SECTION 220548.13 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

Use this Section if Project is not in a seismic area. Use Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for projects in a seismic area.

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

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
   * + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

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

Elastomeric isolation pads.

Elastomeric isolation mounts.

Restrained elastomeric isolation mounts.

Open-spring isolators.

Housed-spring isolators.

Restrained-spring isolators.

Housed-restrained-spring isolators.

Pipe-riser resilient support.

Resilient pipe guides.

Air-spring isolators.

Restrained-air-spring isolators.

Elastomeric hangers.

Spring hangers.

Snubbers.

Restraints - rigid type.

Restraints - cable type.

Restraint accessories.

Post-installed concrete anchors.

Concrete inserts.

Vibration isolation equipment bases.

* + - * 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 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment" for devices for fire-suppression equipment and systems.

Section 230548.13 "Vibration 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.
      1. SUBMITTALS
         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.

Retain first subparagraph below if wind-load design services have been delegated to Contractor.

Include load rating for each wind-load-restraint fitting and assembly.

Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device [**and wind-load-restraint**]component.

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

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

* + - * 1. Shop Drawings:

Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

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

* + - * 1. Delegated-Design Submittal:

For each wind-load protection device that is required by this Section or is indicated on Drawings, submit the following:

Vibration Isolator and Wind-Load-Restraint Selection: Select vibration isolators and wind-load restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data.

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

Concrete Anchors and Inserts: Include calculations showing anticipated wind loads.

Wind-Load Design Calculations: Submit all static and dynamic loading calculations prepared under "Wind-Load Design Calculations" Paragraph in "Performance Requirements" Article.

Retain "Qualified Professional Engineer" subparagraph below if certification by a qualified professional engineer is required by codes, authorities having jurisdiction, or Director’s Representative.

Qualified Professional Engineer: All designated-design submittals for wind-restraint calculations are to be signed and sealed by qualified professional engineer responsible for their preparation.

Retain "Wind-Restraint Detail Drawings" subparagraph below only if design requirements apply but calculations have not been made and details or charts on Drawings do not describe wind restraints in detail. Retaining below requires Contractor to submit Wind-Load-Restraint Delegated-Design Drawings prepared by a Professional Engineer. Revise to suit Project requirements.

Wind-Restraint Detail Drawings:

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

Details: Indicate fabrication and arrangement. Detail attachments of restraints to 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 wind events. Indicate association with vibration isolation devices.

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

Retain first subparagraph below if codes require certification by a qualified Professional Engineer.

All delegated-design submittals for wind-restraint detail Drawings are to be signed and sealed by qualified professional engineer responsible for their preparation.

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

Design Consultant to review code references and verify that the referenced sections/tables are current. Note that code references shall be based on the current version of the Uniform Code.

Design Calculations for Vibration Isolation Devices: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.

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

Retain "Coordination Drawings" paragraph below if piping, ducts, equipment, and other plumbing system components are installed in congested areas.

* + - * 1. Coordination Drawings: Show coordination of vibration isolation [**and wind-load reinforcement**]device installation for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

Retain "Qualification Data" paragraph below if professional engineer or field testing is required.

* + - * 1. Qualification Data: For [Professional Engineer] [and] [testing agency].

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

* + - * 1. Welding certificates.

Retain option in "Air-Spring Mounting System Performance Certification" paragraph below if authorities having jurisdiction require independent testing.

* + - * 1. Air-Spring Mounting System Performance Certification: Include natural frequency, load, and damping test data[**performed by an independent agency**].

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

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

Retain "Wind-Load Performance Certification" paragraph below in "Informational Submittals" Article of all Specification Sections that specify plumbing equipment requiring wind-load certification.

See "Wind-Load Certification" Article in the Evaluations for a discussion on certification. Certification requirement covers plumbing equipment subject to wind load. Plumbing Engineer must identify all equipment and systems required to have wind-load certification. These must be identified in the Equipment Schedule or separate Vibration-Control Schedule; or, if the number of devices and systems is small, they can be listed in the Specifications.

* + - * 1. Wind-Load Performance Certification: Provide special certification for plumbing components subject to high wind exposure and impact damage and designated on Drawings or in the Specifications to require wind-load performance certification.

Provide equipment manufacturer's written certification for each designated plumbing device, stating that it will remain in place and operable following the design wind event and comply with all requirements of authorities having jurisdiction.

Certification must be based on UNIFORM CODE-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.

Design Consultant to review code references and verify that the referenced sections/tables are current. Note that code references shall be based on the current version of the Uniform Code.

Retain subparagraph below only if systems requiring wind-load performance certification are not scheduled. If a schedule is not included on Drawings, all wind-load performance certified systems must be listed below. See "Wind-Load Certification" Article in the Evaluations for more information.

The following plumbing systems and components require special certification for high wind performance. Written special certification of resistance to the effects of high wind load and impact damage must be provided by manufacturer.

<Insert list>.

* + - 1. CLOSEOUT SUBMITTALS

Retain this article for air-spring mounts and restrained-air-spring mounts.

* + - * 1. Operation and Maintenance Data: For [**air-spring mounts**] [**and**] [**restrained-air-spring mounts**] to include in operation and maintenance manuals.
      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 paragraph below if Contractor is to select 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 testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7 “Definition and Requirements for a Nationally Recognized Testing Laboratory” and be acceptable to authorities having jurisdiction.

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 in accordance with AWS D1.1, "Structural Welding Code - Steel."

Retain "Wind-Load-Restraint Device Load Ratings" paragraph below if wind-load restraints are specified.

* + - * 1. Wind-Load-Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: [**UNIFORM CODE-ES product listing**] [**UL product listing**] [**FM Approvals**] [**an evaluation service member of UNIFORM CODE-ES**] [**an agency acceptable to authorities having jurisdiction**].

Design Consultant to review code references and verify that the referenced sections/tables are current. Note that code references shall be based on the current version of the Uniform Code.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

See the Evaluations for more detailed information about controlling vibration, additional information on products described in this Section, selection guides, and supplements to Equipment Schedules.

* + - 1. PERFORMANCE REQUIREMENTS

Retain "Delegated Design" paragraph below if Contractor is required to assume responsibility for design.

* + - * 1. Delegated Design: Engage a qualified professional engineer to design system.

Retain "Wind-Load Performance" subparagraph below for projects requiring wind-load design. Delete subparagraph if performance requirements are indicated on Drawings. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to high wind events. Coordinate requirements with Project Structural Engineer.

Wind-Load Performance: Equipment and systems shall withstand the effects of high wind events determined in accordance with [**ASCE/SEI 7-05**] [**ASCE/SEI 7-10**] [**ASCE/SEI 7-16**] <**Insert requirement**>.

Retain "Wind-Load Design Calculations" paragraph and applicable calculation factors subparagraphs below if wind-load design services have been delegated to Contractor.

* + - * 1. Wind-Load Design Calculations:

ASCE/SEI 7 is generally applicable in most locations, but it is Plumbing Engineer's responsibility to determine the applicable building codes and editions thereof, and applicable wind-load design standards that apply to Project. Data and information required for wind-load calculations in ASCE/SEI 7 are listed below. ASCE/SEI 7-05, ASCE/SEI 7-10, and ASCE/SEI 7-16 differ somewhat; material from all three editions has been included below and has been noted. Plumbing Engineer must delete all non-applicable editions throughout the Section.

If a calculation method other than that prescribed in any edition of ASCE/SEI 7 is applicable to Project, Plumbing Engineer must revise the Section Text to provide alternative appropriate calculation parameters and instructions for delegated designer in lieu of those given below.

Perform calculations to obtain force information necessary to properly select wind-load-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in [**ASCE/SEI 7-05**] [**ASCE/SEI 7-10**] [**ASCE/SEI 7-16**] <**Insert ASCE/SEI 7 edition or other wind-load calculation method required by authorities having jurisdiction**>. Where "ASCE/SEI 7 “Minimum Design Loads and Associated Criteria for Buildings and Other Structures” " is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is intended as referenced throughout the Section Text unless otherwise noted.

Factors indicated below that are specific to individual pieces of equipment must be obtained by Contractor and must be included in individual component submittal packages.

Coordinate design wind-load calculations with vibration isolator calculations for equipment requiring both vibration isolation and wind-load reinforcement. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.

Data values identified below as applying to all components on Project are to be inserted by Plumbing Engineer in these Specifications where indicated in the following list. Data values that are specific to an individual generic component and are indicated to be scheduled should be included by Plumbing Engineer in the Plumbing Vibration-Control and Wind-Load-Restraint Device Schedule or the individual component schedules on Drawings. Data values that are specific to an individual piece of equipment as provided by Contractor and are indicated to be obtained by Contractor must be included in individual component submittal packages.

Retain one of first two design wind pressure subparagraphs below if ASCE/SEI 7-16 applies to this Project.

Design wind pressure "p" for external sidewall-mounted equipment is to be calculated by Delegated-Design Contractor using methods in ASCE/SEI 7-16 “Minimum Design Loads and Associated Criteria for Buildings and Other Structures”, Ch. 30. Perform calculations in accordance with one of the following, as appropriate:

PART 1: Low-Rise Buildings.

PART 2: Low-Rise Buildings (Simplified).

PART 3: Buildings with "h" less than 60 feet.

PART 4: Buildings with "h" greater than 60 feet and less than 160 feet.

PART 5: Open Buildings.

Design wind pressure "p" for rooftop equipment is to be calculated by Delegated-Design Contractor using methods in ASCE/SEI 7-16, Ch. 30, PART 6: Building Appurtenances and Rooftop Structures and Equipment.

"Risk category" value is determined by Plumbing Engineer from Project Structural Engineer or ASCE/SEI 7-16, Table 1.5-1.

Risk Category: [**I**] [**II**] [**III**] [**IV**] [**V**].

"Mean Roof Height" is determined by Plumbing Engineer from Project Drawings.

h = Mean Roof Height: <**Insert value**>.

"Basic Wind Speed" value is obtained by Plumbing Engineer from Wind Hazard map in ASCE/SEI 7-16 Section 26.5 or other source approved authorities having jurisdiction.

V = Basic Wind Speed: <**Insert value**>.

"Wind directionality factor" value is obtained by Plumbing Engineer from ASCE/SEI 7-16 Section 26.6 and Table 26.6-1 or other source approved by authorities having jurisdiction.

Kd = Wind Directionality Factor: <**Insert factor**>.

"Exposure category" value is obtained by Plumbing Engineer from ASCE/SEI 7-16 Section 26.7 or other source approved by authorities having jurisdiction.

Exposure Category: [**B**] [**C**] [**D**].

"Topographic factor" value is obtained by Plumbing Engineer from ASCE/SEI 7-16 Section 26.8 and Table 26.8-1 or other source approved by authorities having jurisdiction.

Kzt = Topographic Factor: <**Insert factor**>.

"Ground elevation factor" value is obtained by Plumbing Engineer from ASCE/SEI 7-16 Section 26.8 and Table 26.8-1 or other source approved by authorities having jurisdiction.

Ke = Ground Elevation Factor: <**Insert factor**>.

"Velocity pressure exposure coefficient" value at height z and height h is obtained by Plumbing Engineer from ASCE/SEI 7-16 Section 26.10.1 or other source approved by authorities having jurisdiction.

Kz = Velocity Pressure Exposure Coefficient (Evaluated at Height z): <**Insert coefficient**>.

Kh = Velocity Pressure Exposure Coefficient (Evaluated at Height h): <**Insert coefficient**>.

qz = Velocity Pressure: Value calculated by delegated wind-load design Contractor using methods detailed in ASCE/SEI 7-16 Section 26.10.1 or other source approved by authorities having jurisdiction.

qh = Velocity Pressure: Value calculated by delegated wind-load design contractor using methods detailed in ASCE/SEI 7-16 Section 26.10.1 or other source approved by authorities having jurisdiction.

"Gust-effect factor" is obtained by Plumbing Engineer form ASCE/SEI 7-16 Section 26.11 or other source approved by authorities having jurisdiction.

G = Gust-Effect Factor: [**0.85**] <**Insert factor**>.

"Enclosure classification" is obtained by Plumbing Engineer from ASCE/SEI 7-16 Section 26.12 or other source approved by authorities having jurisdiction.

Enclosure Classification:<**Insert classification**>.

"Internal pressure coefficient" is obtained by Plumbing Engineer from ASCE/SEI 7-16, Table 26.13-1 or other source approved by authorities having jurisdiction.

GCpi = Internal Pressure Coefficient: <**Insert coefficient**>.

Retain one of two design wind pressure subparagraphs below if ASCE/SEI 7-10 applies to this Project.

Design wind pressure "p" for external sidewall-mounted equipment is to be calculated by Delegated-Design Contractor using methods in ASCE/SEI 7-10, Ch. 30. Perform calculations in accordance with one of the following, as appropriate:

PART 1: Low-Rise Buildings.

PART 2: Low-Rise Buildings (Simplified).

PART 3: Buildings with "h" greater than 60 feet.

PART 4: Buildings with "h" less than 160 feet.

PART 5: Open Buildings.

Design wind pressure "p" for rooftop equipment is to be calculated by Delegated-Design Contractor using methods in ASCE/SEI 7-10, Ch. 30, PART 6: Building Appurtenances and Rooftop Structures and Equipment.

"Risk category" value is determined by Plumbing Engineer from Project Structural Engineer or ASCE/SEI 7-10, Table 1.5-1.

Risk Category: [**I**] [**II**] [**III**] [**IV**] [**V**].

"Mean Roof Height" is determined by Plumbing Engineer from Project Drawings.

h = Mean Roof Height: <**Insert value**>.

"Basic Wind Speed" value is obtained by Plumbing Engineer from Wind Hazard map in ASCE/SEI 7-10, Figures 26.5-1A through 26.1C or other source approved by authorities having jurisdiction.

V = Basic Wind Speed: <**Insert value**>.

"Wind directionality factor" value is obtained by Plumbing Engineer from ASCE/SEI 7-10 Section 26.6 and Table 26.6-1 or other source approved by authorities having jurisdiction.

Kd = Wind Directionality Factor: <**Insert factor**>.

"Exposure category" value is obtained by Plumbing Engineer from ASCE/SEI 7-10 Section 26.7 or other source approved by authorities having jurisdiction.

Exposure Category: [**B**] [**C**] [**D**].

"Topographic factor" value is obtained by Plumbing Engineer from ASCE/SEI 7-10 Section 26.8 and Table 26.8-1 or other source approved by authorities having jurisdiction.

Kzt = Topographic Factor: <**Insert factor**>.

"Velocity pressure exposure coefficient" is obtained by Plumbing Engineer from ASCE/SEI 7-10 Section 26.10.1 or other source approved by authorities having jurisdiction.

Kz = Velocity Pressure Exposure Coefficient (Evaluated at Height z): <**Insert coefficient**>.

Kh = Velocity Pressure Exposure Coefficient (Evaluated at Height h): <**Insert coefficient**>.

qz = Velocity Pressure at Height z: Value calculated by delegated wind-load design Contractor using methods detailed in ASCE/SEI 7-10 Section 26.10.1 or other source approved by authorities having jurisdiction.

qh = Velocity Pressure at Height h: Value calculated by delegated wind-load design Contractor using methods detailed in ASCE/SEI 7-10 Section 26.10.1 or other source approved by authorities having jurisdiction.

"Gust-effect factor" is obtained by Plumbing Engineer form ASCE/SEI 7-10 Section 26.9 or other source approved by authorities having jurisdiction.

G = Gust-Effect Factor: [**0.85**] <**Insert factor**>.

"Enclosure classification" is obtained by Plumbing Engineer from ASCE/SEI 7-10 Section 26.10 or other source approved by authorities having jurisdiction.

Enclosure Classification:<**Insert classification**>.

"Internal pressure coefficient" is obtained by Plumbing Engineer from ASCE/SEI 7-10 Section 26.11, Table 26.11-1 or other source approved by authorities having jurisdiction.

GCpi = Internal Pressure Coefficient: <**Insert coefficient**>.

Retain design wind load subparagraph below if ASCE/SEI 7-05 applies to Project.

Design wind load "F" for rooftop equipment and external sidewall-mounted equipment is to be calculated by Delegated-Design Contractor using methods in ASCE/SEI 7-05, Ch. 6.

"Importance Factor" value is determined by Plumbing Engineer from ASCE/SEI 7-05, Table 6-1 and ASCE/SEI 7-05, Table 1-1.

I = Importance Factor: <**Insert factor**>.

"Mean Roof Height" is determined by Plumbing Engineer from Project Drawings.

h = Mean Roof Height: <**Insert value**>.

"Basic Wind Speed" value is obtained by Plumbing Engineer from Wind Hazard map in ASCE/SEI 7-05, Figure 6.1 or other source approved by authorities having jurisdiction.

V = Basic Wind Speed: <**Insert value**>.

"Wind directionality factor" value is obtained by Plumbing Engineer from ASCE/SEI 7-05, Table 6-4 or other source approved by authorities having jurisdiction.

Kd = Wind Directionality Factor: <**Insert factor**>.

"Exposure category" value is obtained by Plumbing Engineer from ASCE/SEI 7-05 Section 6.5.6.3 or other source approved by authorities having jurisdiction.

Exposure Category: [**B**] [**C**] [**D**].

"Topographic factor" value is obtained by Plumbing Engineer from ASCE/SEI 7-05 Section 6.5.7.2, Table 6-4 or other source approved by authorities having jurisdiction.

Kzt = Topographic Factor: <**Insert factor**>.

"Velocity pressure exposure coefficient" is obtained by Plumbing Engineer from ASCE/SEI 7-05 Section 6.5.6.6, Table 6-3 or other source approved by authorities having jurisdiction.

Kz = Velocity Pressure Exposure Coefficient (Evaluated at Height z): <**Insert coefficient**>.

Kh = Velocity Pressure Exposure Coefficient (Evaluated at Height h): <**Insert coefficient**>.

qz = Velocity Pressure at Height z: Value calculated by delegated wind-load design Contractor using methods detailed in ASCE/SEI 7-05 Section 6.5.10 or other source approved by authorities having jurisdiction.

qh = Velocity Pressure at Roof Height h: Value calculated by delegated wind-load design Contractor using methods detailed in ASCE/SEI 7-05 Section 6.5.10 or other source approved by authorities having jurisdiction.

"Gust-effect factor" is obtained by Plumbing Engineer from ASCE/SEI 7-05 Section 6.5.8 or other source approved by authorities having jurisdiction.

G = Gust-Effect Factor: [**0.85**] <**Insert factor**>.

"Internal pressure coefficient" is obtained by Plumbing Engineer from ASCE/SEI 7-05, Figure 6-5 or other source approved by authorities having jurisdiction

GCpi = Internal Pressure Coefficient: <**Insert coefficient**>.

"External pressure coefficient" is obtained by Plumbing Engineer from ASCE/SEI 7-05, Figure 6-11 through 6-16 or other source approved by authorities having jurisdiction.

GCp= External Pressure Coefficient: <**Insert coefficient**>.

Cf = Force Coefficient: Value determined by delegated wind-load design Contractor from ASCE/SEI 7-05, Figures 6-21 through 6-23 or other source approved by authorities having jurisdiction.

Af = Projected Area Normal to the Wind: Except where Cf is specified for the actual surface area. Value determined by delegated wind-load design Contractor from equipment submittal or manufacturer.

* + - * 1. Consequential Damage: Provide additional restraints for suspended fire-suppression system components or anchorage of floor-, roof-, or wall-mounted fire-suppression system components as indicated in [**ASCE/SEI 7-05**] [**ASCE/SEI 7-10**] [**ASCE/SEI 7-16**] so that failure of a non-essential or essential fire-suppression system component will not cause failure of any other essential architectural, mechanical, or electrical building component.
        2. Fire/Smoke Resistance: All components that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 “Standard Test Method for Surface Burning Characteristics of Building Materials” or UL 723 “Surface Burning Characteristics of "SURFORMA Laminates Fire Retardant"”, and be so labeled.
        3. Component Supports:

Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.

All component support attachments must comply with force and displacement resistance requirements of [ASCE/SEI 7-05,Section 13.6] [ASCE/SEI 7-10,Section 13.6] [ASCE/SEI 7-16 Section 13.6].

* + - 1. ELASTOMERIC ISOLATION PADS

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

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 same Project. Insert drawing designation. Use these designations on Drawings to identify each product.

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

[Manufacturers:](http://www.specagent.com/Lookup?ulid=7632) 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](http://www.specagent.com/Lookup?uid=123457160208).

[CADDY; nVent](http://www.specagent.com/Lookup?uid=123457160219).

[California Dynamics Corporation](http://www.specagent.com/Lookup?uid=123457160209).

[Isolation Technology, Inc](http://www.specagent.com/Lookup?uid=123457160210).

[Kinetics Noise Control, Inc](http://www.specagent.com/Lookup?uid=123457160211).

[Korfund](http://www.specagent.com/Lookup?uid=123457160220).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160212).

[Novia; A Division of C&P](http://www.specagent.com/Lookup?uid=123457160217).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457160213).

[Vibration Isolation](http://www.specagent.com/Lookup?uid=123457160214).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160218).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457160215).

Or equal.

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.

Minimum deflection as indicated on Drawings.

Pad Material: Oil- and water-resistant rubber.

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

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

Retain subparagraph below if pad is infused with synthetic fibers.

Infused nonwoven cotton or synthetic fibers.

* + - 1. ELASTOMERIC ISOLATION MOUNTS

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

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 same Project. Insert drawing designation. Use these designations on Drawings to identify each product.

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

[Manufacturers:](http://www.specagent.com/Lookup?ulid=7633) 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](http://www.specagent.com/Lookup?uid=123457160221).

[CADDY; nVent](http://www.specagent.com/Lookup?uid=123457160232).

[California Dynamics Corporation](http://www.specagent.com/Lookup?uid=123457160222).

[Isolation Technology, Inc](http://www.specagent.com/Lookup?uid=123457160223).

[Kinetics Noise Control, Inc](http://www.specagent.com/Lookup?uid=123457160224).

[Korfund](http://www.specagent.com/Lookup?uid=123457160233).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160225).

[Novia; A Division of C&P](http://www.specagent.com/Lookup?uid=123457160230).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457160226).

[Vibration Isolation](http://www.specagent.com/Lookup?uid=123457160227).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160231).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457160228).

Or equal.

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.

Minimum deflection as indicated on Drawings.

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.

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 same Project. Insert drawing designation. Use these designations on Drawings to identify each product.

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

[Manufacturers:](http://www.specagent.com/Lookup?ulid=7634) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

* 1. [Ace Mountings Co., Inc](http://www.specagent.com/Lookup?uid=123457160234).
  2. [CADDY; nVent](http://www.specagent.com/Lookup?uid=123457160244).
  3. [California Dynamics Corporation](http://www.specagent.com/Lookup?uid=123457160235).
  4. [Isolation Technology, Inc](http://www.specagent.com/Lookup?uid=123457160236).
  5. [Kinetics Noise Control, Inc](http://www.specagent.com/Lookup?uid=123457160237).
  6. [Korfund](http://www.specagent.com/Lookup?uid=123457160245).
  7. [Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160238).
  8. [Novia; A Division of C&P](http://www.specagent.com/Lookup?uid=123457160242).
  9. [Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457160239).
  10. [Vibration Isolation](http://www.specagent.com/Lookup?uid=123457160240).
  11. [Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160243).
  12. Or equal.

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

* 1. Housing: Cast-ductile iron or welded steel.
  2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

1. Minimum deflection as indicated on Drawings
   * + 1. OPEN-SPRING ISOLATORS

Copy "Freestanding, Laterally Stable, Open-Spring Isolators" paragraph below and re-edit for each product.

Configuration and materials of open-spring isolators depend on the equipment being supported. It is possible to have more than one type of open-spring isolator on same Project. Insert drawing designation. Use these designations on Drawings to identify each product.

* + - * 1. Freestanding, Laterally Stable, Open-Spring Isolators: <**Insert drawing designation**>.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=7642) 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](http://www.specagent.com/Lookup?uid=123457160274).

[California Dynamics Corporation](http://www.specagent.com/Lookup?uid=123457160265).

[Isolation Technology, Inc](http://www.specagent.com/Lookup?uid=123457160266).

[Kinetics Noise Control, Inc](http://www.specagent.com/Lookup?uid=123457160268).

[Korfund](http://www.specagent.com/Lookup?uid=123457160275).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160267).

[Novia; A Division of C&P](http://www.specagent.com/Lookup?uid=123457160272).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457160269).

[Vibration Isolation](http://www.specagent.com/Lookup?uid=123457160270).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160273).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457160271).

Or equal.

Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

Minimum Additional Travel: 50 percent of the required deflection at rated load.

Lateral Stiffness: More than 80 percent of rated vertical stiffness.

Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psi.

Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

Minimum deflection as indicated on Drawings.

* + - 1. HOUSED-SPRING ISOLATORS

Copy "Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing" paragraph below and re-edit for each product.

Configuration and materials of housed-spring isolators depend on the equipment being supported. It is possible to have more than one type of housed-spring isolator on same Project. Insert drawing designation. Use these designations on Drawings to identify each product.

* + - * 1. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing: <**Insert drawing designation**>.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=7643) 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](http://www.specagent.com/Lookup?uid=123457160276).

[CADDY; nVent](http://www.specagent.com/Lookup?uid=123457160285).

[California Dynamics Corporation](http://www.specagent.com/Lookup?uid=123457160277).

[Isolation Technology, Inc](http://www.specagent.com/Lookup?uid=123457160278).

[Kinetics Noise Control, Inc](http://www.specagent.com/Lookup?uid=123457160279).

[Korfund](http://www.specagent.com/Lookup?uid=123457160286).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160280).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457160281).

[Vibration Isolation](http://www.specagent.com/Lookup?uid=123457160282).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160284).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457160283).

Or equal.

Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

Minimum Additional Travel: 50 percent of the required deflection at rated load.

Lateral Stiffness: More than 80 percent of rated vertical stiffness.

Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

Minimum deflection as indicated on Drawings.

Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psi.

Top housing with [attachment and leveling bolt] [threaded mounting holes and internal leveling device] [elastomeric pad].

* + - 1. RESTRAINED-SPRING ISOLATORS

Copy "Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint" paragraph below and re-edit for each product.

Configuration and materials of restrained-spring isolators depend on the equipment being supported. It is possible to have more than one type of restrained-spring isolator on same Project. Insert drawing designation. Use these designations on Drawings to identify each product.

* + - * 1. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint: <**Insert drawing designation**>.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=7644) 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](http://www.specagent.com/Lookup?uid=123457160287).

[CADDY; nVent](http://www.specagent.com/Lookup?uid=123457160297).

[California Dynamics Corporation](http://www.specagent.com/Lookup?uid=123457160288).

[Isolation Technology, Inc](http://www.specagent.com/Lookup?uid=123457160289).

[Kinetics Noise Control, Inc](http://www.specagent.com/Lookup?uid=123457160290).

[Korfund](http://www.specagent.com/Lookup?uid=123457160298).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160291).

[Novia; A Division of C&P](http://www.specagent.com/Lookup?uid=123457160295).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457160292).

[Vibration Isolation](http://www.specagent.com/Lookup?uid=123457160293).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160296).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457160294).

Or equal.

Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psi.

Top plate with [threaded mounting holes] [elastomeric pad].

Internal leveling bolt that acts as blocking during installation.

Restraint: Limit stop as required for equipment and authorities having jurisdiction.

Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

Minimum Additional Travel: 50 percent of the required deflection at rated load.

Lateral Stiffness: More than 80 percent of rated vertical stiffness.

Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

Minimum deflection as indicated on Drawings.

* + - 1. HOUSED-RESTRAINED-SPRING ISOLATORS

Copy "Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing" paragraph below and re-edit for each product.

Configuration and materials of housed-restrained-spring isolators depend on the equipment being supported. It is possible to have more than one type of housed-restrained-spring isolator on same Project. Insert drawing designation. Use these designations on Drawings to identify each product.

* + - * 1. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing: <**Insert drawing designation**>.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=7645) 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](http://www.specagent.com/Lookup?uid=123457160299).

[CADDY; nVent](http://www.specagent.com/Lookup?uid=123457160308).

[California Dynamics Corporation](http://www.specagent.com/Lookup?uid=123457160300).

[Isolation Technology, Inc](http://www.specagent.com/Lookup?uid=123457160301).

[Kinetics Noise Control, Inc](http://www.specagent.com/Lookup?uid=123457160302).

[Korfund](http://www.specagent.com/Lookup?uid=123457160309).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160303).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457160304).

[Vibration Isolation](http://www.specagent.com/Lookup?uid=123457160305).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160307).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457160306).

Or equal.

Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with [**adjustable**] [**non-adjustable**] snubbers to limit vertical movement.

Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psi.

Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

Minimum Additional Travel: 50 percent of the required deflection at rated load.

Lateral Stiffness: More than 80 percent of rated vertical stiffness.

Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

Minimum deflection as indicated on Drawings.

* + - 1. PIPE-RISER RESILIENT SUPPORT

Copy "All-Directional, Acoustical Pipe Anchor Consisting of Two Steel Tubes Separated by a Minimum 1/2-inch- Thick Neoprene" paragraph below and re-edit for each product.

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 same Project. Insert drawing designation. Use these designations on Drawings to identify each product.

* + - * 1. All-Directional, Acoustical Pipe Anchor Consisting of Two Steel Tubes Separated by a Minimum 1/2-inch- Thick Neoprene: <**Insert drawing designation**>.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13713) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[California Dynamics Corporation](http://www.specagent.com/Lookup?uid=123457160324).

[Kinetics Noise Control, Inc](http://www.specagent.com/Lookup?uid=123457160325).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160326).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457160327).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160328).

Or equal.

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

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

Minimum deflection as indicated on Drawings.

* + - 1. RESILIENT PIPE GUIDES

Copy "Telescopic Arrangement of Two Steel Tubes or Post and Sleeve Arrangement Separated by a Minimum 1/2-inch- Thick Neoprene" paragraph below and re-edit for each product.

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 same Project. Insert drawing designation. Use these designations on Drawings to identify each product.

* + - * 1. Telescopic Arrangement of Two Steel Tubes or Post and Sleeve Arrangement Separated by a Minimum 1/2-inch- Thick Neoprene: <**Insert drawing designation**>.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

California Dynamics Corporation.

Kinetics Noise Control, Inc.

Mason Industries, Inc.

Vibration Eliminator Co., Inc.

Vibration Mounting & Controls, Inc.

Or equal.

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. AIR-SPRING ISOLATORS

Copy “Freestanding, Single or Multiple, Compressed-Air Bellows” paragraph below and re-edit for each product.

Configuration and materials of air-spring isolators depend on the equipment being supported. It is possible to have more than one type of air-spring isolator on same Project. Insert drawing designation. Use these designations on Drawings to identify each product.

* + - * 1. Freestanding, Single or Multiple, Compressed-Air Bellows: <**Insert drawing designation**>.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=7649) 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](http://www.specagent.com/Lookup?uid=123457160323).

[Firestone Industrial Products Company](http://www.specagent.com/Lookup?uid=123457160320).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160321).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160322).

Or equal.

Bellows Assembly: Upper and lower powder-coated steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows or similar elastomeric material.

Maximum Natural Frequency: 3 Hz.

Operating Pressure Range: 25 to 100 psi.

Burst Pressure: At least three times manufacturer’s published maximum operating pressure.

Minimum deflection as indicated on Drawings.

Retain subparagraph below if air springs are mounted independent of each other and are not supplied by a constant pressure-regulated air supply.

Automatic leveling valve.

* + - 1. RESTRAINED-AIR-SPRING ISOLATORS

Copy “Freestanding, Single or Multiple, Compressed-Air Bellows with Vertical-Limit Stop Restraint” paragraph below and re-edit for each product.

Configuration and materials of restrained-air-spring isolators depend on the equipment being supported. It is possible to have more than one type of restrained-air-spring isolator on same Project. Insert drawing designation. Use these designations on Drawings to identify each product.

* + - * 1. Freestanding, Single or Multiple, Compressed-Air Bellows with Vertical-Limit Stop Restraint: <**Insert drawing designation**>.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=7650) 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](http://www.specagent.com/Lookup?uid=123457160377).

[Firestone Industrial Products Company](http://www.specagent.com/Lookup?uid=123457160374).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160375).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160376).

Or equal.

Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psi.

Top plate with [threaded mounting holes] [elastomeric pad].

Internal leveling bolt that acts as blocking during installation.

Restraint: Limit stop as required for equipment and authorities having jurisdiction.

Minimum deflection as indicated on Drawings.

Minimum Additional Travel: 50 percent of the required deflection at rated load.

Lateral Stiffness: More than 80 percent of rated vertical stiffness.

Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

Bellows Assembly: Upper and lower powder-coated steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows or similar elastomeric material.

Maximum Natural Frequency: 3 Hz.

Operating Pressure Range: 25 to 100 psi.

Burst Pressure: At least three times manufacturer’s published maximum operating pressure.

Retain subparagraph below if air springs are mounted independent of each other and are not supplied by a constant pressure-regulated air supply.

Automatic leveling valve.

* + - 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.

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 same Project. Insert drawing designation. 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=7635) 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](http://www.specagent.com/Lookup?uid=123457160246).

[CADDY; nVent](http://www.specagent.com/Lookup?uid=123457160256).

[California Dynamics Corporation](http://www.specagent.com/Lookup?uid=123457160247).

[Kinetics Noise Control, Inc](http://www.specagent.com/Lookup?uid=123457160249).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160250).

[Novia; A Division of C&P](http://www.specagent.com/Lookup?uid=123457160253).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457160251).

[Vibration Isolation](http://www.specagent.com/Lookup?uid=123457160257).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160255).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457160252).

Or equal.

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.

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

Minimum deflection as indicated on Drawings.

* + - 1. SPRING HANGERS

Copy “Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression” paragraph below and re-edit for each product.

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

* + - * 1. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression: <**Insert drawing designation**>.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=7646) 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](http://www.specagent.com/Lookup?uid=123457160310).

[CADDY; nVent](http://www.specagent.com/Lookup?uid=123457160319).

[California Dynamics Corporation](http://www.specagent.com/Lookup?uid=123457160311).

[Kinetics Noise Control, Inc](http://www.specagent.com/Lookup?uid=123457160312).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160313).

[Novia; A Division of C&P](http://www.specagent.com/Lookup?uid=123457160317).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457160314).

[Vibration Isolation](http://www.specagent.com/Lookup?uid=123457160315).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160318).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457160316).

Or equal.

Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

Minimum Additional Travel: 50 percent of the required deflection at rated load.

Lateral Stiffness: More than 80 percent of rated vertical stiffness.

Minimum deflection as indicated on Drawings.

Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

Retain “Adjustable Vertical Stop” subparagraph below if a vertical-limit stop is required.

Adjustable Vertical Stop: Steel washer with neoprene washer “up-stop” on lower threaded rod.

Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

* + - 1. SNUBBERS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=7636) 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](http://www.specagent.com/Lookup?uid=123457160263).

[Kinetics Noise Control, Inc](http://www.specagent.com/Lookup?uid=123457160258).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160259).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160262).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457160260).

Or equal.

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

Post-Installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors. Anchors to be prequalified in accordance with ACI 355.2 “Seismic Testing of Post-Installed Concrete and Masonry Anchors in Cracked Concrete” testing and designated in accordance with [**ACI 318-08 Appendix D for 2009 IBC**] [**ACI 318-11 Appendix D for 2012 IBC**] [**ACI 318-14 Ch. 17 for 2015 or 2018 IBC]**

Preset Concrete Inserts: Prequalified in accordance with UNIFORM CODE-ES AC446 “Headed Cast-In Specialty Inserts in Concrete” testing. .

Design Consultant to review code references and verify that the referenced sections/tables are current. Note that code references shall be based on the current version of the Uniform Code.

Anchors in Masonry: Design in accordance with TMS 402 “Building Code Requirements”.

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

Resilient Cushion: Maximum ¼-inch air gap, and minimum ¼ inch thick.

* + - 1. RESTRAINTS – RIGID TYPE

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13724) 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](http://www.specagent.com/Lookup?uid=123457160335).

[CADDY; nVent](http://www.specagent.com/Lookup?uid=123457160336).

[California Dynamics Corporation](http://www.specagent.com/Lookup?uid=123457160337).

[Hilti, Inc](http://www.specagent.com/Lookup?uid=123457160338).

[Isolation Technology, Inc](http://www.specagent.com/Lookup?uid=123457160339).

[TOLCO](http://www.specagent.com/Lookup?uid=123457160340).

[Unistrut; Atkore International](http://www.specagent.com/Lookup?uid=123457160341).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457160342).

Or equal.

* + - * 1. Description: Shop- or field-fabricated bracing assembly made of AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53 steel pipe as per NFPA 13 “Standard for the Installation of Sprinkler Systems”, or other rigid steel brace member. Includes 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. RESTRAINTS – CABLE TYPE

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13725) 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](http://www.specagent.com/Lookup?uid=123457160343).

[CADDY; nVent](http://www.specagent.com/Lookup?uid=123457160344).

[Loos & Co](http://www.specagent.com/Lookup?uid=123457160346).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457160345).

Or equal.

* + - * 1. Restraint Cables: [**ASTM A1023 galvanized or ASTM A603 galvanized-steel**] [**ASTM A492 stainless steel**] cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with fittings attached by means of poured socket, swaged socket, or mechanical (Flemish eye) loop.
        2. Restraint cable assembly and cable fittings must comply with [**ASCE/SEI 19-10**] [**ASCE/SEI 19-16**]. All cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge-type end fittings do not comply and are unacceptable.
      1. RESTRAINT ACCESSORIES
         1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

B-line; Eaton, Electrical Sector.

CADDY; nVent.

Hilti, Inc.

Loos & Co.

Mason Industries, Inc.

TOLCO.

Unistrut; Atkore International.

Retain "Hanger-Rod Stiffener" paragraph below for strengthening resistance of hanger rods against wind-load 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 wind load 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**] [**and**] [**restraint cables**].
        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. POST-INSTALLED CONCRETE ANCHORS
         1. Mechanical Anchor Bolts:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=7639) 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](http://www.specagent.com/Lookup?uid=123457160354).

[Hilti, Inc](http://www.specagent.com/Lookup?uid=123457160355).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160357).

[Powers Fasteners](http://www.specagent.com/Lookup?uid=123457160359).

[Simpson Strong-Tie Co., Inc](http://www.specagent.com/Lookup?uid=123457160360).

[Unistrut; Atkore International](http://www.specagent.com/Lookup?uid=123457160358).

Or equal.

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 E488 “Standard Test Methods for Strength of Anchors in Concrete Elements”.

* + - * 1. Adhesive Anchor Bolts:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=7640) 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](http://www.specagent.com/Lookup?uid=123457160364).

[Hilti, Inc](http://www.specagent.com/Lookup?uid=123457160361).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160363).

[Powers Fasteners](http://www.specagent.com/Lookup?uid=123457160365).

[Simpson Strong-Tie Co., Inc](http://www.specagent.com/Lookup?uid=123457160366).

[Unistrut; Atkore International](http://www.specagent.com/Lookup?uid=123457160367).

Or equal.

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 E488 “Standard Test Methods for Strength of Anchors in Concrete Elements”.

* + - * 1. Provide post-installed concrete anchors that have been prequalified for use in wind-load applications. Post-installed concrete anchors must comply with all requirements of [**ASCE/SEI 7-05, Ch. 13**] [**ASCE/SEI 7-10, Ch. 13**] [**ASCE/SEI 7-16, Ch. 13**].

Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.

Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.

Retain paragraph below if ASCE/SEI 7-05 applies.

* + - * 1. Expansion-type anchor bolts are not permitted for equipment in excess of 10 hp that is not vibration isolated.

Undercut expansion anchors are permitted.

* + - 1. CONCRETE INSERTS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13721) 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](http://www.specagent.com/Lookup?uid=123457160329).

[Hilti, Inc](http://www.specagent.com/Lookup?uid=123457160330).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160331).

[Powers Fasteners](http://www.specagent.com/Lookup?uid=123457160334).

[Simpson Strong-Tie Co., Inc](http://www.specagent.com/Lookup?uid=123457160333).

[Unistrut; Atkore International](http://www.specagent.com/Lookup?uid=123457160332).

Or equal.

* + - * 1. Provide preset concrete inserts that are prequalified in accordance with UNIFORM CODE-ES AC466 “Headed Cast-In Specialty Inserts in Concrete” testing.

Design Consultant to review code references and verify that the referenced sections/tables are current. Note that code references shall be based on the current version of the Uniform Code.

* + - * 1. Comply with ANSI/MSS SP-58 “Reverse Osmosis Drinking Water Treatment”.
      1. VIBRATION ISOLATION EQUIPMENT BASES

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=6164) 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](http://www.specagent.com/Lookup?uid=123457160386).

[California Dynamics Corporation](http://www.specagent.com/Lookup?uid=123457160378).

[Kinetics Noise Control, Inc](http://www.specagent.com/Lookup?uid=123457160381).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457160379).

[Novia; A Division of C&P](http://www.specagent.com/Lookup?uid=123457160384).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457160382).

[Vibration Isolation](http://www.specagent.com/Lookup?uid=123457160380).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457160385).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457160383).

Or equal.

* + - * 1. Steel Rails: Factory-fabricated, welded, structural-steel rails.

Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.

Retain first subparagraph below if steel rails are required for pumps.

Include supports for suction and discharge elbows for pumps.

Structural Steel: Steel shapes, plates, and bars complying with ASTM A36 “Standard Specification for Carbon Structural Steel”. Rails shall have shape to accommodate supported equipment.

Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

* + - * 1. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.

Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

Retain first subparagraph below if steel bases are required for pumps.

Include supports for suction and discharge elbows for pumps.

Structural Steel: Steel shapes, plates, and bars complying with ASTM A36 “Standard Specification for Carbon Structural Steel”. Bases shall have shape to accommodate supported equipment.

Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

* + - * 1. Concrete Inertia Base: [**Factory-fabricated**] [**or**] [**field-fabricated**], welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

Retain first subparagraph below if inertia bases are required for pumps.

Include supports for suction and discharge elbows for pumps.

Structural Steel: Steel shapes, plates, and bars complying with ASTM A36 “Standard Specification for Carbon Structural Steel”. Bases shall have shape to accommodate supported equipment.

Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

1. EXECUTION
   * + 1. EXAMINATION
          1. Examine areas and equipment to receive vibration isolation [**and wind-load 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 UNIFORM CODE-ES] [OSHPD] [an agency acceptable to authorities having jurisdiction].

Design Consultant to review code references and verify that the referenced sections/tables are current. Note that code references shall be based on the current version of the Uniform Code.

Indicate on Drawings, in 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 where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to wind load forces.
        2. Strength of Support Assemblies: Where not indicated, select sizes of components so strength is adequate to carry static [and wind-load ]forces within specified loading limits.
      1. INSTALLATION OF VIBRATION-CONTROL [**AND WIND-LOAD CONTROL**] DEVICES
         1. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Device Schedules, where indicated on Drawings, or where the Specifications indicate they are to be installed on specific equipment and systems.

Retain first paragraph if wind-load design services have been delegated to Contractor.

* + - * 1. Provide wind-load control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Device Schedules, where indicated on Drawings, where the Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
        2. Coordinate 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."
        3. Installation of vibration isolators[ and wind-load restraints] must not cause any stresses, misalignment or change of position of equipment or piping.
        4. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
        5. Equipment Restraints:

Indicate type and quantity of snubbers and wind-load control devices described in first three subparagraphs below, on Drawings, in Equipment Schedules, or in Plumbing Vibration-Control Schedule on Drawings.

Install snubbers on plumbing 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.

Retain subparagraph below if wind-load restraints are required.

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

Design Consultant to review code references and verify that the referenced sections/tables are current. Note that code references shall be based on the current version of the Uniform Code.

* + - * 1. Piping Restraints:

Comply with requirements in MSS SP-127 “Bracing for Piping Systems: Seismic-Wind-Dynamic Design, Selection, and Application”.

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.

Retain first two paragraphs below if wind-load restraints are required.

* + - * 1. Install wind-load-restraint cables so they do not bend across edges of adjacent equipment or building structure.
        2. Install wind-load-restraint devices using methods approved by [**an evaluation service member of UNIFORM CODE-ES**] [**OSHPD**] [**an agency acceptable to authorities having jurisdiction**] that provides required submittals for component.

Design Consultant to review code references and verify that the referenced sections/tables are current. Note that code references shall be based on the current version of the Uniform Code.

* + - * 1. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
        2. 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.
        3. 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.
        4. Post-Installed Concrete 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 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.

Mechanical-Type Anchor Bolts: 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-Type Anchor Bolts: 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. INSTALLATION OF AIR-SPRING ISOLATORS

Retain "Independent Isolator Installation" paragraph below if air springs are mounted independent of each other and are not supplied by a constant pressure-regulated air supply.

* + - * 1. Independent Isolator Installation:

Install automatic leveling valve into each air isolator.

Inflate each isolator to [**height**] [**and**] [**pressure**] specified on Drawings.

Retain "Pressure-Regulated Isolator Installation" paragraph below if air springs are supplied with a constant pressure-regulated air supply.

* + - * 1. Pressure-Regulated Isolator Installation:

Coordinate the constant pressure-regulated air supply to air springs with requirements for piping and connections specified in Section 221513 "General-Service Compressed-Air Piping."

Connect all pressure regulators to a single dry, filtered [**facility**] [**constant**] air supply.

Inflate isolators to [**height**] [**and**] [**or**] [**pressure**] specified on Drawings.

* + - 1. ACCOMMODATION OF DIFFERENTIAL MOTION

Coordinate this article with Drawings.

* + - * 1. Provide flexible connections in piping systems where they cross structural joints and other point where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7 “Minimum Design Loads and Associated Criteria for Buildings and Other Structures”. Comply with requirements in Section 221116 "Domestic Water Piping" and Section 221119 "Domestic Water Piping Specialties" for piping flexible connections.
      1. INSTALLATION OF VIBRATION ISOLATION EQUIPMENT BASES
         1. Coordinate 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. Coordinate dimensions of steel equipment rails, bases, and concrete inertia bases, with requirements of isolated equipment specified in this and other Sections. Where dimensions of base are indicated on Drawings, they may require adjustment to accommodate actual isolated equipment.
      2. ADJUSTING
         1. Adjust isolators after system is at operating weight.
         2. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
      3. FIELD QUALITY CONTROL

Retain first option in "Testing Agency" paragraph below if Director’s Representative will hire an independent testing agency.

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

Retain "Manufacturer's Field Service" paragraph below to require a Company Service Advisor to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a Company Field Advisor to test and inspect components, assemblies, and equipment installations, including connections.
        2. Tests and Inspections:

Retain "Perform tests and inspections" subparagraph below to require Contractor to perform tests and inspections and retain option to require Contractor to arrange for the assistance of a Company Service Advisor.

Perform tests and inspections with the assistance of a Company Field Advisor.

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

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

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

Test no fewer than [**four**] <**Insert number**> of each type and size of installed anchors and fasteners selected by Director’s Representative.

Test to 90 percent of rated proof load of device.

Measure isolator restraint clearance.

Measure isolator deflection.

Verify snubber minimum clearances.

Retain subparagraph below if restrained-air-spring isolators are included in Project.

Test and adjust restrained-air-spring isolator controls and safeties.

* + - * 1. Remove and replace malfunctioning units and retest as specified above.
        2. Units will be considered defective if they do not pass tests and inspections.
        3. Prepare test and inspection reports.

END OF SECTION 220548.13