling, clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies Mason Industries, Inc. Type SRC, or UC.
 5. Pipe clevis cross-bolt braces are required in all restraint locations. Special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross brace Mason Industries, Inc. Type CCB.

2.012 FLEXIBLE SPHERE CONNECTOR

- A. Flexible EPDM pipe connectors manufactured of multiple plies of Kevlar tire cord fabric and EPDM; both molded and cured in hydraulic rubber presses. Do not use steel wire or rings as pressure reinforcement.
- B. Connectors up to and including 2-inch diameter may have a single sphere and threaded ends. Connectors 2-1/2-inch and larger manufactured with twin spheres up to 12-inches and a single sphere on larger sizes and floating steel flanges recessed to lock the connectors raised face EPDM flanges.
- C. Rated a minimum of 150 psi at 220 degrees F. Pre-extended as recommended by the manufacturer to prevent additional elongation under pressure.

2.013 FLEXIBLE HOSE CONNECTOR

- A. Flexible stainless steel hoses manufactured using type 304 stainless steel hose and braid with one fixed and one floating raised face carbon steel plate flange.
- B. Sizes 2-1/2-inch and smaller may have threaded male nipples or copper sweat ends. Grooved ends are acceptable in all sizes in grooved piping systems. Weld ends are not acceptable. Copper sweat end hoses for water service all copper or bronze construction.
- C. Close pitch annular corrugations for maximum flexibility and low stiffness. Tested hose stiffness at various pressures must be included in the submittals.
- D. Capable of continuous operation at 150 psi and system test pressure when installed in piping systems.
- E. Same size as the pipe it connects and have pipe thread connectors on both ends with male or female end adapters as required.

2.014 EXPANSION JOINT/SEISMIC CONNECTOR

- A. T304 stainless steel hose and braid, Schedule 40 radius elbows and 180 degree bend, flange or weld end Schedule 40 fittings. ASA certified when used for natural gas service. Metraflex Metaloop only.
- B. Connector accepts differential support displacement without damaging pipe, equipment connections, or support connections.

PART 3 EXECUTION

3.01 GENERAL

- A. Do not install equipment or pipe which makes rigid contact with the building.
- B. Installation or use of vibration isolators must not cause any change of position of equipment or piping which would result in stresses in piping connections or misalignment of shafts or bearings. In order to meet this objective, equipment, and piping maintained in a rigid position during installation. Load not transferred to the isolator until the installation is complete and under full operational load.
- C. Correct, at no additional cost, all installations which are defective in workmanship or materials.

3.02 PREPARATION

- A. Treat isolators, including springs, hardware, and housing, with a corrosion protective coating of epoxy powder or electro galvanizing.
- B. Coat steel frames exposed to weather with a rustproof metal primer.
- C. Provide hot dipped galvanizing on steel frames as indicated on the plans for corrosion protection in severe conditions.

3.03 INSTALLATION

- A. General:
 - 1. Install isolation where indicated on the Drawings by type and location and where indicated below.

2. Mark assigned code number on isolators and bases to assure placement in the proper location.
 3. Anchor isolator seismic housing baseplate to floor.
 4. Provide rubber grommets and washers to isolate the bolt from the building structure. Do not destroy the isolation efficiency destroyed when bolting the isolators to the building structure.
- B. Type 1 Neoprene Waffle Pad: Service: Boilers
- C. Type 2 Restrained Neoprene Mount: Service: TBD
- D. Type 3 Springs: Service: TBD
- E. Type 4 Springs with Restraints: Service: TBD
- F. Type 5 Base with Springs: Service:
1. Air Compressors
- G. Type 7 Isolating Spring Hangers: Service:
1. In-Line Circulating Pumps
 2. Piping rigidly connected to rotating equipment
- H. Type 8 Isolating Neoprene Hangers: Service: In-Line Circulating Pumps
- I. Flexible Connectors:
1. Flexible Hose Connectors: Provide as indicated on the drawings and for the following services:
 - a. Hot water
 2. Expansion Joint/Seismic Connector: Provide for piping services where they cross expansion or seismic joints.

3.04 SEISMIC RESTRAINTS

- A. General:
1. Install and adjust seismic restraints so that the equipment and piping support is not degraded by the restraints.
 2. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.
- B. Supported Equipment:
1. Each vibration isolation frame for supported equipment have a minimum of four seismic snubbers mounted as close as possible to the vibration isolators and/or the frame extremities.
 2. Care must be taken so that the 1/4-inch air gap in the seismic restraint snubber is preserved on all sides in order that the vibration isolation potential of the isolator is not compromised. This requires that the final snubber adjustment be completed after the vibration isolators are properly installed and the installation approved.
- C. Bracing of Pipes:
1. Branch lines may not be used to brace main lines.
 2. Transverse Bracing: Maximum 40-feet, except where a lesser spacing is indicated in the SMACNA tables for bracing of pipes
 3. Longitudinal bracing at 80-feet maximum except where a lesser spacing is indicated in the tables. In pipes where thermal expansion is a consideration, an anchor point may be used as the specified longitudinal brace provided that it has a capacity to resist both the seismic load and the additional force induced by expansion and contraction.
 4. A rigid piping system not be braced to dissimilar parts of the building or to two dissimilar building systems that may respond differently during an earthquake.
 5. Transverse bracing for one pipe section may also act as longitudinal bracing for a pipe section of the same size connected perpendicular to it if the bracing is installed within 24 inches of the elbow or tee.

6. Subject to confirmation by field inspection, seismic bracing is not required on piping when the piping is supported by rod hangers and the hangers in the entire run are 12-inches or less in length from the top of the pipe to the supporting structure, hangers are detailed to avoid bending of the hangers and their attachments and provisions are made for piping to accommodate expected deflections.
- D. Suspended Equipment, Piping, Cable Method:
 1. Adjust cables to a degree of slackness approved by the Structural Engineer.
 2. Uplift and downward restraint nuts and Mason type RW neoprene covered steel rebound washers for the Type 6 hangers adjusted with a maximum 1/4-inch clearance.

3.05 FIELD QUALITY CONTROL

- A. Installation Report: Isolation manufacturer's representative confirms that isolation is installed correctly and submit report stating that isolators are installed as shown on Shop Drawings, isolators are free to work properly, and that installed deflections are as scheduled and as specified.

END OF SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

- A. The intent of Division 23, HVAC Specifications and the accompanying Drawings is to provide a complete and workable facility with complete systems as shown, specified and required by applicable codes. Include work specified in Division 23, HVAC and shown on the accompanying Drawings, including appurtenances, connections, etc., in the finished job.
- B. Division 23, HVAC Specifications are intended to provide requirements as they relate to new equipment and products required to reconfigure and refurbish existing systems as described in the contract documents.
- C. The Drawings that accompany the Division 23, HVAC Specifications are diagrammatic. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Offsets and transitions assumed at a minimum at each duct crossing, structural penetrations through shear walls or beams, structural grids where ceiling heights are restricted, and at piping mains. Follow the Drawing as closely as is practical to do so and install additional bends, offsets and elbows where required by local conditions from measurements taken at the Building, subject to approval, and without additional cost to the Owner. The right is reserved to make any reasonable changes in outlet location prior to roughing-in, without cost impact.
- D. The General and Supplemental Conditions apply to this Division, including but not limited to:
 - 1. Drawings and specifications.
 - 2. Public ordinances, permits.
 - 3. Include payments and fees required by governing authorities for work of this Division.
- E. Division 01, General Requirements, General Requirements, applies to this Division.

1.02 RELATED SECTIONS

- A. Division 01, General Requirements
- B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Products and equipment prohibited from containing pentabrominated, octabrominated, and decabrominated diphenyl ethers. Where products or equipment within this specification contain these banned substances, provide complying products and equipment from approved manufacturers with equal performance characteristics.
 - 2. General: Work and materials conforms to the local and State codes, and Federal, State, and other applicable laws and regulations.
 - 3. Contractor responsible for obtaining and payment for permits, licenses, and inspection certificates required in accordance with provisions of Contract Documents.
- B. New materials and equipment. Work of good quality, free of faults and defects and in conformance with the Contract Documents.
- C. Apparatus built and installed to deliver its full rated capacity at the efficiency for which it was designed.
- D. The entire mechanical system and apparatus operates at full capacity without objectionable noise or vibration.
- E. Install equipment level and true. Housekeeping pads and curbs account for floor or roof slope.

F. Materials and Equipment:

1. Each piece of equipment furnished meet detailed requirements of the Drawings and Specifications and suitable for the installation shown. Equipment not meeting requirements will not be acceptable, even though specified by name along with other manufacturers.
2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer. Component parts of the entire system need not be products of same manufacturer.
3. Furnish materials and equipment of size, make, type, and quality herein specified.
4. Equipment scheduled by performance or model number considered the basis of the design. If other specified manufacturer's equipment is provided in lieu of the basis of design equipment the contractor is responsible for changes and costs which may be necessary to accommodate this equipment, including different sizes and locations for connections, different electrical characteristics, different dimensions, different access requirements, or any other differences which impact the project.

G. Workmanship:

1. General: Install materials in a neat and professional manner.
2. Manufacturer's Instructions:
 - a. Follow manufacturer's directions where they cover points not specifically indicated.
 - b. If conflict with the Drawings and Division 23, HVAC Specifications, obtain clarification before starting work.

H. Cutting and Patching:

1. Cutting, patching, and repairing for the proper installation and completion of the work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting performed by skilled craftsmen of each respective trade in conformance with the appropriate Division of Work.
2. Additional openings required in building construction made by drilling or cutting. Use of jackhammer is specifically prohibited.
3. Fill holes which are cut oversize so that a tight fit is obtained around the sleeves passing through.
4. Do not pierce beams or columns without permission of Architect and then only as directed.
5. Restore new or existing work cut or damaged to its original condition. Where alterations disturb lawns, paving, walks, etc., surfaces repaired, refinished, and left in condition existing prior to commencement of work.

1.04 SUBMITTALS

A. Shop Drawings:

1. The Contract Drawings indicate the general layout of the piping, ductwork, and various items of equipment. Coordination with other trades and with field conditions will be required. For this purpose, prepare Shop Drawings of piping, ductwork, and equipment installations. Shop Drawings new drawings prepared by Contractor and not reproductions or tracings of Architect's Drawings. Overlay drawings with shop drawings of other trades and check for conflicts. Drawings the same size as Architect's Drawings with title block similar to Contract Drawings and identifying Architect's Drawing number or any reference drawings. Drawings fully dimensioned including both plan and elevation dimensions. Shop drawings cannot be used to make scope changes.
2. Prepare in two-dimensional format.
3. Include but are not limited to:
 - a. Complete floor plans with sheet metal and HVAC piping to a minimum of 1/4-inch equals 1-foot scale.
 - b. Sheet metal and HVAC piping of mechanical and fan rooms to a minimum of 1/2-inch equals 1-foot scale.
 - c. Sections of congested areas to a minimum of 1/2-inch equals 1-foot scale.

- d. Beam penetration drawings indicating beam penetrations meeting the requirements indicated on the floor plans and on the structural drawings to a minimum of 1/4-inch equals 1-foot scale.
 - e. Slab penetration drawings of HVAC, plumbing, sprinklers, lighting and electrical to a minimum of 1/4-inch equals 1-foot scale.
 - f. Fabrication drawings of radiant ceiling panels, architectural metal ceiling, including panel penetrations for lighting, sprinkler heads, fire alarm devices, and any other penetrations.
4. Submit shop drawings for review prior to beginning fabrication. Additional shop drawings may be requested when it appears that coordination issues are not being resolved in the field or when there is a question as to whether contract documents are being complied with or the design intent is being met.
- B. Product Data:
1. In general, submit product data for review on scheduled pieces of equipment, on equipment requiring electrical connections or connections by other trades, and as required by each specification section or by Drawing notes. Include manufacturer's detailed shop drawings, specifications, and data sheets. Data sheets include capacities, RPM, BHP, pressure drop, design and operating pressures, temperatures, and similar data. Manufacturer's abbreviations or codes are not acceptable.
 2. In the case of equipment such as wiring devices, time switches, valves, etc., specified by specific catalog number, a statement of conformance will suffice.
- C. Submission Requirements:
1. Shop Drawings and Product Data:
 - a. Refer to Division 01, General Requirements for additional requirements related to submittals.
 - b. Submit electronic copies of shop drawings and product data for Work of Division 23, HVAC in PDF format with each item filed under a folder and labeled with its respective specification section number, Article and paragraph and mark if applicable.
 - c. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.
 - d. Partial submittals will not be accepted. Other stragglers submitted after return of the original binder includes a tab similar to that originally submitted. Upon receipt of the returned late submittal, insert them in the previously submitted binder.
- D. Contractor Responsibilities:
1. Submit submittals one time and are in proper order.
 2. Ensure that equipment will fit in the space provided.
 3. Assure that deviations from Drawings and Specifications are specifically noted in the submittals. Failure to comply will void review automatically.

1.05 AS-BUILT DRAWINGS

- A. Provide record drawings at the end of the project on CD-ROM.
- B. Record drawings in the following source format:
 1. AutoCAD
- C. Record Drawings: Provide hard copies and pdf format.
 1. Drawings include the following:
 - a. Project Specific Titleblock.
 - b. Notations reflecting the as built conditions of any additions to or variations from the construction documents provided as part of the BIM coordination, RFIs, ASIs, Owner Changes, and Field Coordination.

1.06 OPERATING AND MAINTENANCE MANUAL, PARTS LISTS, AND OWNER'S INSTRUCTIONS

- A. Refer to Division 01, General Requirements for additional requirements.

- B. Submit three bound copies of manufacturer's operation and maintenance instruction manuals and parts lists for each piece of equipment or item requiring servicing. Literature on 8-1/2-inch by 11-inch sheets or catalogs suitable for side binding. Submit data when the work is substantially complete, packaged separately, and clearly identified in durable 3-ring binder. Include name and contact information for location of source parts and service for each piece of equipment. Clearly mark and label in each submittal, the piece of equipment provided with the proper nameplate and model number identified. Provide wiring diagrams for electrically powered equipment.
- C. Instruct Owner thoroughly in proper operation of equipment and systems, in accordance with manufacturer's instruction manuals. Operating instructions cover phases of control.

1.07 PROJECT CONDITIONS

- A. Existing Conditions:
 - 1. Prior to bidding, verify and become familiar with existing conditions by visiting the site, and include factors which may affect the execution of this Work.
 - 2. Include related costs in the initial bid proposal.
- B. Coordinate exact requirements governed by actual job conditions. Check information and report discrepancies before fabricating work. Report changes in time to avoid unnecessary work.
- C. Coordinate shutdown and start-up of existing, temporary, and new systems and utilities. Notify Owner, the City, and Utility Company.

1.08 WARRANTY

- A. Provide a written guaranty covering the work of this Division (for a period of one calendar year from the date of acceptance by the Owner) as required by the General Conditions.
- B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a period of one year from the date of Owner acceptance of Work of this Division.
- C. Correct warranty items promptly upon notification.

1.09 TEST REPORTS AND CERTIFICATES

- A. Submit one copy of test reports and certificates specified herein to the Architect.

1.010 SUBSTITUTIONS

- A. Submit requests for product substitutions in accordance with the Instructions to Bidders and the General and Supplemental Conditions.

PART 2 PRODUCTS

2.01 ACCESS PANELS

- A. Furnish under this Division as specified in another Division of work.

2.02 PIPE AND DUCT SLEEVES

- A. Interior Wall and Floor Sleeves: 18-gauge galvanized steel, or another pre-approved system.
- B. Interior Wall and Floor Sleeves (fire rated): Fire rated and water tight system approved by Authority Having Jurisdiction and Owners Insurance underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size, and service.
- C. Exterior Wall Sleeves: Cast iron
- D. On Grade Floor Sleeves: Same as exterior wall sleeves.
- E. Water Tight Sleeves: Combination steel pipe sleeves with water stop and anchor plate; Link Seal Model WS, mated with synthetic rubber links interlocked with bolts and nuts; Link Seal Model LS.

2.03 FLOOR, WALL, AND CEILING PLATES

- A. Furnish stamped split type plates as follows:
 - 1. Floor Plates: Cast brass, chromium plated.
 - 2. Wall and Ceiling Plates: Spun aluminum.

2.04 MACHINERY GUARDS

- A. Furnish guards for protection on rotating and moving parts of equipment. Provide guards for metal fan drives and motor pulleys, regardless of being enclosed in a metal cabinet.
- B. Design guards so as not to restrict air flow at fan inlets resulting in reduced capacity.
- C. Provide shaft holes in guards for easy use of tachometers at pulley centers. Guards easily removable for pulley adjustment or removal and changing of belts.
- D. Guards meet OSHA requirements including back plates.
- E. Provide inlet and outlet screens on fans in plenums or where exposed to personnel.

PART 3 EXECUTION

3.01 ACCESS PANELS

- A. Install in accord with manufacturer's recommendations, coordinated with architectural features.
- B. Provide 2-hour fire rated doors where required bearing the UL label.
- C. Furnish 18-inch by 18-inch panels for ceilings and for access to equipment in soffits and shafts, and 12-inch by 12-inch for walls unless indicated otherwise.
- D. Furnish where indicated and where required to access valves, fire/smoke dampers, trap primers, shock arresters, and other appurtenances requiring operation, service, or maintenance. Submit proposed locations for review prior to installation.

3.02 SLEEVES

- A. Interior Floor and Wall Sleeves:
 - 1. Provide sleeves large enough to provide 3/4-inch clearances around pipe or ductwork.
 - 2. Where pipe or ductwork is insulated, insulation passes continuously through sleeve with 3/4-inch clearance between insulation and sleeve.
 - 3. Penetrations through mechanical room and fan room floors watertight by packing with safig insulation and sealing with Tremco Dymeric Sealant or approved system.
- B. Sleeves through Rated Floors and Walls: Similar to interior sleeves except install fire rated system approved by Authority Having Jurisdiction and Owners insurance underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping or duct material, size, and service.
- C. Sleeves specified or indicated at fire damper penetrations take precedence over this article.
- D. Exterior Wall Sleeves Below Grade:
 - 1. Provide water tight sleeves. Install at pipes entering building below grade and where shown.
 - 2. Adjust to provide positive hydrostatic seal.
 - 3. Follow manufacturer's procedure for installing and tightening seal.
 - 4. Secure sleeves against displacement.
- E. On Grade Floor Sleeves: Same as below grade exterior wall sleeves, caulked from inside.
- F. Exterior Wall Sleeves Above Grade: Similar to interior wall sleeves except caulk outside with Tremco Dymeric Sealant.
- G. Layout work prior to concrete forming. Do cutting and patching required. Reinforce sleeves to prevent collapse during forming and pouring.
- H. Floor sleeves maintain a water barrier by providing a water tight seal or they extend 1-inch above finished floor except through mechanical equipment room floors and shafts where sleeves extend 2-inches above finished floor level. Sleeves through roof extend 8-inches above roof. Wall sleeves flush with face of wall unless otherwise indicated.

- I. Do not support pipes by resting pipe clamps on floor sleeves. Supplementary members provided so pipes are floor supported.
- J. Special sleeves detailed on drawings take precedence over this section.

3.03 CLEANING

- A. General: Clean mechanical equipment, piping and ductwork of stampings and markings (except those required by codes), iron cuttings, and other refuse.
- B. Painted Surfaces: Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.
- C. Additional requirements are specified under specific Sections of this Division.

3.04 EQUIPMENT PROTECTION

- A. Keep pipe, ductwork, and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, conduit, ductwork, equipment, and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore damaged or contaminated fixtures, equipment, or apparatus to original conditions or replace at no cost to the Owner.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.
- C. Cover or otherwise suitably protect equipment and materials stored on the job site.

3.05 ACCESSIBILITY

- A. General: Locate valves, thermometers, cleanout fittings and other indicating equipment or specialties requiring frequent reading, adjustments, inspection, repairs, and removal or replacement conveniently and accessibly with reference to the finished building.
- B. Thermometers and Gauges: Install thermometers and gauges so as to be easily read from the floors, platforms, and walkways.

3.06 FLOOR, WALL, AND CEILING PLATES

- A. Install on piping and ductwork passing through finished walls, floors, ceilings, partitions, and plaster furrings. Plates completely cover opening around pipe and duct.
- B. Secure wall and ceiling plates to pipe, insulation, or structure.
- C. Plates not to penetrate insulation vapor barriers.
- D. Plates not required in mechanical rooms or unfinished spaces.

3.07 PAINTING

- A. General:
 - 1. Coordinate painting of mechanical equipment and items with products and methods in conformance with the appropriate Division of Work, Painting.
 - 2. Exposed work under this Division receives either a factory painted finish or a field prime coat finish, except:
 - a. Exposed copper piping.
 - b. Aluminum jacketed outdoor insulated piping.
- B. Equipment Rooms and Finished Areas:
 - 1. Insulation: Not painted.
 - 2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Structural Steel Stands, Uninsulated Tanks, and Equipment Bases: Paint one coat of black enamel.
 - 3. Steel Valve Bodies and Bonnets: One coat of black enamel.
 - 4. Brass Valve Bodies: Not painted.
 - 5. Equipment:
 - a. One coat of grey machinery enamel.
 - b. Do not paint nameplates.

6. Grilles, Diffusers, Registers: Paint sheet metal and visible ductwork behind grilles, diffusers, and registers flat black.
- C. Concealed Spaces (above ceilings, not visible):
 1. Insulation: Not painted.
 2. Do not paint the following:
 - a. Hangers
 - b. Uninsulated Piping
 - c. Miscellaneous Iron Work
 - d. Valve Bodies and Bonnets
- D. Exterior Steel: Wire brush and apply two coats of rust-inhibiting primer and one coat of grey exterior machinery enamel.
- E. Roof Mounted Equipment:
 1. Paint two coats of exterior machinery enamel.
 2. Color as selected by Architect.
 3. Where factory standard finish is indicated in the equipment specification, it is assumed that the standard finish is painted.
- F. Exterior Black Steel Pipe:
 1. Wire brush and apply two coats of rust-inhibiting primer and one coat of exterior enamel.
 2. Painting schemes comply with ANSI A13.1.

3.08 ADJUSTING AND CLEANING

- A. Before operating any equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made accordingly and that recommended lubricants have been used.
- B. Use particular care in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment as approved or replace with new equipment.

3.09 EQUIPMENT CONNECTIONS

- A. Make final connections to equipment specified in sections other than Division 23, HVAC of the specifications and Owner furnished equipment in accordance with manufacturer's instructions and shop drawings furnished and as indicated.
- B. Piping:
 1. Connections include steam supply, steam vent, and condensate.
 2. Provide valves and specialties as specified and as detailed on the Drawings. Provide increasers, reducers, and any other fittings required for complete installation.
 3. Independently support piping connections supported to prevent undue strain on equipment.

END OF SECTION

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SECTION 23 05 29
HANGERS, SUPPORTS, AND ANCHORS FOR HVAC

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, General Requirements Specification Sections, apply to this Section.
- B. The provisions of Division 23, Heating, Ventilation and Air Conditioning (HVAC) Section 23 05 00, Common Work Results for HVAC, apply to work specified in this Section.
- C. The provisions of this specification are intended to provide requirements as they relate to new equipment and products required to reconfigure and refurbish existing systems as described in the contract documents.

1.02 SUMMARY

- A. This Section includes Design-Build work.
- B. This Section includes:
 - 1. Supports
 - 2. Anchors
 - 3. Pipe Rollers
 - 4. Insulation Protection Shields
 - 5. Insulation Protection Saddles
 - 6. Building Attachments

1.03 RELATED SECTIONS

- A. Division 01, General Requirements
- B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)
- C. Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment
- D. Section 23 07 00, Insulation for HVAC

1.04 QUALITY ASSURANCE

- A. Provide pipe and equipment hangers and supports in accordance with the following:
 - 1. Design supports, anchorages, and seismic restraints for equipment, and supports and seismic restraints for conduit, piping, and ductwork when not shown on the Drawings.
 - 2. Hangers, supports and sway braces to be fabricated in accordance with ANSI B31.1 and MSS SP-58 and SP-89.
 - 3. Use components for intended design purpose only. Do not use for rigging or erection purposes.
 - 4. Seismic restraints and anchorages shall resist seismic forces as specified in the state and local code or by the authority having jurisdiction for the seismic zone in which the project is constructed.
 - 5. Connections to structural framing are not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
 - 6. Seismic Restraints:
 - a. Shall not introduce stresses in the piping caused by thermal expansion or contraction to exceed forces or design limits of the piping per ASME B31.9.
 - b. Provided in accordance with the latest edition of the SMACNA, Seismic Restraint Manual Guidelines for Mechanical Systems" for the Seismic Hazard Level corresponding to the seismic zone in which the project is constructed.
 - c. Provided in accordance with the local applicable codes.
 - d. Follow provisions described in Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment.
 - 7. Piping Connections to Equipment:
 - a. Shall not introduce twisting, torsion, or lateral forces or moments on the equipment.

- b. Shall be supported and isolated in a manner not to exceed the equipment's point of connection load limitations.
- B. Engineered Support Systems: Provide design services for the following support systems:
 - 1. Supports and seismic restraints for suspended piping, ductwork, and equipment.
 - 2. Support frames such as pipe racks or stanchions for piping, ductwork, and equipment which provide support from below.
 - 3. Equipment, ductwork, and piping support frame anchorage to supporting slab or structure.

1.05 SUBMITTALS

- A. Submit the following:
 - 1. Shop Drawings of contractor fabricated support structures.
 - 2. Structural Details and Calculations:
 - a. Submit structural details and calculations substantiating that building structure, anchorages, and fabricated steel braces can safely withstand maximum calculated loads.
 - b. Details and calculations shall bear the seal of a professional engineer registered in the state having jurisdiction.
 - 3. No other submittals required under this section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Supports:
 - 1. Unistrut
 - 2. Superstrut
 - 3. Powerstrut
 - 4. Kinline
 - 5. B-Line Systems
 - 6. AnvilStrut
- B. Pipe Hangers:
 - 1. Anvil
 - 2. Superstrut
 - 3. B-Line Systems
 - 4. Tolco
 - 5. ERICO
 - 6. Pipe Shields Inc.
 - 7. Rilco
- C. Pipe Rollers
 - 1. Anvil
 - 2. Super Strut
 - 3. B-Line Systems
 - 4. Tolco
 - 5. ERICO
- D. Insulation Protection Shields
 - 1. Anvil
 - 2. Super Strut
 - 3. B-Line Systems
 - 4. Tolco
 - 5. ERICO
- E. Insulation Protection Saddles
 - 1. Anvil
 - 2. Super Strut
 - 3. B-Line Systems
 - 4. Tolco

- 5. ERICO
- F. Pipe Guides
 - 1. Anvil
 - 2. B-Line Systems
 - 3. Pipe Shields Inc.
 - 4. Rilco
 - 5. Hyspan
- G. Pipe Anchors
 - 1. Anvil
 - 2. B-Line Systems
 - 3. Pipe Shields Inc.
 - 4. Rilco
- H. Building Attachments
 - 1. Anvil
 - 2. Elcen
 - 3. Superstrut
 - 4. B-Line Systems
 - 5. Tolco
 - 6. ERICO

2.02 SUPPORTS

- A. Fabricate support members from welded standard structural shapes, pipe, and plate to carry the necessary rollers, hangers, and accessories as required. Support piping less than 4-inch pipe size from or by prefabricated roll-formed channels with necessary accessories to adequately support piping system.
- B. Supports and Accessories: Preformed roll-formed channels and accessories with matching compatible accessories as shown, as specified, and as required.
- C. Dissimilar Metal Protection: Hydra-Zorb cushions or Cush-a-strip.
- D. Clamps: Super Strut Series 700 through 702 or AnvilStrut Series 1000 through 1200.

2.03 PIPE HANGERS

- A. Uninsulated Horizontal Copper Piping:
 - 1. 2-inch and Smaller: Anvil CT-65, CT-69.
 - 2. Larger than 2-inch: Anvil 260 field or factory copper plated, plastic coated or other recognized industry methods. Electricians' tape is unacceptable.
- B. Insulated Horizontal Copper Pipe with Hangers Inside of Insulation: Same as Uninsulated Horizontal Copper Pipe.
- C. Insulated Horizontal Copper Pipe with Hangers Outside of Insulation:
 - 1. 2-inch and Smaller: Anvil 65, 104 or 260.
 - 2. Larger than 2-inch: Anvil 260.
- D. Other Uninsulated Horizontal Pipe:
 - 1. 2-inch and Smaller: Anvil 65, 104 or 260.
 - 2. Larger than 2-inch: Anvil 260.
- E. Other Insulated Horizontal Pipe with Hangers Inside of Insulation:
 - 1. 2-inch and Smaller: Anvil 65, 104, 260 or 300.
 - 2. Larger than 2-inch: Anvil 260.
- F. Other Insulated Horizontal Pipe with Hangers Outside of Insulation:
 - 1. 2-inch and Smaller: Anvil 65, 104 or 260.
 - 2. Larger than 2-inch: Anvil 260.
- G. Riser Clamps Copper Pipe:
 - 1. 4-inch and Smaller: Anvil CT-121, CT-261.

2. Larger than 4-inch: Anvil 261.

H. Riser Clamps Other Piping: Anvil 261.

2.04 PIPE ROLLERS

- A. Cast Iron roll and sockets, steel roll rod.
 1. Anvil 171, 175, 177, 178, 181, or 274 as required.
 2. Size for pipe plus insulation for insulated pipe.

2.05 INSULATION PROTECTION SHIELDS

- A. Galvanized carbon steel.
 1. Anvil 167.

2.06 INSULATION PROTECTION SADDLES

- A. Carbon steel.
 1. Anvil 160 series.
 2. Saddles for copper pipe: Factory copper plated.

2.07 PIPE GUIDES

- A. Spider type alignment guide.
 1. Anvil 255, 256, 257 & 436
 2. Steel Piping:
 - a. Carbon steel housing
 - b. Carbon steel spider clamp
 3. Copper Piping:
 - a. Carbon steel housing
 - b. Factory copper plated steel spider clamp

2.08 PIPE ANCHORS

- A. Uninsulated Pipe
 1. Pipe Shields Inc. C1000
- B. Insulated Pipe
 1. Pipe Shields Inc. C3000 through C4300 series
- C. Pipe Stanchions
 1. Anvil 62

2.09 BUILDING ATTACHMENTS

- A. Beam Hangers:
 1. On piping 6-inch and smaller: Anvil 86 with retaining clip Fig. 89.
 2. On piping larger than 6-inch: Anvil 228, or 292.
- B. Inserts: Anvil 152 malleable iron or 281 steel inserts. Inserts sized for required rod to support load being carried.
- C. Expansion Plugs: Similar and equal to Phillips "red-head" self-drilling flush shell selected for safety factor of 4.
- D. Powder actuated fasteners with silencers as approved by Architect.

PART 3 EXECUTION

3.01 HANGERS AND SUPPORTS

- A. General:
 1. Install support systems as detailed and in accordance with manufacturer's recommendations. Provide pipe racks, pipe stands, trapeze hangers, etc., as required, and as detailed on the Drawings.
 2. Provide adjustable hangers for pipes complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., except where specified otherwise.

3. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping and do not support piping from other piping.
 4. Except as otherwise indicated for exposed continuous pipe runs, install hangers, and supports of same type and style as installed for adjacent similar piping.
 5. Support piping within 2-feet of each change of direction on both sides of fitting.
- B. Insulated Piping Systems:
1. Refer to Section 23 07 00, Insulation for HVAC for insulation requirements.
 2. Insulated Piping Systems with Vapor Barrier Insulation:
 - a. Install hangers outside of insulation.
 - b. On piping 1-1/2-inch and larger, provide insulation protection shields at each support location.
 3. Heating Water (over 230 degrees F), Medium Pressure Steam and High-Pressure Steam (Non-Vapor Barrier Insulation):
 - a. As specified for Insulated Piping Systems with Vapor Barrier Insulation.
 4. Other insulated Piping Systems with Non-Vapor Barrier Insulation:
 - a. At the contractor's option, hangers may be installed inside or outside of insulation for piping 2-inch and smaller.
 - b. If hangers are installed outside of insulation, provide insulation protection shields at support locations on piping 1-1/2-inch and larger.
 - c. On piping larger than 2-inch, provide insulation saddles at each support location.
 5. Insulation Protection:
 - a. Band insulation protection shields firmly to insulation to prevent slippage.
 - b. Tack weld insulation protection saddles to steel pipe. Braze saddles to copper pipe.
- C. Vertical Piping:
1. Support Spacing: Provide support at minimum spacing in accordance with state and local codes.
 2. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
 3. Provide mid-story vertical guide support where floor to floor distances exceed spacing as required by state and local codes. Riser clamps on steel pipe to be directly welded to pipe. Riser clamps on copper pipe to be installed directly under fitting.
 4. Risers that are not subject to thermal change to be supported at each floor of penetration.
 5. Risers that are subject to thermal change require engineered supports. Size supports to carry forces exerted by piping system when in operation. Riser supports follow the provisions described in Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment.
- D. Horizontal Piping:
1. Trapeze Hangers: Multiple pipe runs where indicated supported on channels with rust resistant finish. Provide necessary rods and supporting steel.
 2. Support Spacing:
 - a. Provide support at maximum spacing in accordance with state and local codes and any applicable manufacturer requirements.
 - b. Support piping within 2-feet of each change in direction.
 - c. Provide piping with acoustical lagging wrap supported a maximum of 5-feet on center. Install hangers outside of acoustical lagging.

E. Building Attachments:

1. Fastening or attaching to steel deck (without concrete fill) is prohibited. It will be necessary to support piping from structural members, beams, joists, or provide intermediate angle iron supporting members between joists. Supports may be attached to concrete filled steel deck with load limitations shown on the structural drawings or otherwise obtained from the structural engineer.
2. Provide horizontal bracing on horizontal runs 1-1/2-inch and larger and exceeding 50-feet in length at 75-foot intervals and as required to provide stabilized piping systems.
3. Provide additional structural steel angles, channels, or other members required to support piping where structures do not occur as required for proper support.
4. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points.

END OF SECTION

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, General Requirements Specification Sections, apply to this Section.
- B. The provisions of Division 23, Heating, Ventilation and Air Conditioning (HVAC) Section 23 05 00, Common Work Results for HVAC, apply to work specified in this Section.

1.02 SUMMARY

- A. This Section includes:
 - 1. Neoprene Waffle Pad
 - 2. Restrained Neoprene Mount
 - 3. Spring Isolators
 - 4. Springs with Restraints
 - 5. Base with Springs
 - 6. Inertia Base
 - 7. Isolating Spring Hangers
 - 8. Isolating Neoprene Hangers
 - 9. Rooftop Air Handling Unit Isolation Curb
 - 10. Isolating Sleeves
 - 11. Seismic Restraints
 - 12. Flexible Sphere Connector
 - 13. Flexible Hose Connector
- B. Isolation of mechanical equipment as indicated on the Drawings and specified herein.
- C. Seismic restraint of equipment, piping, and ductwork.

1.03 RELATED SECTIONS:

- A. Division 01, General Requirements
- B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)
- C. Section 23 05 29, Hangers, Supports and Anchors for HVAC

1.04 QUALITY ASSURANCE

- A. Single manufacturer select and furnish isolation required, except packaged equipment with integral isolators meeting all the isolation and seismic requirements of this Specification.
- B. System of vibration isolators and seismic controls designed, detailed, and bear the seal of a professional engineer registered in the State having jurisdiction.
- C. Isolation performance requirements are indicated in the specifications. Deflections indicated are nominal static deflections for specific equipment supported.
- D. Isolator Stability and Rated Capacity:
 - 1. Spring diameters not less than 0.8 of the compressed height of the spring at rated load.
 - 2. Springs have a minimum additional travel to solid equal to 50 percent of the rated deflection.
- E. Seismic Restraints:
 - 1. Restraint of equipment, piping, and ductwork to be in accordance with the current state and local Building Code.
 - 2. Calculations in accordance with current state and local Building Code.

1.05 SUBMITTALS

- A. Submit the following:
 - 1. Submit Shop Drawings showing complete details of construction for steel and concrete bases including:
 - a. Equipment mounting holes.
 - b. Dimensions
 - c. Isolation selected for each support point.
 - d. Details of mounting brackets for isolator.
 - e. Weight distribution for each isolator.
 - f. Code number assigned to each isolator.
 - 2. Submit product data and calculation sheets for isolators, showing:
 - a. Size, type, load rating, and rated deflection of each required isolator.
 - b. Percent of vibration transmitted based on the lowest disturbing frequency of the equipment.
 - 3. Structural Details and Calculations substantiating that building structure, anchorages, and fabricated steel braces can safely withstand maximum calculated loads stamped and signed by a registered structural engineer.
 - 4. Installation report as specified in PART 3 of this Section.
 - 5. Operation and maintenance data.

1.06 EQUIPMENT VIBRATION ISOLATION

- A. Provide a balanced set of vibration isolators for each piece of equipment listed in the Equipment Schedules.
- B. Isolation work to include, but not necessarily be limited to, the following:
 - 1. Isolation support of motor-driven equipment.
 - 2. Inertia base frames in conjunction with isolation.
 - 3. Isolation support of air-handling housings.
 - 4. Isolation support of piping, piping risers, and ductwork.
 - 5. Penetration isolation of pipework, ductwork, and conduits through walls, floors, or ceilings.
 - 6. Flexible connections of ductwork and piping to equipment.
- C. Each piece of rotating equipment must meet a reasonable criterion for maximum vibration levels at each bearing, while in operation. The criteria for varying operating speeds are given as follows:
 - 1. Rotating equipment operating at peak vibration velocities must not exceed 0.08-inch/second.
 - 2. If it is discovered that the operating vibration velocities exceed this criteria, the equipment repaired or replaced at no expense to the owner until approval of the equipment is given by the Engineer.
- D. Provide components or materials not specially mentioned herein, but necessary to the proper vibration isolation of the equipment.

1.07 CONTRACTOR RESPONSIBILITY

- A. Vibration isolation devices, including auxiliary steel bases and pouring forms, design and furnish by a single manufacturer or supplier.
- B. Adequately restrain all equipment, piping, and ductwork to resist seismic forces. Design and select restraint devices to meet seismic requirements as defined in the latest issue of the International Building Code under Earthquake Loads and applicable state and local codes.
- C. Have the following responsibilities:
 - 1. Selection, installation, adjustment, and performance of vibration isolators which will meet the requirements given on the plans or in the Specifications.
 - 2. Provide Engineering drawings, details, supervision, and instruction to assure proper installation and performance.

3. Provide whatever assistance necessary to ensure correct installation and adjustment of the isolators.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Type 1 – Neoprene Waffle Pad:
 1. Mason Type Super W or Super WM and HG Grommet
 2. Kinetics Corporation.
- B. Type 2 – Restrained Neoprene Mount:
 1. Mason Type BR
- C. Type 3 – Spring Isolators:
 1. Mason Type SLF
 2. Amber-Booth Type SW
 3. Kinetics Corporation
 4. Vibrex
- D. Type 4 – Springs with Restraints:
 1. Mason Type SSLR or SLRS with seismic restraints
 2. Kinetics Corporation Model FYS
 3. Vibrex
- E. Type 5 – Base with Springs:
 1. Mason WFSL
 2. Kinetics Corporation
 3. Vibrex
- F. Type 6 – Inertia Base:
 1. Mason BMK or KSL
 2. Kinetics Corporation
 3. Vibrex
- G. Type 7 – Isolating Spring Hangers:
 1. Mason 30N, similar Amber-Booth
 2. Consolidated Kinetics
 3. Vibrex
- H. Type 8 – Isolating Neoprene Hangers:
 1. Mason HD
 2. Consolidated Kinetics
 3. Vibrex
- I. Type 9 – Rooftop Air Handling Unit Isolation Curb:
 1. Mason RSC, similar Amber-Booth
 2. Kinetics Corporation
 3. Vibrex
- J. Isolating Sleeves:
 1. Potter-Roemer PR isolators
 2. Grinnell Semco Trisolators
- K. Flexible Sphere Connector:
 1. Mason Type SFU, SFDEJ, or SFEJ
- L. Flexible Hose Connector:
 1. Mason Type FFL, MN, CPS or CPSB
 2. HCi
 3. Metraflex

2.02 TYPE 1 - NEOPRENE WAFFLE PAD

- A. 3/4-inch-thick neoprene waffle pads with pattern repeating on 1/2-inch centers.

- B. Select Duro rating for recommended deflection at average load rating.
- C. Include load distribution steel plate as required.
- D. Include anchor bolt grommet as required.

2.03 TYPE 2 - RESTRAINED NEOPRENE MOUNT

- A. Bridge-bearing neoprene mountings directional seismic capability.
- B. Provide minimum deflection of 0.2-inch.
- C. Ductile iron casting containing two separated and opposing molded neoprene elements.
- D. Elements prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation.
- E. Shock absorbing neoprene materials compounded to bridge-bearing specifications.

2.04 TYPE 3 – SPRING ISOLATORS

- A. Free standing springs without housings.
- B. Provide minimum deflection of 1-inch.
- C. 1/4-inch-thick molded neoprene cup with steel reinforcement washer or neoprene acoustical friction pads between base plate and support.
- D. Mounting: Leveling bolts with height saving brackets.
- E. Springs mounted outboard of channels.
- F. Attach baseplate screws using neoprene bushings and washers.
- G. Diameter not less than 0.8 of the compressed height of the spring at rated load.
- H. Additional travel to solid equal to 50 percent of the rated deflection.
- I. Submittals to include the following:
 - 1. Spring Diameters
 - 2. Deflection
 - 3. Compressed Spring Height
 - 4. Solid Spring Height

2.05 TYPE 4 - SPRINGS WITH RESTRAINTS

- A. Same as springs except housing with seismic restraints to be added.
- B. Seismic restraint with molded directional neoprene bushings an integral part of isolator.
- C. Seismic restraint selected for minimum safety factor of 2 from ultimate seismic capacity.
- D. Spring mount must have neoprene cup or pad inside the seismic housing to allow anchoring of the housing baseplate without short circuiting pad.
- E. A minimum clearance of 1/4-inch shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action.
- F. Restraining Bolts: Neoprene bushing between the bolt and the housing.
- G. Limit stops out of contact during normal operation.

2.06 TYPE 5 - BASE WITH SPRINGS

- A. Steel base with wide flange beams and springs.
- B. Provide minimum clearance of 1-inch.
- C. Depth of base equal to 10 percent of the span between supports, 6-inch minimum.
- D. Provide external height saving brackets.

2.07 TYPE 6 – INERTIA BASE

- A. Steel Inertia Base with 1/2-inch square bar reinforcing, for field grout.
- B. Provide minimum clearance of 1-inch.
- C. Bases must be sized to fit stanchions for pump elbows or suction diffusers.

- D. Depth of base equal to 8 percent of the span between supports, 6-inch minimum.
- E. Provide integral height saving brackets and steel templates with anchor bolts sleeves.

2.08 TYPE 7 - ISOLATING SPRING HANGERS

- A. Combination rubber-in shear and steel spring isolators installed on the hanger rods.
- B. Provide minimum deflection of 1-inch.
- C. Isolators shall have the proper deflection to allow the piping to deflect as a unit with the equipment isolators.
- D. Neoprene element and the cup shall have neoprene bushing bushings projecting through the steel box.
- E. Hangers designed for 30-degree angular movement.
- F. Minimum Deflection: 1-inch

2.09 TYPE 8 – ISOLATING NEOPRENE HANGERS

- A. Double deflection neoprene hangers.
- B. Provide minimum static deflection of 0.35-inch.
- C. Provide projecting bushing to prevent steel to steel contact.

2.010 TYPE 9 – ROOFTOP AIR HANDLING UNIT ISOLATION CURB

- A. Rooftop unit spring isolation curb.
- B. Provide minimum deflection of 2-inches.
- C. Steel springs shall be laterally stable and rest on 1/4-inch-thick neoprene acoustical pads.
- D. Hardware shall be plated and the springs provided with a rust resistance finish.
- E. Curb waterproofing shall consist of a continuous flexible flashing attached over the lower curb waterproofing.
- F. All spring locations shall have accessibility to adjust springs.
- G. Curb provides continuous support for equipment and be constructed to resiliently resist wind and seismic forces.
- H. Construction of curb must not enable rigid connection between vibrating equipment and building structure.
- I. Provide provisions for sloped roof, plenum curb, tall curb, and duct openings where required by installation conditions.

2.011 ISOLATING SLEEVES

- A. Provide for piping through walls and floors of penthouses and chiller room. Size for piping as required.

2.012 SEISMIC RESTRAINTS

- A. General Requirements:
 - 1. Provided for equipment, piping and ductwork, both supported and suspended.
 - 2. Bracing of piping shall be in accordance with state and local code requirements and ASCE 7 Seismic Design Requirements for Nonstructural Components, whichever is most stringent.
 - 3. Bracing of ductwork shall be in accordance with the state and local code requirements, ASCE 7 Seismic Design Requirements for Nonstructural Components, and with the provisions set forth in the SMACNA seismic restraint manual.
 - 4. The structural requirements for the restraints, including their attachment to the building structure, shall be reviewed, and approved by the Structural Engineer.
 - 5. Attachments to supported or suspended equipment must be coordinated with the equipment manufacturer.

- B. Supported Equipment:
 - 1. All-directional Seismic Rubbers: Interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene.
 - 2. Replaceable bushing and minimum of 1/4-inch thick. Rated loadings not to exceed 1000 psi.
 - 3. An air gap of 1/4-inch shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces.
 - 4. Snubber End Caps:
 - a. Removable to allow inspection of internal clearances.
 - b. Rotated neoprene bushings be rotated to ensure no short circuits exist before systems are activated.
 - 5. Snubber: Mason Industries, Inc. Type Z-1225
- C. Bracing of Pipes:
 - 1. Provide seismic bracing of piping as detailed below to meet the building code requirements:
 - a. Exception: Piping suspended by individual hangers need not be braced where the following criteria are met.
 - 1) Distance between the top of the pipe to the bottom of the support structure is 12-inches or less.
 - 2) Seismic braces are not required on high deformability piping when the $l_p=1.0$ and provisions are made to avoid impact with larger pipe or mechanical components or to protect the pipe in the event of such impact and the nominal pipe size is 3-inch diameter or less.
 - 3) Seismic braces are not required on high deformability piping when the $l_p=1.5$ and provisions are made to avoid impact with larger pipe or mechanical components or to protect the pipe in the event of such impact and the nominal pipe size is 1-inch diameter or less.
 - 2. Seismic braces for pipes on trapeze hangers may be used.
 - 3. Provide flexibility in joints where pipes pass through building seismic joints or expansion joints, or where pipes connect to equipment.
 - 4. Cast iron pipe of all types, glass pipe, and any other pipe joined with a shield and clamp assembly, where the top of the pipe is 12-inches or more from the supporting structure, shall be braced on each side of a change in direction of 90 degrees or more. Riser joints on unsupported sections of piping shall be braced or stabilized between floors.
 - 5. Vertical risers shall be laterally supported with a riser clamp at each floor. For buildings greater than six stories high or for piping subject to thermal change all risers shall be engineered individually.
- D. Bracing of Ductwork:
 - 1. Brace rectangular ducts with cross sectional areas of 6 square feet and larger. Brace flat oval ducts in the same manner as rectangular ducts. Brace round ducts with diameters of 28-inches and larger. Brace flat oval ducts the same as rectangular ducts of the same nominal size.
 - 2. Exception: No bracing is required if the duct is suspended by hangers 12-inches or less in length, as measured from the top of the duct to the bottom of the support where the hanger is attached.
 - 3. Transverse bracing shall occur at the interval specified in the SMACNA tables or at both ends if the duct run is less than the specified interval. Transverse bracing shall be installed at each duct turn and at each end of a duct run, with a minimum of one brace at each end.
 - 4. Longitudinal bracing shall occur at the interval specified in the SMACNA tables with at least one brace per duct run. Transverse bracing for one duct section may also act as longitudinal bracing for a duct section connected perpendicular to it if the bracing is installed within four feet of the intersection of the ducts and if the bracing is sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.

5. Install duct flex connections at equipment connections to accept expected differential displacement and protect the equipment connection from damage.
- E. Suspended Equipment and Piping and Ductwork:
 1. Seismic cable restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint.
 2. Cable must be pre-stretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement.
 3. Cable assemblies shall be type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod and the clevis or SCBV if clamped to a beam, all as manufactured by Mason Industries, Inc.
 4. Steel angles or strut, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall be type SRC or UCC as manufactured by Mason Industries, Inc.
 5. Pipe clevis cross-bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross brace shall be type CCB as manufactured by Mason Industries, Inc.

2.013 FLEXIBLE SPHERE CONNECTOR

- A. Flexible EPDM pipe connectors shall be manufactured of multiple plies of Kevlar tire cord fabric and EPDM; both molded and cured in hydraulic rubber presses. No steel wire or rings shall be used as pressure reinforcement.
- B. Connectors up to and including 2-inch diameter may have a single sphere and threaded ends. Connectors 2-1/2-inch and larger shall be manufactured with twin spheres up to 12-inches and a single sphere on larger sizes and floating steel flanges recessed to lock the connectors raised face EPDM flanges.
- C. Connectors shall be rated a minimum of 150 psi at 220 degrees F. Connections shall be pre-extended as recommended by the manufacturer to prevent additional elongation under pressure.
- D. Provide expansion joint control rods and install per the manufacturer's installation recommendations.

2.014 FLEXIBLE HOSE CONNECTOR

- A. Flexible stainless-steel hoses shall be manufactured using type 304 stainless steel hose and braid with one fixed and one floating raised face carbon steel plate flange.
- B. Sizes 2-1/2-inch and Smaller:
 1. Threaded male nipples or copper sweat ends.
 2. Grooved ends are acceptable in all sizes in grooved piping systems.
 3. Weld ends are not acceptable.
 4. Copper sweat end hoses for water service shall be all copper or bronze construction.
- C. Hose shall have close pitch annular corrugations for maximum flexibility and low stiffness. Tested hose stiffness at various pressures must be included in the submittals.
- D. Hose shall be capable of continuous operation at 150 psi and system test pressure when installed in piping systems.
- E. Hose shall be the same size as the pipe it connects and have pipe thread connectors on both ends with male or female end adapters as required.

PART 3 EXECUTION

3.01 GENERAL

- A. Do not install any equipment or pipe which makes rigid contact with the building.
- B. The installation or use of vibration isolators must not cause any change of position of equipment or piping which would result in stresses in piping connections or misalignment of shafts or bearings. In order to meet this objective, equipment and piping shall be maintained in a rigid position during installation. The load shall not be transferred to the isolator until the installation is complete and under full operational load.
- C. Correct, at no additional cost, all installations which are defective in workmanship or materials.

3.02 PREPARATION

- A. Treat all isolators, including springs, hardware, and housing, with a corrosion protective coating of epoxy powder or electro galvanizing.
- B. Coat steel frames exposed to weather with a rustproof metal primer.
- C. Provide hot dipped galvanizing on steel frames as indicated on the plans for corrosion protection in severe conditions.

3.03 INSTALLATION

- A. General:
 - 1. Install isolation where indicated on the Drawings by type and location and where indicated below.
 - 2. The assigned code number shall be marked on the isolators and bases to assure placement in the proper location.
 - 3. Anchor isolator seismic housing baseplate to floor.
 - 4. Rubber grommets and washers shall be provided to isolate the bolt from the building structure. Under no circumstances shall the isolation efficiency be destroyed when bolting the isolators to the building structure.
- B. Type 1 – Neoprene Waffle Pad:
 - 1. Service:
 - a. Boilers
 - b. Floor Mounted Indoor Air Handling Units
- C. Type 2 – Restrained Neoprene Mount:
 - 1. Service:
 - a. Boilers
 - b. Roof Exhaust Fans
 - c. Ceiling Exhaust Fans
 - d. Small Cabinet Fans
 - e. Inline Centrifugal Fans
 - f. Fan Coil Units
- D. Type 3 – Spring Isolator:
 - 1. Service:
 - a. Suspended AHU
- E. Type 4 – Springs with Restraints:
 - 1. Service:
 - a. Boilers
- F. Type 5 – Base with Springs:
 - 1. Service:
 - a. Centrifugal Fans

- G. Type 6 – Inertia Base with Springs:
 - 1. Service:
 - a. Centrifugal Pumps:
 - 1) Fill with concrete to provide base weight equal to 2 times supported weight, including equipment, piping, and fluid.
 - 2) Support heels of pump suction and discharge elbows from base.
 - 3) Secure pump and heel supports with inserts and grout.
- H. Type 7 – Isolating Spring Hangers:
 - 1. Service:
 - a. In-Line Circulating Pumps
 - b. Piping rigidly connected to rotating equipment
 - c. Propeller Fans
 - d. Small Cabinet Fans
 - e. Inline Centrifugal Fans
 - f. Fan Powered Terminal Units
 - g. Fan Coil Units
 - h. Split-System Air Conditioning Unit
 - i. Split-System Heat Pump
 - j. Unit Heaters
- I. Type 8 – Isolating Neoprene Hanger:
 - 1. Service:
 - a. In-Line Circulating Pumps
 - b. Split-System Air Conditioning Unit
 - c. Split-System Heat Pump
 - d. Unit Heaters
- J. Type 9 – Rooftop Air Handling Unit Isolation Curb:
 - 1. Service:
 - a. Rooftop Mounted Air Handling Units
 - b. Rooftop Mounted Energy Recovery Units
 - c. Make-Up Air Units.
- K. Flexible Connectors:
 - 1. Mechanical Couplings: Provide three or more flexible couplings as vibration isolation as indicated on the drawings and for the following services: Hot water

3.04 SEISMIC RESTRAINTS

- A. General:
 - 1. Install and adjust seismic restraints so that the equipment, piping, and ductwork support is not degraded by the restraints.
 - 2. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.
- B. Supported Equipment:
 - 1. Each vibration isolation frame for supported equipment shall have a minimum of four seismic snubbers mounted as close as possible to the vibration isolators and/or the frame extremities.
 - 2. Care must be taken so that the 1/4-inch air gap in the seismic restraint snubber is preserved on all sides in order that the vibration isolation potential of the isolator is not compromised. This requires that the final snubber adjustment be completed after the vibration isolators are properly installed and the installation approved.
- C. Bracing of Pipes:
 - 1. Branch lines may not be used to brace main lines.
 - 2. Transverse bracing shall be at 40-feet maximum, except where a lesser spacing is indicated in the SMACNA Seismic Restraint Manual for bracing of pipes.

3. Longitudinal bracing shall be at 80-feet maximum except where a lesser spacing is indicated in the tables. In pipes where thermal expansion is a consideration, an anchor point may be used as the specified longitudinal brace provided that it has a capacity to resist both the seismic load and the additional force induced by expansion and contraction.
 4. Fuel oil, gas, cast iron pipe of all types, glass pipe and any other pipes joined with four band shield and clamp assembly shall be braced at 1/2 the spacings shown above.
 5. A rigid piping system shall not be braced to dissimilar parts of the building or to two dissimilar building systems that may respond differently during an earthquake.
 6. Transverse bracing for one pipe section may also act as longitudinal bracing for a pipe section of the same size connected perpendicular to it if the bracing is installed within 24-inches of the elbow or tee.
 7. Branch lines may not be used to restrain main lines.
 8. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
 9. Subject to confirmation by field inspection, seismic bracing is not required on piping when the piping is supported by rod hangers and the hangers in the entire run are 12-inches or less in length from the top of the pipe to the supporting structure, hangers are detailed to avoid bending of the hangers and their attachments and provisions are made for piping to accommodate expected deflections.
- D. Bracing of Ductwork:
1. Transverse restraints shall occur at 30-foot intervals or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.
 2. Longitudinal restraints shall occur at 60-foot intervals with at least one restraint per duct run. Transverse restraints for one duct section may also act as a longitudinal restraint for a duct section connected perpendicular to it if the restraints are installed within 4-feet of the intersection of the ducts and if the restraints are sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.
 3. Hanger straps must be positively attached to the duct within 2-inches of the top of the duct with a minimum of two number 10 sheet metal screws.
 4. A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.
 5. Walls, including gypsum board nonbearing partitions, which have ducts running through them, may replace a typical transverse brace. Provide solid blocking around duct penetrations at stud wall construction.
 6. Unbraced ducts shall be installed with a 6-inch minimum clearance to vertical ceiling hanger wires.
- E. Suspended Equipment, Piping, and Ductwork Cable Method:
1. The cables shall be adjusted to a degree of slackness approved by the Structural Engineer.
 2. The uplift and downward restraint nuts and Mason type RW neoprene covered steel rebound washers for the Type 6 hangers adjusted so there is a maximum 1/4-inch clearance.
 3. C-clamps for attachment to the bottom of I-beams must incorporate a restraining strap.

3.05 FIELD QUALITY CONTROL

- A. Installation Report: Isolation manufacturer's representative shall confirm that all isolation is installed correctly and submit report stating that isolators are installed as shown on Shop Drawings, isolators are free to work properly, and that installed deflections are as scheduled and as specified.

END OF SECTION

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The provisions of This Section, Common Work Results for Electrical, apply to all sections in Division 26.
- C. All Sections of Division 26, ELECTRICAL, are interrelated. When interpreting any direction, material, and method specified in any section of Division 26, consider it within the entirety of Work in Division 26.

1.02 SUMMARY

- A. This Section includes Design-Build work.
 - 1. The intent of Division 26 Specifications and Drawings is to provide a complete and workable facility, with complete systems as required by applicable codes, as indicated, and as specified.
 - 2. Include all work specified in Division 26 and indicated on Drawings, including appurtenances, connections, fasteners, and accessories required to make a complete working system, whether indicated or not indicated.
 - 3. See Division 1 Section, "Design-Build".
- B. The Division 26 Specifications and the accompanying Drawings are complementary, and what is called for by one shall be as binding as if called for by both.
 - 1. Items shown on the Drawings are not necessarily included in the Specifications and vice versa.
 - 2. In case of conflict, Specifications supersede Drawings.
- C. Imperative language used in Division 26 Sections addresses the Contractor, as specified in Division 1 Section, "Summary".

1.03 REFERENCES

- A. The latest adopted revisions of the publications listed below apply to these Specifications as referenced:
 - 1. International Building Code (IBC).
 - 2. National Electrical Code (NEC).
 - 3. National Fire Protection Association (NFPA).
 - 4. National Electrical Manufacturers Association (NEMA).
 - 5. National Electrical Contractors Association (NECA).
 - 6. American National Standards Institute (ANSI).
 - 7. Institute of Electrical and Electronic Engineers (IEEE).
 - 8. Underwriters Laboratories (UL).
 - 9. Oregon Administrative Rules (OAR).
 - 10. The publications are referred to in the text by acronym or initials in parentheses above.

1.04 SYSTEM DESCRIPTION

- A. Ground Systems:
 - 1. Provide complete ground systems indicated.
 - 2. Include conduit system, transformer housings, switchboard frame, and neutral bus, motors, and miscellaneous grounds required by Contract Documents and by applicable codes.
- B. System Identification:
 - 1. Clearly identify all elements of the Project electrical system to indicate the loads served, or the function of each item of equipment, connected under this work.

2. Comply with requirements of Division 26 Section, "Identification," and with applicable codes.
- C. Drawings:
 1. The Drawings are diagrammatic: they do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts with other construction.
 - a. Prior to installing work, take field dimensions, and note conditions available for, installation.
 - b. Follow the Drawings as closely as practical to do so, and install additional bends, offsets, and elbows where required by installation conditions.
 - 1) Additional offsets, bends, and other connectors are subject to approval by Project Engineer.
 - 2) Install additional offsets, bends, and other connectors without additional cost to Owner.
 - c. The right to make any reasonable changes in outlet location prior to roughing in is reserved to the Owner's Representative.
 2. Luminaire Designations:
 - a. Lower case letters adjacent to devices or luminaires indicate switching arrangement or circuit grouping.
 - b. Numbers adjacent to devices indicate circuit connection.
 3. Circuits and Switching:
 - a. Do not change branch circuiting and switching indicated; nor combine homeruns, without Engineer's prior approval.
 - b. Do not combine or change feeder runs.
 4. Circuit Conductors:
 - a. Cross or hash marks on conduit runs indicate quantity of No. 12 copper branch circuit conductors, unless otherwise noted.
 - b. Where such marks do not appear, provide quantity of circuit conductors to the outlets shown to perform the control or circuiting indicated.
 - c. Include ground, travelers and switch legs required by the circuiting arrangement indicated.
 - d. Provide a dedicated neutral conductor with each circuit, do not use a shared neutral conductor between phases unless specifically requested or directed.

1.05 SUBMITTALS

- A. Comply with Division 1 Section, "Submittal Procedures".
- B. Shop Drawings and Equipment Data:
 1. Combine electrical shop drawings and equipment data in Submittal binders.
 2. Include in Submittal binders:
 - a. A complete index of materials and equipment required by Specifications to be documented by submittals.
 - b. Manufacturer's detailed specifications and data sheets to fully describe equipment furnished.
 - c. All deviations from the Drawings and Specifications, noted on the submittals. Failure to comply will automatically void any implied approval for use of the equipment on this project.
- C. Installation Drawings:
 1. Submit prior to starting installation.
 2. Show all outlets, devices, terminal cabinets, conduits, wiring, and connections required for the complete system described.
- D. Record Drawings:
 1. Keep record drawings up to date as the work progresses.
 2. Show all changes, deviations, addendum items, change orders, corrections, and other variations from the Contract Drawings.

3. Keep record drawings at the jobsite and available for the Architect's review.
 4. At the completion of the work, incorporate all deviations from the installation drawings to indicate "as-built" conditions.
- E. Operation and Maintenance Data:
1. As specified in Division 1 Section, "Closeout Procedures".
 2. Provide a separate manual or chapter for each system as follows:
 - a. Low voltage distribution system.
 - b. Fire alarm system.
 - c. Lighting system.
 - d. Lighting control system.
 3. Description of system.
 4. Operating Sequence and Procedures:
 - a. Step-by-step procedure for system start-up, including a pre-start checklist.
 - 1) Refer to controls and indicators by nomenclature consistent with that used on panels and in control diagrams.
 - b. Detailed instruction in proper sequence, for each mode of operation (i.e., day-night, staging of equipment).
 - c. Emergency Operation:
 - 1) If some functions of the equipment can be operated while other functions are disabled, give instructions for operations under those conditions.
 - 2) Include here only those alternate methods of operations (from normal) which the operator can follow when there is a partial failure or malfunctioning of components or other unusual condition.
 - d. Shutdown Procedure:
 - 1) Include instructions for stopping and securing the equipment after operation.
 - 2) If a particular sequence is required, give step-by-step instructions in that order.
 5. Preventive Maintenance:
 - a. Schedule for preventive maintenance.
 - 1) State the recommended frequency of performance of each preventive maintenance task such as cleaning, inspection, and scheduled overhauls.
 - b. Cleaning: Provide instructions and schedules for all routine cleaning and inspection with recommended lubricants.
 - c. Inspection: If periodic inspection of equipment is required for operation, cleaning, or other reasons, indicate the items to be inspected and give the inspection criteria.
 - d. Provide instructions for lubrication and adjustments required for preventive maintenance routines. Identify test points and given values for each.
 6. Manufacturers' Brochures:
 - a. Include manufacturers' descriptive literature covering devices and equipment used in the system, together with illustrations, exploded views, and renewal parts lists.
 - b. Edit manufacturers' standard brochures so that the information applying to the actual installed equipment is clearly defined.
 7. Results of performance testing, as specified in Part 3 of This Section.
- F. Submittals Procedures:
1. Review and recommendations by the Architect or Engineer are not to be construed as change authorizations.
 2. If discrepancies are discovered between the materials or equipment submitted, and the Contract Documents, either prior to or after the data is processed, the Contract Documents govern.

1.06 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. All products and equipment shall comply with Oregon Revised Statute (ORS) 453.005(7)(e) prohibiting pentabrominated, octabrominated and decabrominated diphenyl ethers. Where products or equipment within this specification contain these banned substances, provide complying products and equipment from approved manufacturers with equal performance characteristics.
 - 2. Provide work and materials conforming to:
 - a. Local and State codes
 - b. Federal and State laws and regulations.
 - c. Other applicable laws and regulations.
 - 3. Obtain and pay for all permits, licenses, and inspection certificates required by authorities having jurisdiction.
 - 4. Pay any other fees required by governing authorities for work of this Division.
- B. Install only electrical products listed by a recognized testing laboratory, or approved in writing by the local inspection authority as required by governing codes and ordinances.

1.07 SITE VISITATION

- A. The Contractor shall visit the site prior to bidding and become familiar with existing conditions and all other factors which may affect the execution of the work. Coordination of installation of equipment with prior bid packages previously issued shall be completed. Include all related costs in the initial bid proposal.

1.08 COORDINATION

- A. Coordinate Work of This Division with all other trades to ensure proper installation of electrical equipment.
 - 1. Review Drawings of other trades or crafts to avoid conflicts with equipment, structural members, and other possible impediments to electrical work.
 - 2. Report potential conflicts to Architect prior to rough-in.
 - 3. Proceed with rough-in following Architect's directives to resolve conflicts.
 - 4. In general, the Architectural Drawings govern.
- B. Verify the physical dimension of each item of electrical equipment to fit the available space. Contractor's responsibility includes:
 - 1. Coordination of the equipment to fit into the available space.
 - 2. Access routes through the construction.
- C. Layout Drawings:
 - 1. Equipment arrangement shown on Drawings is diagrammatic to indicate general equipment sizing and spatial relationship. Contractor shall include, as part of distribution equipment submittal, a scaled floor plan which includes all equipment shown with their submitted sizes. Include all feeder conduit routing, both above-ground and underground, including termination points at equipment. Submit for Engineer's review prior to commencing work.
 - 2. Provide additional wiring details at switchboards, motor control centers, and other areas where work is of sufficient complexity to warrant additional detailing for coordination.
 - 3. Submit layout drawings for approval prior to commencing field installation.
- D. Where electrical connections are required for equipment provided as Work of other Divisions, coordinate rough-in and wiring requirements for that equipment with its supplier and installer prior to commencing work. Notify Architect and Engineer of any discrepancies between the actual rough-in and wiring requirements, and those identified on Drawings for resolution prior to installation.
- E. Arrange raceways, wiring, and equipment to permit ready access to switches, motors, and control components.
 - 1. Doors and access panels shall be kept clear.

- F. Coordinate electrical, telephone, and other utility services with the appropriate serving utility.
 - 1. No additional compensation will be allowed the Contractor for connection fees or additional work or equipment required by the serving utility, but not covered in the Drawings or Specifications.
- G. Coordinate underground work with other contractors working on the site.
 - 1. Coordinate particularly with contractors installing storm sewer, sanitary sewer, water, and irrigation lines to avoid conflicts.
 - 2. Common trenches may be used with other trades, providing clearances required by codes and ordinances are maintained.

1.09 CHANGE ORDERS

- A. All supplemental cost proposals by the Contractor shall be accompanied with a complete itemized breakdown of labor and materials. At the Architect's request, Contractor's estimating sheets for the supplemental cost proposals shall be made available to the Architect. Labor shall be separated and allocated for each item of work.

1.010 WARRANTY

- A. Provide a written warranty covering the work of this Division as required by the General Conditions.
- B. Apparatus:
 - 1. Free of defects of material and workmanship and in accord with the Contract Documents.
 - 2. Built and installed to deliver its full rated capacity at the efficiency for which it was designed.
 - 3. Operate at full capacity without objectionable noise or vibration.
- C. Include in Contractor's warranty for Work of Division 26 system damage caused by failures of any system component.

1.011 ALTERNATES

- A. Comply with Division 1 Section, "Alternates".
- B. Refer to Electrical Drawings for detailed information relating to the appropriate alternates.

PART 2 PRODUCTS

2.01 GENERAL

- A. Where specified materials or methods conflict with applicable codes, the more stringent requirement applies.
- B. Provide apparatus built and installed to deliver its full rated capacity at the efficiency for which it was designed.
- C. Ensure that entire electrical system operates at full capacity without objectionable noise or vibration.
- D. Materials and Equipment:
 - 1. Use materials and equipment that are:
 - a. New.
 - b. Of quality meeting or exceeding specified standards.
 - c. Free of faults and defects.
 - d. Conforming to Contract Documents.
 - e. Of size, make, type, and quality specified.
 - f. Suitable for the installation indicated.
 - g. Manufactured in accordance with NEMA, ANSI, U.L. or other applicable standards.
 - h. Otherwise as specified in Division 1 Section, "Product Requirements".
 - 2. Equipment not meeting all requirements will not be acceptable, even though specified by name.
 - 3. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer.
 - a. Component parts of the entire system need not be products of same manufacturer.

4. Basis of Design:
 - a. Equipment scheduled or specified by performance or model number shall be considered the Basis of Design.
 - b. If other equipment is provided in lieu of the Basis of Design equipment, assume responsibility for all changes and costs which may be necessary to accommodate this equipment, including, but not limited to:
 - 1) Different sizes and locations for connections.
 - 2) Different dimensions.
 - 3) Different access requirements.
 - 4) Any other differences.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General:
 1. Provide a complete properly operating system for each item of equipment specified.
 2. Install materials in a neat and professional manner.
 3. Comply with equipment manufacturer's written instructions, the best industry practices, and the Contract Documents.
 4. Comply with latest published NECA Standard of Installation, and provide competent supervision.
- B. Clarification:
 1. Where there is a conflict among manufacturer's instruction, best practice, and the Documents, request clarification from the Architect prior to rough-in.
 2. Architect's decision will be final.
 3. Work installed without clarification shall be removed and corrected by the Contractor at no cost to the Owner.

3.02 INSTALLATION IN RATED CONSTRUCTION

- A. Install intumescent material around ducts, conduits, and other electrical elements penetrating rated construction.
- B. Comply with firestop materials manufacturer's written instructions to prevent spread of smoke or fire through sleeves or block-outs penetrating rated fire barriers.
- C. Provide firestop materials specified in Division 7 Section, "Through-Penetration Firestop Systems," and as follows:
 1. Capable of passing a 3-hour test per ASTM E-814 (UL 1479).
 2. Consisting of material capable of expanding nominally eight times when exposed to temperatures of 250-350°F.
 3. An alternate method utilizing intumescent materials in caulk or putty complying with Division 7 Section, "Through-Penetration Firestop Systems" may be used.

3.03 EXCAVATION AND BACKFILL

- A. Perform all necessary excavation and backfill for the installation of electrical work in compliance with Division 31.
- B. For direct burial cable or non-metallic conduit, a minimum 3-inch cover of sand or clean earth fill shall be placed all around the cable or conduit on a leveled trench bottom. Lay all steel conduit on a smooth level trench bottom, so that contact is made for its entire length. Water shall be removed from trench while electrical conduit is being laid.
- C. Place backfill in layers not exceeding 8-inches deep and compact to 95% of maximum density at optimum moisture to preclude settlement.
 1. Interior: Bank sand or pea gravel.
 2. Exterior: Excavated material with final 8-inches clean soil.
- D. Following backfilling, grade all trenches to the level of surrounding soil. All excess soil shall be disposed of at the site as directed.

- E. Provide 6-inches wide vinyl tape marked "ELECTRICAL" in backfill, 12-inches below finished grade, above all high voltage cable or conduit runs.
- F. Coordinate patching of all asphalt or concrete surfaces disturbed by this work with General Contractor.

3.04 NOISE CONTROL

- A. Minimize transmission of noise between occupied spaces.
- B. Outlet Boxes:
 - 1. Do not install outlet boxes on opposite sides of partitions back to back.
 - 2. Do not use straight through outlet boxes, except where indicated.
- C. Conduit:
 - 1. Route conduit along corridors or other "noncritical" space to minimize penetrations through sound rated walls, or through non-sound-rated partitions between occupied spaces.
 - 2. Grout solid and airtight all penetrations through sound rated partitions.
 - 3. Use flexible connections or attachments between independent wall structures.
 - a. Do not rigidly connect (i.e., bridge) independent wall structures.
- D. Do not install contactors, transformers, starters, and similar noise-producing devices on walls that are common to occupied spaces, unless otherwise indicated.
 - 1. Where such devices are indicated to be mounted on walls common to occupied spaces, use shock mounts, or otherwise isolate them to prevent the transmission of noise to the occupied spaces.
- E. Ballasts, contactors, starters, transformers, and like equipment which are found to be noticeably noisier than other similar equipment on the project will be deemed defective and shall be replaced.

3.05 EQUIPMENT CONNECTIONS

- A. General:
 - 1. Provide complete electrical connections for all items of equipment requiring such connections, including incidental wiring, materials, devices, and labor necessary for a finished working installation.
 - 2. Verify the location and method for connecting to each item of equipment prior to roughing-in.
 - 3. Check the amperage, maximum overcurrent protection, voltage, phase and similar attributes of each item of equipment before rough-in and connection.
- B. Motor Connections:
 - 1. Make motor connections for the proper direction of rotation.
 - 2. Minimum Size Flex for Mechanical Equipment: 1/2-inch; except at small control devices where 3/8-inch flex may be used.
 - 3. Exposed Motor Wiring: Jacketed metallic flex with minimum 6-inches slack loop.
 - 4. Do not test run pump motors until liquid is in the system.
- C. Control devices and wiring relating to the HVAC systems are furnished and installed under Division 23; except for provisions or items indicated in Division 26 Drawings and Specifications.

3.06 EQUIPMENT SUPPORT

- A. Minimum Support Capacity:
 - 1. Provide fastening devices and supports for electrical equipment, luminaires, panels, outlets, and cabinets capable of supporting not less than four times the ultimate weight of the object or objects fastened to or suspended from the building structure.
- B. Luminaire Supports:
 - 1. Support luminaires from the building structure.
 - 2. Use supports that provide proper alignment and leveling of luminaires.

3. Where permitted at exposed luminaires, install flexible connections neat and straight, without excess slack, and attached to the support device.
- C. Support all junction boxes, pull boxes, or other conduit terminating housings located above the suspended ceiling from the floor above, roof, or penthouse floor structure to prevent sagging or swaying.
- D. Conduits:
 1. Support suspended conduits 1-inch and larger from the overhead structural system with metal ring or trapeze hangers and threaded steel rod having a safety factor of four.
 2. Conduits smaller than 1-inch installed in ceiling cavities, may be supported on the mechanical system supports when available space and support capacity has been coordinated with the subcontractor installing the supports.
 3. Anchor conduit installed in poured concrete to the steel reinforcing with No. 14 black iron wire.
- E. Powder actuated or similar shot-in fastening devices will not be permitted for any electrical work except by special permission from the Architect.

3.07 ACCESS DOORS

- A. Location and size of access doors is Work of Division 26.
- B. Furnishing and installation of access doors is work of Division 8 Section, "Access Doors and Frames".

3.08 ALIGNMENT

- A. Install panels, cabinets, and equipment level and plumb, parallel with structural building lines.
- B. Install distribution equipment and all electrical enclosures fitted neatly, without gaps, openings, or distortion.
- C. Properly and neatly close all unused openings with approved devices.
- D. Fit surface panels, devices, and outlets with neat, appropriate, trims, plates, or covers without overhanging edges, protruding corners, or raw edges.

3.09 CUTTING AND PATCHING

- A. General:
 1. Comply with Division 1 Section, "Cutting and Patching".
 2. Restore to original condition new or existing work cut or damaged by installation, testing, and removal of electrical Work.
 3. Patch and finish spaces around conduits passing through floors and walls to match the adjacent construction, including painting or other finishes.
 4. Clean up and remove all dirt and debris.
- B. Make additional required openings by drilling or cutting. Use of jackhammer is prohibited.
- C. Fill holes that are cut oversize so that a tight fit is obtained around the objects passing through.
 1. In rated construction, comply with Division 7 Section, "Through-Penetration Firestop Systems".
- D. Obtain Architect's permission and direction prior to piercing beams or columns.
- E. Where alterations disturb lawns, paving, walks, and other permanent site improvements, repair and refinish surfaces to condition existing prior to commencement of work.

3.010 PROTECTION OF WORK

- A. Protect all electrical work and equipment installed under this Division against damage by other trades, weather conditions, or any other causes.
 1. Equipment found damaged or in other than new condition will be rejected as defective.

- B. Keep switchgear, transformers, panels, luminaires, and all electrical equipment covered or closed to exclude dust, dirt, and splashes of plaster, cement, paint, or other construction material spray.
 - 1. Equipment not free of all such contamination is not acceptable.
- C. Provide enclosures and trims in new condition, free of rust, scratches, and other finish defects.
 - 1. If damaged, properly refinish in a manner acceptable to the Architect.

3.011 COMPLETION AND TESTING

- A. General:
 - 1. Comply with Division 1 Section, "Quality Requirements".
- B. Upon completion, test systems to show that installed equipment operates as designed and specified, free of faults and unintentional grounds.
 - 1. Schedule system tests so that several occur on the same day.
 - 2. Coordinate testing schedule with construction phasing.
 - 3. Conduct tests in the presence of the Architect or its representative.
 - 4. Notify Architect of tests 48 hours in advance.
- C. Engage a journeyman electrician with required tools to conduct equipment tests. Arrange to have the equipment factory representative present for those test where the manufacturer's warranty could be impacted by the absence of a factory representative.
- D. Perform tests per the requirements of each of the following systems:
 - 1. Low voltage distribution system.
 - 2. Emergency power system.
 - 3. Standby power system.
 - 4. Fire alarm system.
 - 5. Security system.
 - 6. Public address system.
 - 7. Lighting system.
 - 8. Lighting control system.
 - 9. Power metering and monitoring system.
- E. Provide a written record of performance tests and submit with operation and maintenance data.

END OF SECTION

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SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The provisions of Division 26 Section, Common Work Results for Electrical, apply to this section.

1.02 SUMMARY

- A. This section describes supporting devices for electrical equipment, associated conduit, and cable.
- B. Related Sections include:
 - 1. Section 26 05 33 Raceways and Boxes for Electrical Systems.
 - 2. Section 26 50 00 Lighting.

1.03 REFERENCED STANDARDS

- A. International Building Code (IBC)
- B. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

PART 2 PRODUCTS

2.01 PRODUCTS

- A. Hangers: Kindorf B-905-2A channel, H-119-D washer, C105 strap, minimum 1/2-inch rod with ceiling flange.
- B. Pipe Straps: Two-hole galvanized or malleable iron.
- C. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide all electrical equipment supports.
- B. Install vertical support members for equipment, straight and parallel to building walls.
- C. Provide independent supports to structural member for electrical fixtures, materials, or equipment installed in or on ceiling, walls, or in void spaces and/or over furred or suspended ceilings.
- D. Do not use other trades' fastening devices to support electrical equipment materials or fixtures.
- E. Do not use supports and/or fastening devices to support other than one particular item.
- F. Support conduits within 18 inches of outlets, boxes, panels, cabinets, and deflections.
- G. Provide complete seismic anchorage and bracing for the vertical and lateral restraint of conduit, cable trays, bus ducts, and electrical equipment as required by IBC Chapter 16 and the most recent version of the SMACNA Seismic Restraint Manual for Seismic Hazard Level (SHL) A. Shop drawings of bracing systems shall be submitted to the Architect for review and shall bear the seal of a professional engineer registered in the State of Oregon.

3.02 LUMINAIRES

- A. Light-Duty Ceiling Systems:
 - 1. Attach No. 12 hanger wire from each corner of the luminaire to the structure above.

2. Positively and securely attach luminaire within 6 inches of each corner to the suspended ceiling framing member by mechanical means.
- B. Intermediate-Duty Ceiling Systems:
 1. Positively and securely attach luminaire within 6 inches of each corner to the suspended ceiling framing member by mechanical means.
 2. Attach No. 12 hanger wire within 3 inches of each corner of each luminaire.
 3. Connect two 12-gauge slack wires from the luminaire housing to the structure above for luminaires weighing less than 56 pounds.
 4. Support luminaires weighing 56 pounds or more directly from the structure above with approved hangers attached to each corner of the luminaire.
- C. Heavy-Duty Ceiling Systems:
 1. Positively and securely attach luminaire within 6 inches of each corner to the suspended ceiling framing member by mechanical means.
 2. Connect two 12-gauge slack wires from the luminaire housing to the structure above for luminaires weighing less than 56 pounds.
 3. Support luminaires weighing 56 pounds or more directly from the structure above with approved hangers attached to each corner of the luminaire.

3.03 PULL AND JUNCTION BOXES

- A. Pull and junction boxes installed within the cavity of a suspended ceiling that is not a fire rated assembly may be attached to the suspended ceiling framing members, provided the following criteria are met:
 1. Installation complies with the ceiling system manufacturer's instructions.
 2. Pull or junction box is not larger than 100 cubic inches.
 3. The pull or junction box is supported to the main runner with two fastening devices that are designed for framing member application and positively attach or lock to the member.
 4. The pull or junction box serves branch circuits and associated equipment in the area.
 5. The pull or junction box is within 6 feet of the luminaires supplied.
 6. The framing members are not rotated more than 2 degrees after installation.
 7. Pull and junction boxes installed within the cavity of a suspended ceiling may be attached to independent support wires, provided the following criteria are met:
 - a. Independent support wires are taut and connected at both ends, one end to the ceiling framing member and the other to the structure above.
 - b. Pull or junction box is not larger than 100 cubic inches.
 - c. The pull or junction box is secured to the independent support wires by two fastening devices that are designed for the application.
 - d. Independent support wires in a fire-rated ceiling are distinguishable by color, tagging or other effective means.

3.04 CABLES AND RACEWAY

- A. Cables and raceway installed within the cavity of a suspended ceiling may be attached to independent support wires provided the following criteria are met:
 1. Independent support wires are taut and connected at both ends, one end to the ceiling framing member and the other to the structure above.
 2. Raceways are not larger than one inch trade size and cables and bundled cables are not larger than one inch diameter including insulation.
 3. Not more than three raceways or cables are supported by any independent support wire and are supported within the top or bottom 12 inches.
 4. Raceways are secured at intervals required for the type of raceway installed.
 5. Cables and raceway are secured to independent support wires by fastening devices and clips designed for the purpose.
 6. Independent support wires are distinguishable by color, tagging, or other effective means.

- B. Cables and raceway installed within the cavity of a suspended ceiling may be supported with trapezes constructed of steel rods and channels provided the following criteria are met:
1. The size of the rods, channel, and fastening devices are suitable for the anticipated weight.
 2. The spacing of the trapezes meets that required for the type of raceway installed.
 3. Cables and raceway are secured to a trapeze by straps designed for the purpose.
 4. Cables and raceway do not support other raceway or cables.
 5. An appropriately sized seismic bracing system is installed.

END OF SECTION

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SECTION 26 05 45

SEISMIC RESTRAINTS FOR ELECTRICAL RACEWAYS AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes:
 - 1. Seismic Bracing
 - 2. Channel Type Elements
 - 3. Bolting Accessories

1.02 RELATED SECTIONS

- A. Division 01, General Requirements
- B. Division 26, Electrical
- C. Section 26 05 29, Hangers and Supports for Electrical Systems

1.03 REFERENCED STANDARDS

- A. The following are the referenced standards:
 - 1. SMACNA Sheet Metal and Air Conditioning Contractor's National Association
 - 2. AISC American Institute of Steel Construction
 - 3. ASTM American Society for Testing and Materials
 - 4. AWS American Welding Society
 - 5. IBC International Building Code
 - 6. ICC International Code Council
 - 7. OSHPD Office of Statewide Health Planning and Development
 - 8. ASCE 7-16 Minimum Design Loads and Associated Criteria for Buildings and Other Structures

1.04 QUALITY ASSURANCE

- A. General Requirements:
 - 1. Provide seismic restraints for equipment, both supported and suspended, conduits, and cable tray systems.
 - 2. Bracing of conduits and cable trays in accordance with the provisions set forth in the SMACNA seismic restraint manual and the requirements set in ASCE 7 Section 13.2.
 - 3. Review and approve structural requirements for restraints, including their attachment to the building structure by a registered structural engineer in the same state as the project.
 - 4. Attachments to supported or suspended equipment must be coordinated with the equipment manufacturer.
- B. Bracing of Conduits:
 - 1. Provide seismic bracing of conduit as detailed below:
 - a. Brace electrical conduits 2-1/2 inch nominal diameter or larger.
 - b. Exception: Conduits suspended by individual hangers 12-inches or less in length, as measured from the top of the conduit to the bottom of the support where the hanger is attached, need not be braced.
- C. Suspended Equipment and Raceways:
 - 1. Cable Method: The seismic restraint shall consist of a combination of stranded steel aircraft cable with an added nut and neoprene and steel washer.
 - 2. Cable attachment details, cable size, and the neoprene and steel washers shall be sized by the manufacturer and are to be indicated in the shop drawings.
 - 3. Provide detailed shop drawings for approval in sufficient time to allow structural attachment work to be incorporated into the normal work sequence.

- D. Seismic restraints, including anchors to building structure, designed by a registered professional structural engineer licensed in the state of Oregon. Design includes:
1. Number, size, capacity, and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both the unit to the curb and the curb to the structure. For units weighing greater than 2500 pounds, or curbs more than 10 feet long, provide substantiating calculations the curb can accept the prescribed seismic forces.
 2. Number, size, capacity, and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations, test data, or California OSHPD approval number verifying the horizontal and vertical ratings of the seismic restraint devices.
 3. Number, size, capacity, and location of braces and anchors for suspended raceways, bus ducts, and cable trays on as-built plan drawings.
 - a. Select a single seismic restraint system pre-designed to meet the requirements of the latest edition of the IBC such as the 1999 Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork, and Electrical Systems.
 - b. Details or designs from separate seismic restraint guidelines are not acceptable. Installation not addressed by the selected system shall be designed, detailed, and submitted alone with the as-built plan drawings.
 - c. Maximum seismic loads shall be indicated on drawings at each brace location. Drawings shall bear the stamp and signature of the registered professional structural engineer licensed in the state of Oregon who designed the layout of the braces.
- E. Supports, Hangers, and Anchors: Comply with the requirements of Section 26 05 29, Hangers and Supports for Electrical Systems meet the requirements of ASCE 7 Section 13.2 based on the Seismic Design Criteria located on the structural drawings.

1.05 SUBMITTALS

- A. Product Data: Submit product data for products specified herein.
- B. Shop Drawings:
1. Submit shop drawings complying with the requirements of the Quality Assurance article of this Section.
 2. Stamp shop drawings by a professional structural engineer licensed in the state of Oregon.
 3. Approve submittals prior to rack fabrication and installation.
- C. Calculations:
1. Submit seismic calculations indicating restraint loadings resulting from the design seismic forces presented in the Quality Assurance article of this Section.
 2. Include anchorage details that include the diameter, embedment, and material grade of the material in which the anchor is placed.
 3. Stamped by a professional structural engineer licensed in the state of Oregon.
- D. Certifications:
1. Submit certification of seismic restraint's and building structural member's capability to safely accept loads resulting from seismic forces calculated in the previous paragraph.
 2. Tests in three planes clearly showing ultimate strength and appropriate safety factors performed by independent laboratories and certified by a professional structural engineer licensed in the state of Oregon or calculations by a professional structural engineer licensed in the state of Oregon are acceptable.

PART 2 PRODUCTS

2.01 SEISMIC BRACING:

- A. Steel fabrication, in accordance with AISC Steel Manual, with structural steel shapes of ASTM A 36 steel.
- B. Welding in accordance with AWS D1.1.

- C. Design and sizes as required.
- D. Fastenings, bracing, and assembly selected by a professional structural engineer licensed in the state of Oregon.
- E. Show that the maximum stress in any structural steel member will not exceed 18,000 psi.

2.02 CHANNEL TYPE ELEMENTS

- A. 12 gauge formed steel, 1-5/8-inch square prime painted or chromate dip finish. Use spring-in nuts with grooves.

2.03 BOLTING ACCESSORIES

- A. Machine bolts with semi-finished nuts.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide support assemblies to meet the seismic zone indicated. Equipment shall be braced and anchored to conform to the requirements listed under the Quality Assurance article of this Section.
- B. Seismically brace raceways, cable trays, and suspended bus duct to conform to the requirements listed under the Quality Assurance article of this Section.
- C. Provide pipeline seismic flexible connectors where piping crosses building earthquake joints. Arrange raceways and connectors for the amount of motion required. Maintain continuity of the grounding system for each of the joints.
- D. Do not use powder-actuated inserts.
- E. Seismic Restraints:
 - 1. Attach to structural members of the building, which are capable of withstanding the design load of the seismic restraint.
 - 2. Ensure load capacity of the structural members is greater than or equal to the capacity of the seismic restraint.

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