SECTION 210548 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

Use this Section if Project is in a seismic area. Use Section 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment" for Projects not in a seismic area.

Revise this Section by deleting and inserting text to meet Project-specific requirements.

1. GENERAL
   * + 1. RELATED DOCUMENTS
          1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
       2. SUMMARY
          1. Section Includes:

Elastomeric isolation pads.

Elastomeric isolation mounts.

Restrained elastomeric isolation mounts.

Pipe-riser resilient supports.

Resilient pipe guides.

Elastomeric hangers.

Snubbers.

Restraint channel bracings.

Seismic-restraint accessories.

Mechanical anchor bolts.

Adhesive anchor bolts.

* + - * 1. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.

Section 230548 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. IBC: International Building Code.
        2. ICC-ES: ICC-Evaluation Service.
        3. OSHPD: Office of Statewide Health Planning & Development (for the State of California).
      1. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
        2. Manufacturer’s installation instructions shall be provided along with product data.
        3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
        4. Product Data: For each type of product.

Include rated load, rated deflection, and overload capacity for each vibration isolation device.

Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component required.

See Evaluations for a discussion on seismic-restraint capacities and rating services.

Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by [**an evaluation service member of ICC-ES**] [**OSHPD**] [**an agency acceptable to authorities having jurisdiction**].

Annotate to indicate application of each product submitted and compliance with requirements.

Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

Retain "Delegated-Design Submittal" Paragraph below if design services have been delegated to Contractor.

* + - * 1. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional Director’s Representative responsible for their preparation.

Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, due to seismic forces required to select vibration isolators, and due to seismic restraints.

Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.

Retain "Seismic-Restraint Details" Subparagraph below only if seismic design requirements apply but calculations have not been made and details or charts on Drawings do not describe seismic restraints in detail. Retaining subparagraph requires Contractor to submit seismic-restraint delegated-design Drawings prepared by a professional engineer. Revise to suit local requirements.

Seismic-Restraint Details:

Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

Retain first subparagraph below if Project includes equipment mounted outdoors.

Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

Preapproval and Evaluation Documentation: By [**an evaluation service member of ICC-ES**] [**OSHPD**] [**an agency acceptable to authorities having jurisdiction**], showing maximum ratings of restraint items and the basis for approval (tests or calculations).

Retain "Coordination Drawings" Paragraph below for situations where limited space necessitates maximum utilization for efficient installation of different components or if coordination is required for installation of products and materials by separate installers. Coordinate paragraph with other Sections specifying products listed below. Preparation of coordination drawings requires the participation of each trade involved in installations within the limited space.

* + - * 1. Coordination Drawings: Show coordination of vibration isolation device installation and seismic bracing for fire-suppression piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
        2. Qualification Data: For [**testing agency**].

Retain "Welding certificates" Paragraph below if retaining "Welding Qualifications" Paragraph in "Quality Assurance" Article.

* + - * 1. Welding certificates.

Retain "Field quality-control reports" Paragraph below if Contractor is responsible for field quality-control testing.

* + - * 1. Field quality-control reports.
      1. QUALITY ASSURANCE

If additional control is needed, retain "Testing Agency Qualifications" Paragraph below to specify 29 CFR 1910.7. 29 CFR 1910.7 defines "NRTL" (nationally recognized testing laboratory) as it applies to testing and inspecting for safety, and lists, labels, or accepts equipment and materials that comply with certain OSHA criteria.

Retain "Testing Agency Qualifications" Paragraph below if Contractor selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article.

* + - * 1. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
        2. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

Retain "Welding Qualifications" Paragraph below if shop or field welding is required. If retaining, also retain "Welding certificates" Paragraph in "Informational Submittals" Article.

* + - * 1. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."
        2. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by 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 unavailable, 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 NYS licensed professional engineer.

1. PRODUCTS

See Evaluations for more detailed information about controlling vibration, additional information on products described in this Section, illustrations, selection guides, and supplements to equipment schedules.

Coordinate specifications for products in this Section with structural engineer and with Drawings.

* + - 1. PERFORMANCE REQUIREMENTS
         1. Seismic-Restraint Loading:

Obtain values for items in subparagraphs below from Project structural engineer or from ASCE/SEI 7. If the code at Project site is other than the IBC or NFPA 5000, revise parameters to comply with applicable code.

Specify design spectral response acceleration at short periods (0.2 second) and at 1.0 second based on site class in "Site Class as Defined in the IBC" Subparagraph below. Typical values range from 2 to 200 percent. Design spectral response acceleration is required for seismic force calculations to size seismic restraints. For each seismic restraint, include component importance factor, component response modification factor, and component amplification factor in the Fire-Suppression Vibration-Control and Seismic-Restraint Device Schedule on Drawings.

Site Class as Defined in the IBC: [**A**] [**B**] [**C**] [**D**] [**E**] [**F**].

In "Assigned Seismic Use Group or Building Category as Defined in the IBC" Subparagraph below, retain Seismic Use Group or Building Category for Project structure from three classifications defined in the IBC.

Assigned Seismic Use Group or Building Category as Defined in the IBC: [**I**] [**II**] [**III**].

Retain "Component Importance Factor," "Component Response Modification Factor," and "Component Amplification Factor" subparagraphs below if these values are not included in the Fire-Suppression Vibration-Control and Seismic-Restraint Device Schedule on Drawings. Factors below often vary among supported equipment. However, it is possible to specify maximum values for these factors for various classes of equipment or for all equipment instead of scheduling each piece of equipment.

Component Importance Factor: [**1.0**] [**1.5**] <**Insert value**>.

Component Response Modification Factor: [**1.5**] [**2.5**] [**3.5**] [**5.0**] <**Insert value**>.

Component Amplification Factor: [**1.0**] [**2.5**] <**Insert value**>.

Design Spectral Response Acceleration at Short Periods (0.2 Second): <**Insert number**>.

Design Spectral Response Acceleration at 1.0-Second Period: <**Insert number**>.

See Evaluations for a discussion on seismic-restraint capacities and rating services.

Rated strengths, features, and applications shall be as defined in reports by [**an evaluation service member of ICC-ES**] [**OSHPD**] [**an agency acceptable to authorities having jurisdiction**].

Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least [**four**] <**Insert number**> times the maximum seismic forces to which they are subjected.

* + - 1. ELASTOMERIC ISOLATION PADS

Copy "Elastomeric Isolation Pads" Paragraph below and re-edit for each product.

The configuration and materials of elastomeric isolation pads depend on the equipment being supported. It is possible to have more than one type of elastomeric isolation pad on the same Project. Insert Drawing designation for each elastomeric isolation pad type required. Use these designations on Drawings to identify each product.

* + - * 1. Elastomeric Isolation Pads: <**Insert drawing designation**>.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9242) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Ace Mountings Co., Inc.

CADDY; nVent

Isolation Technology, Inc

Kinetics Noise Control, Inc

Korfund

Approved equivalent.

Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.

Size: Factory or field cut to match requirements of supported equipment.

Verify availability of various pad materials and their properties with manufacturers.

Pad Material: Oil and water resistant with elastomeric properties.

Surface Pattern: [**Smooth**] [**Ribbed**] [**Waffle**] pattern.

Retain first subparagraph below if pad is infused with synthetic fibers.

Infused nonwoven cotton or synthetic fibers.

Retain first subparagraph below if galvanized-steel baseplates are adhered to the isolation pad to facilitate load distribution.

Load-bearing metal plates adhered to pads.

Retain "Sandwich-Core Material" Subparagraph below if pad has a sandwich-core material.

Copy "Sandwich-Core Material" Subparagraph below and re-edit for each sandwich-core material. Core materials may not be elastomeric. See the "Elastomeric Isolation Pads" Article in the Evaluations for more information.

Sandwich-Core Material: [**Resilient**] [**and**] [**elastomeric**] <**Insert compound**>.

Retain "Surface Pattern" Subparagraph below if the sandwich-core material has a surface pattern.

Surface Pattern: [**Smooth**] [**Ribbed**] [**Waffle**] pattern.

Retain subparagraph below if pad is infused with synthetic fibers.

Infused nonwoven cotton or synthetic fibers.

* + - 1. ELASTOMERIC ISOLATION MOUNTS

Copy "Double-Deflection, Elastomeric Isolation Mounts" Paragraph below and re-edit for each product.

The configuration and materials of elastomeric isolation mounts depend on the equipment being supported. It is possible to have more than one type of elastomeric isolation mount on the same Project. Insert drawing designation for each elastomeric isolation mount type required. Use these designations on Drawings to identify each product.

* + - * 1. Double-Deflection, Elastomeric Isolation Mounts: <**Insert drawing designation**>.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9242) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Ace Mountings Co., Inc.

CADDY; nVent

Isolation Technology, Inc

Kinetics Noise Control, Inc

Korfund

Approved equivalent.

Mounting Plates:

Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded [**with threaded studs or bolts**].

Retain "Baseplate" Subparagraph below if the elastomeric mount being specified has a baseplate.

Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

* + - 1. RESTRAINED ELASTOMERIC ISOLATION MOUNTS

Copy "Restrained Elastomeric Isolation Mounts" Paragraph below and re-edit for each product.

The configuration and materials of restrained elastomeric isolation mounts depend on the equipment being supported. It is possible to have more than one type of restrained elastomeric isolation mount on the same Project. Insert drawing designation for each restrained elastomeric isolation mount type required. Use these designations on Drawings to identify each product.

* + - * 1. Restrained Elastomeric Isolation Mounts: <**Insert drawing designation**>.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9242) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Ace Mountings Co., Inc.

CADDY; nVent

Isolation Technology, Inc

Kinetics Noise Control, Inc

Korfund

Approved equivalent.

Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

Housing: Cast-ductile iron or welded steel.

Elastomeric Material: Molded, oil-resistant rubber, neoprene or other elastomeric material.

* + - 1. PIPE-RISER RESILIENT SUPPORT

Copy "Description" Paragraph below and re-edit for each product.

The configuration and materials of pipe-riser resilient supports depend on the equipment being supported. It is possible to have more than one type of pipe-riser resilient support on the same Project. Insert drawing designation for each pipe-riser resilient support type required. Use these designations on Drawings to identify each product.

* + - * 1. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- thick neoprene <**Insert drawing designation**>.

Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.

Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

* + - 1. RESILIENT PIPE GUIDES

Copy "Description" Paragraph below and re-edit for each product.

The configuration and materials of resilient pipe guides depend on the equipment being supported. It is possible to have more than one type of resilient pipe guide on the same Project. Insert drawing designation for each resilient pipe guide type required. Use these designations on Drawings to identify each product.

* + - * 1. Description: Telescopic arrangement of two steel tubes or post-and-sleeve arrangement separated by a minimum 1/2-inch- thick neoprene <**Insert drawing designation**>.

Retain "Factory-Set Height Guide with Shear Pin" Subparagraph below where vertical motion due to pipe expansion and contraction is required and clearances are not readily visible.

Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

* + - 1. ELASTOMERIC HANGERS

Copy "Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods" Paragraph below and re-edit for each product.

The configuration and materials of elastomeric hangers depend on the equipment being supported. It is possible to have more than one type of elastomeric hanger on the same Project. Insert drawing designation for each elastomeric hanger type required. Use these designations on Drawings to identify each product.

* + - * 1. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods: <**Insert drawing designation**>.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9242) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

Ace Mountings Co., Inc.

CADDY; nVent

Isolation Technology, Inc

Kinetics Noise Control, Inc

Mason Industries, Inc.

Approved equivalent.

Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.

Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

* + - 1. SNUBBERS
         1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9242) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

CADDY; nVent

Kinetics Noise Control, Inc

Mason Industries, Inc.

Vibration Management Corp.

Vibration Mountings & Controls, Inc.

Approved equivalent.

* + - * 1. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.

Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.

Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

Metal framing systems are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

* + - 1. RESTRAINT CHANNEL BRACINGS
         1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9242) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

CADDY; nVent

B-line; Eaton, Electrical Sector

Hilti, Inc.

Unistrut; Atkore International

Approved equivalent.

* + - * 1. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.
      1. SEISMIC-RESTRAINT ACCESSORIES
         1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9242) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

CADDY; nVent

B-line; Eaton, Electrical Sector

Mason Industries, Inc.

Approved equivalent.

Retain "Hanger-Rod Stiffener" Paragraph below for strengthening resistance of hanger rods against seismic forces that may cause buckling of rods; delete if detailed on Drawings. Use with either channel- or cable-type bracing assemblies when required to counter seismic forces. Detail fabrication and indicate locations on Drawings.

* + - * 1. Hanger-Rod Stiffener: [**Steel tube or steel slotted-support-system sleeve with internally bolted connections**] [**Reinforcing steel angle clamped**] to hanger rod.
        2. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings.
        3. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
        4. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
        5. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
      1. MECHANICAL ANCHOR BOLTS
         1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9242) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B-line; Eaton, Electrical Sector

Hilti, Inc.

Mason Industries, Inc.

Powers Fasteners

Simpson Strong-Tie Co., Inc.

Unistrut; Atkore International

Approved equivalent.

Expansion-type anchor bolts are not permitted by ASCE/SEI 7 for nonisolated equipment in excess of 10 hp.

* + - * 1. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.
      1. ADHESIVE ANCHOR BOLTS
         1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9242) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B-line; Eaton, Electrical Sector

Hilti, Inc.

Mason Industries, Inc.

Powers Fasteners

Simpson Strong-Tie Co., Inc.

Unistrut; Atkore International

Approved equivalent.

* + - * 1. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

1. EXECUTION
   * + 1. EXAMINATION
          1. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
          2. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
          3. Proceed with installation only after unsatisfactory conditions have been corrected.
       2. APPLICATIONS
          1. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by [**an evaluation service member of ICC-ES**] [**OSHPD**] [**an agency acceptable to authorities having jurisdiction**].

Indicate on Drawings, by details, schedules, or a combination of both, the locations where hanger rods for individual pipes and hanger rods for trapeze hangers require hanger-rod stiffeners.

* + - * 1. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
        2. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.
      1. VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION
         1. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in [**Section 033000 "Cast-in-Place Concrete."**].
         2. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
         3. Comply with requirements in Section 077200 "Roof Accessories" for installation of equipment supports and roof penetrations.
         4. Equipment Restraints:

Indicate type and quantity of snubbers described in first subparagraph below on Drawings or in the Fire-Suppression Vibration-Control and Seismic-Restraint Device Schedule on Drawings.

Install seismic snubbers on fire-suppression equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

Install seismic-restraint devices using methods approved by [**an evaluation service member of ICC-ES**] [**OSHPD**] [**an agency acceptable to authorities having jurisdiction**] that provides required submittals for component.

* + - * 1. Piping Restraints:

Comply with requirements in MSS SP-127.

In first subparagraph below, options for 40 and 80 feet are recommended by MSS SP-127. Revise these dimensions based on the configuration of piping.

Space lateral supports a maximum of [**40 feet**] <**Insert dimension**> o.c., and longitudinal supports a maximum of [**80 feet**] <**Insert dimension**> o.c.

Brace a change of direction longer than 12 feet.

* + - * 1. Install seismic-restraint devices using methods approved by [**an evaluation service member of ICC-ES**] [**OSHPD**] [**an agency acceptable to authorities having jurisdiction**] that provides required submittals for component.
        2. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
        3. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
        4. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
        5. Drilled-in Anchors:

Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural Director’s Representative if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

Set anchors to manufacturer's recommended torque, using a torque wrench.

Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

* + - 1. ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

Coordinate this article with Drawings.

* + - * 1. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 211200 "Fire -Suppression Standpipes," Section 211313 "Wet-Pipe Sprinkler Systems," and Section 211316 "Dry-Pipe Sprinkler Systems" for piping flexible connections.
      1. FIELD QUALITY CONTROL

Retain "Testing Agency" and "Perform tests and inspections" paragraphs below to identify who shall perform tests and inspections. If retaining second option in "Testing Agency" Paragraph, or if retaining "Perform tests and inspections" Paragraph, retain "Field quality-control reports" Paragraph in "Informational Submittals" Article.

* + - * 1. Testing Agency: [**Director’s Representative will engage**] [**Engage**] a qualified testing agency to perform tests and inspections.

Retain "Perform tests and inspections" Paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform tests and inspections.
        2. Tests and Inspections:

Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

Schedule test with Director’s Representative, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.

Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

Test at least [**four**] <**Insert number**> of each type and size of installed anchors and fasteners selected by Architect.

Test to 90 percent of rated proof load of device.

Measure isolator restraint clearance.

Measure isolator deflection.

Verify snubber minimum clearances.

* + - * 1. Remove and replace malfunctioning units and retest as specified above.
        2. Prepare test and inspection reports.

END OF SECTION 210548