SECTION 22 0548 - SEISMIC PROTECTION

ALL LIBRARIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 APPLICABILITY

A. Seismic supports and restraints shall be provided for all Life Safety and Hazardous or Flammable systems. The following are defined as Life Safety and Hazardous or Flammable:

1. Gas and high-hazard piping.
2. Water heaters, and other equipment utilizing combustible energy sources or high-temperature energy sources.
3. Any system or component containing hazardous or flammable materials.

B. In addition to the above, seismic supports and restraints shall be provided for all of the following systems:

1. Reciprocating or rotating equipment or any equipment with moving parts.
2. Tanks, heat exchangers, and pressure vessels.
3. Piping systems.

1.3 SUMMARY

A. Description of Work: The purpose of this section is to define seismic restraint requirements for plumbing systems, equipment and devices, hereinafter referred to as components.

B. This Section does not specify seismic force resisting systems for building structures and structural elements, which are addressed in Divisions 03 through 06.

C. The requirements for seismic protection specified herein are in addition to any requirements for support and/or seismic protection specified in other sections of these specifications.

D. The Contractor shall be responsible for developing details to provide proper support of equipment and devices in accordance with the requirements specified herein.

E. The Contractor shall not proceed with installation of equipment nor seismic protection system until all applicable submittals required by this section have been completed.

F. This section includes the following:

1. Applicable Code.
2. Project-specific Code Coefficients
3. Rigid Support Items.
4. Non-rigid Support Items.

5. Sway Braces.
6. Anchors, Bolts and Clamps.
7. Restraining Cables.
8. Seismic Snubbers.
9. Installation Requirements.

G. Related sections: The following sections contain requirements that relate to this section:

1. Division 05 Section "Metal Fabrications" for materials to anchor equipment piping to building structure.
2. Division 07 Section "Roof Accessories" for roof equipment supports.
3. Division 09 Section "Painting" for field-applied painting requirements.
4. Division 22 Section "Common Work Results for Plumbing" for general plumbing requirements.
5. Division 22 Section "Hangers and Supports" for piping and equipment supports.
6. Division 22 Section "Vibration Isolation" for vibration-isolation hangers, supports and flexible connectors.
7. Division 22 Section "Insulation" for pipe insulation.
8. All Division 22 Sections for plumbing equipment and systems requiring seismic protection.

1.4 DEFINITIONS

A. Terminology used in this section is defined in ASCE/SEI 7-05: *Minimum Design Loads for Buildings and Other Structures*.

B. OSHPD: Office of Statewide Health Planning & Development for the State of California.

1.5 PERFORMANCE REQUIREMENTS

A. Refer to Structural drawings for seismic performance requirements.

1.6 SUBMITTALS

A. The Engineer shall receive one copy of all submittal data supplied to the Owner as required in this specification. It is the responsibility of the Contractor to provide seismic protection as outlined herein. Receipt by the Engineer of a copy of the submittals is to verify conformance to the submittal requirements set forth in this specification section. It is not an admission by the Engineer as to the accuracy or completeness of the calculations submitted and equipment proposed.

B. Prior to installation of equipment and devices requiring seismic restraints, the Contractor shall submit required documentation and details at the shop drawing review stage to the Owner. Submit the following in accordance with conditions of contract and Division 01 specification sections.

C. Product data: Include installation details and instructions for each type of seismic support and restraint. Submit equipment support and restraint schedule showing size, location, and features for each required support and restraint.

D. Product certificates: Signed by the manufacturer of seismic supports and restraints certifying that their products meet the specified requirements.

E. Shop Drawings: Calculations and Drawings signed and sealed by a qualified professional engineer registered to practice in the State of **Missouri** shall be provided for the installation details of each piece of equipment. Include the following:

1. Design Calculations: Calculate requirements for selecting seismic restraints.

   a. Exception: Certified and stamped calculations are not required for seismic-restrained systems which have been pre-approved by OSHPD or comply with ANSI Standard *Seismic Restraint Manual; Guidelines for Mechanical Systems*, as issued by the Sheet Metal and Air Conditioning Contractors National Association, Inc., 1998; Chantilly, Virginia including Addendum 1 issued 2000. A signed letter on Contractor's letterhead shall be provided as part of the submittal process stating which approved systems are being utilized.

2. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
3. Assembly-type shop drawings: For each type of seismic support and restraint, indicate dimensions, weights, required clearances, and methods of assembly of components. Submittal Drawings shall indicate in complete detail size, type, material grade, locations and dimensions; and shall show construction details, reinforcement, anchorage and installation with relation to the building construction. Submittals shall include, but not be limited to sway braces, flexible couplings or joints, resilient type vibration devices, and anchorage of concrete equipment pads to structure.
4. Where seismic anchors and braces for one component must unavoidably be attached to two or more elements of a structure subject to differential movement, such as a wall and a floor or two different floors, submit sealed calculations for relative displacements; including selection of sufficient flexible fittings to accommodate the relative displacement. Examples subject to relative displacement include vertical pipe risers; or a pump anchored to a floor and rigidly connected to piping anchored to the roof structure above.

F. Welder certificates: Signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" Article.

G. Maintenance data: For seismic supports and restraints for inclusion in Operating and Maintenance Manual specified in Division 01.

H. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the

unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

I. Contractor's Acknowledgement of Seismic Responsibility: Submit written contractor's statement of responsibility prior to commencement of the work, acknowledging an awareness of the seismic restraint requirements of the project, that control will be exercised to obtain conformance with the Construction Documents, listing procedures for exercising control over the seismic restraint installation, and identifying the responsible person(s) within their organization.

1.7 QUALITY ASSURANCE

A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD and shall bear anchorage preapproval "R" number, from OSHPD or another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and calculations must include both shear and tensile loads and one test or analysis at 45 degrees to the weakest mode.

B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.8 REFERENCES

A. Regulatory Requirements: Comply with applicable codes pertaining to product materials and installation of seismic supports and restraints.

B. Referenced Codes and Standards: All work provided under this section shall comply with the requirements specified herein, and additionally as provided in the following Codes and Standards. In all cases where conflicting requirements are provided within these specifications, Codes and Standards, the most stringent requirement shall apply.

1. IBC 2009: Comply with the International Building Code.
2. ASCE/SEI 7-05: Comply with *Minimum Design Loads for Buildings and Other Structures*.
3. American Institute of Steel Construction (AISC) "Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design", with Commentary and Supplements.
4. NFPA Compliance: Seismic supports and restraints shall comply with NFPA standard No. 13 when used as a component of a fire protection system.
5. UL and FM Compliance: Seismic supports and restraints shall be listed and labeled by

UL and FM where used for fire protection piping systems.

6. ANSI/SMACNA: All seismic restraints for piping shall comply with ANSI Standard *Seismic Restraint Manual; Guidelines for Mechanical Systems*, as issued by the Sheet Metal and Air Conditioning Contractors National Association, Inc., 1998; Chantilly, Virginia; including Addendum 1 published 2000. A seismic hazard level A (SHL-A) shall be utilized.
7. ANSI Standards and ASTM Publications: Seismic supports and restraints shall comply with American National Standards Institute, Inc. (ANSI) and the American Society for Testing and Materials (ASTM) Publications.

   a. B18.2.1-1981 Square and Hex Bolts and Screws Inch Series
   b. B18.2.2-1972 Square and Hex Nuts (R 1983)
   c. A 36-84a Structural Steel
   d. A 307-86a Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
   e. A 325-86a High-Strength Bolts for Structural Steel Joints
   f. A 501-84 Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
   g. A 576-87 Steel Bars, Carbon, Hot-Wrought, Special Quality

8. Federal Specification: Seismic supports and restraints shall comply with Federal Specification RR-W-410D for Wire Rope and Strand.
9. "Tri-Service Manual", TM-5809-10, NAVFAC P-365, AFM 88-3, Chapter 13, Departments of Army, Navy and Air Force, Government Printing Office, Washington, D.C.
10. Public Law 95-124 & 101-614 "Earthquake Hazards Reduction Act" and Executive Order 12699; NEHRP (FEMA) Standard "Recommended Provisions for the Development of Seismic Regulations for New Buildings"; National Earthquake Hazards Reduction Program of the Federal Emergency Management Association, Washington, D.C.

1.9 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Seismic Snubber Units: Furnish replacement neoprene inserts for all snubbers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. B-Line Systems, Inc.
3. California Dynamics Corp.
4. Kinetics Noise Control, Inc.
5. Loos & Co., Inc.; Cableware Technology Division.
6. Mason Industries, Inc.
7. Tolco division of NIBCO, Inc.
8. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
9. Vibration Eliminator Co., Inc.
10. Vibration Isolation Co., Inc.
11. Vibration Mountings & Controls/Korfund.

B. All seismic restraint devices of any one general group; raceways or suspended equipment, or switchgear or other floor mounted equipment, etc., shall be provided by a single manufacturer.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

C. Bolts and Nuts: Square and hex bolts and nuts, ANSI B18.2.1 and B18.2.2, SAE Grade 5, and ASTM A 307 or A 325.

1. Underground bolts shall be galvanized.

D. Sway Brace: Material used for members listed in Table I of this specification, except for pipes, shall be structural steel conforming with ASTM A 36. Steel pipes shall conform to ASTM A 501. Note additional exception below.

TABLE I

MAXIMUM LENGTH AND ALLOWABLE CONCENTRIC LOADS FOR SWAY BRACES

Type	Size	Maximum Length*	Allowable Concentric Load* (kips)
Angles	1½" x 1½" x ¼"	4'-10"	3.4
	2" x 2" x ¼"	6'-6"	4.6
	2½" x 2½" x ¼"	8'-2"	5.9
	3" x 3" x ¼"	9'-10"	7.1
Rods	¾"	3'-1"	2.2
	7/8"	3'-7"	3.0
Pipes (40S)	1"	6'-9"	2.4
	1¼"	8'-8"	3.3
	1½"	10'-1"	3.9
	2"	12'-9"	5.3
	2½"	15'-4"	8.4
	3"	19'-0"	11.0

*Based on the slenderness ratio of 1/r = 200, and load applied concentrically to brace. The tabulated load values include a 33% stress increase as permitted for seismic loads. For non-concentric loading,

allowable brace load is to be determined per the AISC Specification for Structural Steel Buildings / ASD 1989.

1. Contractor's Option: In lieu of utilizing angles, rods, bars or pipes as noted in Table I, U-channel systems consisting of channels, fittings and accessories may be utilized. The u-channel system shall be manufactured as a complete system by one supplier and listed by the manufacturer for use in seismic restraint application. The system shall have the approval of OSHPD. The equipment shall provide multi-directional bracing of plumbing piping systems.

E. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement. Cables shall conform to Fed. Spec RR-W-410 as follows:

1.	5/32 inch diameter	Type V, Class 1
2.	3/16 inch to 5/16 diameter	Type V, Class 2
3.	1/4 inch to 5/8 diameter	Type I, Class 2

F. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.

G. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

H. Flexible Couplings: Flexible couplings shall have same pressure ratings as adjoining pipe.

I. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix ratio shall be 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

J. Galvanizing Repair Paint: High-zinc-dust-content paint, with dry film containing not less than 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive seismic-control devices for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Examine substrates and conditions under which seismic supports and restraints are to be installed

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

3.2 SEISMIC PROTECTION, GENERAL

A. Attachments and supports for plumbing systems and components shall be designed to resist the seismic forces specified herein.

B. Plumbing systems and components shall be designed by their manufacturer to consider dynamic effects of the equipment and its contents. Design, selection, and installation of seismic bracing for plumbing systems and components shall account for interaction between equipment and supporting structures, and the effect imposed by attached utility or service lines, and shall ensure that impact between components is avoided during a seismic event.

C. Anchorage: Install seismic supports and restraints complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

1. Friction resulting from gravity loads shall not be considered to provide resistance to seismic loads.
2. All bolts, including fasteners and anchor bolts, used for attachment of anchors to components and to structure shall be sized for the seismic forces described in Part I but shall not be less than ½-inch diameter in any case.
3. Powder-driven fasteners and shot pins shall not be permitted in tension load applications.
4. Expansion anchors, other than undercut expansion anchors, shall not be permitted to anchor non-vibration isolated equipment rated over 10 horsepower.
5. Anchorage Embedment Depth: Not less than eight times the anchorage diameter.
6. Anchorage Edge Distance: Place anchorage not less than ten times the anchorage diameter from edge of concrete housekeeping pad.

D. Base-Mounted Equipment: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions for seismic forces at Project site.

1. Concrete equipment pads shall be anchored to the supporting structure as required to resist the seismic loads specified herein. Anchorage shall adequately distribute loads to the elements of the supporting structure; coordinate with building structural engineer if required. Anchorage devices may consist of either cast-in-place or drilled-in and epoxy grouted reinforcing steel dowels. Unless otherwise indicated, install dowel rods to connect concrete base to concrete floor on 18-inch (450-mm) centers around the full perimeter of the base.
2. All floor or pad mounted equipment shall be anchored with cast-in-place anchor bolts, expansion bolts or epoxy bolts. For vibratory equipment, the nuts shall be secured against loosening by either installing double nuts, tack welding single nut to bolt or scoring bolt threads.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Cast-in-place concrete materials and placement requirements are specified in Division 03.

E. Resilient Vibration Isolation Devices: Selection of anchor bolts for vibration isolation devices and/or snubbers to equipment base and foundations shall follow the same procedure as for base-mounted equipment in subsection above, except that the seismic force found in Part 1

shall be doubled for the purpose of selecting isolation devices, anchorage, and snubbers.

1. Vibration Isolation Devices are suitable for seismic restraint provided the vertical and horizontal seismic forces are within the limits designed into the device.
2. Resilient and Spring-Type Vibration Devices: Vibration isolation devices shall be selected so that the maximum movement of equipment from the static deflection point shall be 0.5 inches.
3. Multidirectional Seismic Snubbers: If vibration isolators are required then multidirectional seismic snubbers employing elastomeric pads shall be installed on all vibration isolated equipment. These snubbers shall provide 0.25-inches free vertical and horizontal movement from the static deflection point. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure. Snubber medium shall consist of viscoelastic or other impact-limiting material arranged around a flanged steel trunnion so both horizontal and vertical overturning forces are resisted by the snubber medium.
4. Install resilient bolt isolation washers on equipment anchor bolts.
5. Do not short-circuit vibration isolation device with rigid connection directly to structure.

F. Equipment Sway Bracing: Required for all items supported from overhead structures. Braces shall consist of angles, rods, bars, pipes, cables, or factory fabricated U-channel systems and secured at both ends with not less than ½-inch bolts. Braces shall conform to Table 1, or as recommended by U-channel systems fabricator. Bracing shall be provided in two planes of directions, 90 degrees apart, for each item of equipment. Details of all equipment bracing shall be submitted.

1. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

3.3 PIPES

A. General: Select and install restraints for piping in complete and strict accordance with ANSI Standard *Seismic Restraint Manual; Guidelines for Mechanical Systems*, as issued by the Sheet Metal and Air Conditioning Contractors National Association, Inc., 1998; Chantilly, Virginia including Addendum 1 published 2000; except where more stringent requirements are described herein.

B. Transverse Sway Bracing: Transverse sway bracing shall be provided at each horizontal turn of 45 degrees or more, at the end of each pipe run, and otherwise at regular intervals spaced no further than required by the above Standard. Sway bracing shall be provided at closer intervals if so recommended by U-channel manufacturer when using U-channel systems.

C. Longitudinal Sway Bracing: Longitudinal sway bracing shall be provided at regular intervals spaced no further than required by the above Standard. Transverse bracing for one pipe section may also act as longitudinal bracing for a pipe section connected perpendicular to it, if the bracing is installed within 4 feet of the intersection, and if it is sized for the larger pipe. Sway bracing shall be provided at closer intervals if so recommended by U-channel manufacturer when using U-channel systems.

D. Anchor Rods, Angles, and Bars: Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as required.

E. Restraining Cables: Install restraining cables slightly slack. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

F. Hanger Rod Reinforcement: Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe and equipment hangers where required. Do not weld angles to rods.

G. Clamps: Clamps on uninsulated pipes shall be applied directly to pipes. Insulated piping shall have clamps applied over insulation vapor barrier with high-density inserts and metal protection shields under each clamp. Vapor barrier shall not be punctured.

1. At trapeze anchor locations, shackle or clamp piping to trapeze.

H. Vertical Runs: Vertical runs of piping shall be braced at each floor and roof level. Provide intermediate lateral braces at 13 foot maximum spacing where story height exceeds 13 feet.

I. Spreaders: Required between racked or adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 4 inches (or four times the maximum displacement due to seismic force) apart. Spreaders shall be applied at same interval as sway braces. Spreaders shall be applied to surface of bare or insulated hot pipe, and over insulation utilizing high-density inserts and pipe protection shields where vapor-barrier-type insulation is employed.

J. Flexible Couplings or Joints: Flexible couplings and joints of the mechanical joint type may be used for aboveground and underground piping. Flexible couplings or joints in building piping shall be provided at bottom of all pipe risers larger than 3½ inches in diameter. Cast-iron waste and vent piping need only comply with these provisions when caulked joints are used. Flexible bell and spigot pipe joints using rubber gaskets or no-hub fittings may be used at each branch adjacent to tees and elbows for underground waste piping inside of building to comply with these requirements.

K. Mechanical couplings for steel or cast-iron pipe shall be of the sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movement caused by expansion, contraction, slight settling or shifting of the ground, minor variations in trench gradients, and traffic vibrations. Where permitted in other sections of these specifications, joints utilizing split-half couplings with grooved or shouldered pipe ends may be used.

L. Sleeve-type couplings shall be used for joining plain-end pipe sections. The coupling shall consist of one steel middle ring, two steel followers, two gaskets, and necessary steel bolts and nuts to compress the gaskets. Underground bolts shall be galvanized.

M. Underground Piping: All underground piping shall have flexible couplings installed adjacent to building. Additional flexible couplings shall be provided as follows:

1. On each side of the joints of demarcation between soils having widely differing degrees of consolidation.

2. At all points that can be considered to act as anchors.
3. On every branch of a tee and each side of an elbow.

N. Emergency Gas Supply Connections: Facilities which are to be connected to natural gas distribution systems shall be provided with an aboveground locked, valved and capped emergency gas supply connection. An automatic device to safely interrupt the flow of gas to the building in case of an earthquake shall be provided as specified in Division 22 Section "Facility Natural Gas Piping". Provisions shall be made for attachment of a portable, commercial-sized gas cylinder system to this connection. Connection shall be located within 12 inches of the exterior wall and clearly marked with an appropriate metal sign mounted on wall above.

3.4 SEISMIC RELATIVE DISPLACEMENT

A. Do not attach seismic anchorage or bracing for any one component to two or more elements of a structure subject to differential movement, such as a wall and a floor or two different floors. Do not attach seismic anchorage or bracing for any one component to two or more separate structures or structural systems.

B. Piping shall be designed to accommodate differential movement between components and structures when attached to structures that could displace relative to each other and where the components cross a seismic isolation interface. Examples include vertical pipe risers; or a pump anchored to a floor and rigidly connected to piping anchored to the roof structure above.

1. Furnish and install sufficient flexible fittings to accommodate the relative displacement.

3.5 ADJUSTING

A. Support and Restraint Adjustment: Adjust supports and restraints to distribute loads equally on attachments.

B. Adjust snubbers according to manufacturer's written recommendations.

C. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

D. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

3.6 CLEANING

A. After completing equipment installation, inspect seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

B. Paint Touch-Up: Immediately after installation of equipment, devices and seismic protection system; clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas per requirements in Division 09 section "Painting".

C. Galvanizing Touch-Up: Immediately after installation of equipment, devices and seismic protection system; clean field welds, bolted connections, and abraded areas of galvanizing.

Apply galvanizing repair paint to comply with ASTM A 780.

3.7 FIELD QUALITY CONTROL

A. Review: Engage an authorized representative of the seismic restraint vendor to perform the following field quality control review:

1. Examine all plumbing systems and equipment to confirm all seismic-restraint systems are installed properly and in compliance with these specifications and the submittals.
2. Examine all seismic restraints and seismic snubbers for minimum clearances.
3. Examine all cable bracing systems for proper installation, angle of slope, and tension or slack.

B. Report: Submit a certification report of the authorized representative of the seismic restraint vendor to verify the above review and to include the following:

1. Certify that all seismic-restraint systems are installed properly and in compliance with these specifications and the submittals.
2. Identify those areas that require corrective measures or certify that no corrective measures are necessary.
3. Any changes to the originally submitted seismic restraint designs, such as those due to field coordination, shall be clearly defined and detailed in the report.

END OF SECTION 22 0548