SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

Use this Section if Project is in a seismic area. Use Section 230548.13 "Vibration Controls for HVAC" for projects not 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.

Restrained isolation roof-curb rails.

* + - 1. DEFINITIONS

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

* + - * 1. Designated Seismic System: An HVAC component that requires design in accordance with ASCE/SEI 7, Ch. 13, and for which the Component Importance Factor is greater than 1.0.
				2. Uniform Code IBC: International Building Code.

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

* + - * 1. OSHPD: Office of Statewide Health Planning and Development (for the State of California owned and regulated medical facilities).
			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-force-restraint fitting and assembly.

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

See the Evaluations for a discussion on seismic-restraint capacities and rating services. Retain all applicable subparagraphs below.

Annotate types and sizes of seismic restraints and accessories, complete with listing markings or report numbers and load rating in tension and compression as evaluated by [**ICC-ES product listing**] [**UL product listing**] [**FM Approvals**] [**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.

* + - * 1. Shop Drawings:

Detail fabrication and assembly of equipment bases.

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 design services have been delegated to Contractor.

* + - * 1. Delegated-Design Submittal:

For each seismic-restraint [**and**] [**wind-load protection**] device, including [**seismic-restrained mounting,**] [**pipe-riser resilient support,**] [**snubber,**] [**seismic restraint,**] [**seismic-restraint accessory,**] [**concrete anchor and insert,**] [**and**] [**restrained isolation roof-curb rail**] that is required by this Section or is indicated on Drawings, submit the following:

Seismic [**and Wind-Load**]Restraint, and Vibration Isolation Base Selection: Select vibration isolators, seismic [**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, spring deflection changes, and seismic loads. 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 seismic and wind loads. Include certification that device is approved by an NRTL for seismic reinforcement use.

Retain "Seismic Design Calculations" subparagraph below if seismic design services have been delegated to Contractor.

Seismic Design Calculations: Submit all input data and loading calculations prepared under "Seismic Design Calculations" Paragraph in "Performance Requirements" Article.

Retain "Wind-Load Design Calculations" subparagraph below if wind-load design services have been delegated to Contractor.

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

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

Retain first subparagraph below only if design requirements apply but calculations have not been made and details or charts on Drawings do not describe seismic or wind restraints in detail. Retaining below requires Contractor to submit seismic-restraint delegated-design Drawings prepared by a Professional Engineer. Revise to suit Project requirements.

Seismic-[**and Wind-**]Restraint Detail Drawing:

Design Analysis: To support selection and arrangement of seismic[**and 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 seismic events. Indicate association with vibration isolation devices.

Retain first subparagraph below if Project includes equipment mounted outdoors or otherwise subject to wind loading.

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

All delegated-design submittals for seismic- and 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 ICC-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 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.

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

Retain "Wind-Force Performance Certification" paragraph below when applicable codes require special certification. Retain paragraph in "Informational Submittals" Article of all Specification Sections that specify HVAC equipment requiring wind-force certification.

See "Special Certifications" Article in the Evaluations for a discussion on wind-force certification. Certification requirement covers HVAC equipment subject to wind load and devices, such as intake and exhaust louvers, which cover building openings. These must be identified by Mechanical Engineer on 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-Force Performance Certification: Provide special certification for HVAC components subject to high wind exposure and impact damage and designated on Drawings or in the Specifications to require wind-force performance certification.

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

* + - 1. CLOSEOUT SUBMITTALS

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

* + - * 1. Operation and Maintenance Data: For [**air-spring isolators**] [**and**] [**restrained-air-spring isolators**] to include in operation and maintenance manuals.
			1. QUALITY ASSURANCE

If an independent testing agency is required, see Section 014000 "Quality Requirements" for general testing and inspecting agency qualification requirements. 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, 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/D1.1M, "Structural Welding Code - Steel."
				2. Seismic-[**and 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: [**ICC-ES product listing**] [**UL product listing**] [**FM Approvals**] [**an evaluation service member of ICC-ES**] [**an agency acceptable to authorities having jurisdiction**].
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. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

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

Coordinate specifications for products in this Section with Project Structural Engineer and with Drawings.

* + - 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, as defined in Section 014000 "Quality Requirements," to design seismic [**and**] [**wind-**] load control system.

Retain "Seismic( and Wind-Load) Performance" Subparagraph below for projects requiring seismic design. Delete subparagraph if performance requirements are indicated on Drawings. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Coordinate requirements with Structural Engineer.

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

Retain "Seismic Design Calculations" Paragraph and applicable calculation factors subparagraph below if seismic design services have been delegated to Contractor.

* + - * 1. Seismic Design Calculations:

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

If a calculation method other than that prescribed in any edition of ASCE/SEI 7 is applicable to Project, Mechanical 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 seismic-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 including supplement No. 1**] [**ASCE/SEI 7-16**] <**Insert ASCE/SEI 7 edition or other seismic calculation method required by authorities having jurisdiction**>. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is the edition intended as reference throughout the Section Text.

Data indicated below to be determined by Delegated-Design Contractor must be obtained by Contractor and must be included in individual component submittal packages.

Retain first subparagraph below if wind-load design is delegated to Contractor.

Coordinate seismic design calculations with wind-load calculations for equipment mounted outdoors. 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 Mechanical 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 Mechanical Engineer in HVAC Vibration-Control and Seismic-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.

The term "Building Occupancy Category" is used in ASCE/SEI 7-05 and earlier editions of ASCE/SEI 7. Mechanical engineer must obtain the value from Project Structural Engineer and retain first subparagraph below.

Building Occupancy Category: [**I**] **[II**] [**III**] [**IV**].

The term "Building Risk Category" is used in ASCE/SEI 7-10 and ASCE/SEI 7-16. Mechanical engineer must obtain the value from Project Structural Engineer and retain first subparagraph below.

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

Mechanical engineer must obtain "Building Site Classification" value from Project Structural Engineer and retain first subparagraph below.

Building Site Classification: [**A**] [**B**] [**C**] [**D**] [**E**] [**F**].

Retain "Calculation Factors, ASCE/SEI 7-16, Ch. 13 - Seismic Design Requirements for Nonstructural Components" Subparagraph below if ASCE/SEI 7-16 applies to this Project.

**C**alculation Factors, ASCE/SEI 7-16, Ch. 13 - Seismic Design Requirements for Nonstructural Components: All section, paragraph, equation, and table numbers refer to ASCE/SEI 7-16 unless otherwise noted.

Horizontal Seismic Design Force Fp: Value is to be calculated by Delegated-Design Contractor using Equation 13.3-1. Factors below must be obtained for this calculation:

In first subparagraph below, value applies to all components on Project. Value is to be obtained by Mechanical Engineer from Project Structural Engineer based on ASCE/SEI 7-16 Section 11.4.5.

SDS = Spectral Acceleration: <**Insert value**>. Value applies to all components on Project.

"Component Amplification Factor" for each component is selected by Mechanical Engineer as explained in ASCE/SEI 7-16 Section 13.6.1. List on Drawing Schedule for each component.

ap = Component Amplification Factor: See Drawing Schedule for each component.

"Component Importance Factor" is assigned by Mechanical Engineer as explained in ASCE/SEI 7-16 Section 13.1.3. List on Drawing Schedule for each component.

Ip = Component Importance Factor: See Drawing Schedule for each component.

Wp = Component Operating Weight: For each component. Obtain by Delegated-Design Contractor from each component submittal.

"Component Response Modification Factor" is selected by Mechanical Engineer from ASCE/SEI 7-16, Table 13.6-1. List on Drawing Schedule for each component.

Rp = Component Response Modification Factor: See Drawing Schedule for each component.

z = Height in Structure of Point of Attachment of Component for Base: Determine from Project Drawings for each component by Delegated-Design Contractor. For items at or below the base, "z" shall be taken as zero.

h = Average Roof Height of Structure for Base: Determine from Project Drawings by Delegated-Design Contractor.

Vertical Seismic Design Force: Calculated by Delegated-Design Contractor using method explained in ASCE/SEI 7-16, Paragraph 13.3.1.2.

Seismic Relative Displacement Dpl: Calculate by Delegated-Design Contractor using methods explained in ASCE/SEI 7-10, Paragraph 13.3.2. Factors below must be obtained for this calculation:

Dp = Relative Seismic Displacement that Each Component Must Be Designed to Accommodate: Calculate by Delegated-Design Contractor in accordance with ASCE/SEI 7-10, Paragraph 13.3.2.

"Structure Importance Factor" value is obtained by Mechanical Engineer from Project Structural Engineer and ASCE/SEI 7-10 Section 11.5.1.

Ie = Structure Importance Factor: <**Insert value**>. Value applies to all components on Project.

"Deflection at building level x of Structure A" value is determined for each component in building in accordance with ASCE/SEI 7-10, Equation 12.8-15 and depends upon location of component in building. Value is obtained by Mechanical Engineer from Project Structural Engineer.

δxA = Deflection at Building Level x of Structure A: See Drawing Schedule for each component.

"Deflection at building level y of Structure A" value is determined for each component in building in accordance with ASCE/SEI 7-10, Equation 12.8-15 and depends upon location of component in building. Value is obtained by Mechanical Engineer from Project Structural Engineer.

δyA = Deflection at Building Level y of Structure A: see Drawing Schedule for each component.

"Deflection at building level y of Structure B" value is determined for each component in building in accordance with ASCE/SEI 7-10, Equation 12.8-15 and depends upon location of component in building. Value is obtained by Mechanical Engineer from Project Structural Engineer.

δyB = Deflection at Building Level y of Structure B: See Drawing Schedule for each component.

hx = Height of Level x to which Upper Connection Point Is Attached: Determine for each component by Delegated-Design Contractor from Project Drawings and manufacturer's data.

hy = Height of Level y to which Upper Connection Point Is Attached: Determine for each component by Delegated-Design Contractor from Project Drawings and manufacturer's data.

"Allowable story drift for Structure A" value is determined in accordance with ASCE/SEI 7-16, Equation 12.12-1 and depends upon location of component in building. Value is obtained by Mechanical Engineer from Project Structural Engineer.

ΔaA = Allowable Story Drift for Structure A: See Drawing Schedules for each component.

"Allowable story drift for Structure B" value is determined in accordance with ASCE/SEI 7-16, Equation 12.12-1 and depends upon location of component in building. Value is obtained by Mechanical Engineer from Project Structural Engineer.

ΔaB = Allowable Story Drift for Structure B: See Drawing Schedules for each component.

"Story Height" used in the definition of "allowable drift" value is determined in accordance with ASCE/SEI 7-16, Table 12.12-1 and depends upon location of component in building. Value is obtained by Mechanical Engineer from Project Structural Engineer.

hsx = Story Height Used in the Definition of Allowable Drift Δa: See Drawings Schedules for each component.

Component Fundamental Period Tp: Calculated by Delegated-Design Contractor using methods explained in ASCE/SEI 7-16, Paragraph 13.3.3. Factors below must be obtained for this calculation:

Wp = Component Operating Weight: Determined by Contractor from Project Drawings and manufacturer's data.

g = Gravitational Acceleration: [**32.17 fps2 (9.81 m/s2)**] <**Insert option**>.

Kp = Combined Stiffness of Component, Supports, and Attachments: Determined by delegated-design seismic engineer. <**Insert value**>.

Retain "Calculation Factors, ASCE/SEI 7-10, Ch. 13 - Seismic Design Requirements for Nonstructural Components" Subparagraph below if ASCE/SEI 7-10 applies to this Project.

Calculation Factors, ASCE/SEI 7-10, Ch. 13 - Seismic Design Requirements for Nonstructural Components: All section, paragraph, equation, and table numbers refer to ASCE/SEI 7-10 unless otherwise noted.

Horizontal Seismic Design Force Fp: Calculated by Delegated-Design Contractor by ASCE/SEI 7-10, Equation 13.3-1. Factors below must be obtained for this calculation:

In first subparagraph below, spectral acceleration value applies to all components on Project. Value is to be obtained by Mechanical Engineer from Project Structural Engineer based on ASCE/SEI 7-10 Section 11.4.5.

SDS = Spectral Acceleration: <**Insert value**>. Value applies to all components on Project.

"Component Amplification Factor" is selected by Mechanical Engineer as explained in ASCE/SEI 7-10 Section 13.6.1. List on Drawing Schedule for each component.

ap = Component Amplification Factor: See Drawing Schedule for each component.

"Component Importance Factor" for each component is selected by Mechanical Engineer as explained in ASCE/SEI 7-10 Section 13.1.3. List on Drawing Schedule for each component.

Ip = Component Importance Factor: See Drawing Schedule for each component.

Wp = Component Operating Weight: For each component. Obtain by Delegated-Design Contractor from equipment submittal.

"Component Response Modification Factor" is selected by Mechanical Engineer from ASCE/SEI 7-10, Table 13.6-1. List on Drawing Schedule for each component.

Rp = Component Response Modification Factor: See Drawing Schedule for each component.

z = Height in Structure of Point of Attachment of Component for Base: Determined from Project Drawings for each component by Contractor. For items at or below the base, "z" shall be taken as zero.

h = Average Roof Height of Structure for Base: Determine from Project Drawings by Delegated-Design Contractor.

Vertical Seismic Design Force: Calculate by Delegated-Design Contractor using method explained in ASCE/SEI 7-10, Paragraph 13.3.1.

Seismic Relative Displacement Dpl: Calculate by Delegated-Design Contractor using methods explained in ASCE/SEI 7-10, Paragraph 13.3.2. Factors below must be obtained for this calculation:

Dp= Relative Seismic Displacement that Each Component Must Be Designed to Accommodate: Calculate by Delegated-Design Contractor in accordance with ASCE/SEI 7-10, Paragraph 13.3.2.

"Structure Importance Factor" value is obtained by Mechanical Engineer from Project Structural Engineer and ASCE/SEI 7-10 Section 11.5.1.

Ie= Structure Importance Factor: <**Insert value**>. Value applies to all components on Project.

"Deflection at building level x of Structure A" value is determined for each component in building in accordance with ASCE/SEI 7-10, Equation 12.8-15 and depends upon location of component in building. Value is obtained by Mechanical Engineer from Project Structural Engineer.

δxA= Deflection at Building Level x of Structure A: See Drawing Schedule for each component.

"Deflection at building level y of Structure A" value is determined for each component in building in accordance with ASCE/SEI 7-10, Equation 12.8-15 and depends upon location of component in building. Value is obtained by Mechanical Engineer from Project Structural Engineer.

δyA= Deflection at Building Level y of Structure A: see Drawing Schedule for each component.

"Deflection at building level y of Structure B" value is determined for each component in building in accordance with ASCE/SEI 7-10, Equation 12.8-15 and depends upon location of component in building. Value is obtained by Mechanical Engineer from Project Structural Engineer.

δyB= Deflection at Building Level y of Structure B: See Drawing Schedule for each component.

hx = Height of Level x to which Upper Connection point Is Attached: Determine for each component by Delegated-Design Contractor from Project Drawings and manufacturer's data;

hy = Height of Level y to which Upper Connection Point Is Attached: Determine for each component by Delegated-Design Contractor from Project Drawings and manufacturer's data.

"Allowable story drift for Structure A" value is determined in accordance with ASCE/SEI 7-10, Equation 12.12-1 and depends upon location of component in building. Value is obtained by Mechanical Engineer from Project Structural Engineer.

ΔaA = Allowable Story Drift for Structure A: See Drawing Schedule for each component.

"Allowable story drift for Structure B" value is determined in accordance with ASCE/SEI 7-10, Equation 12.12-1 and depends upon location of component in building. Value is obtained by Mechanical Engineer from Project Structural Engineer.

ΔaB = Allowable Story Drift for Structure B: See Drawing Schedule for each component.

"Story Height" used in the definition of "allowable drift" value is determined in accordance with ASCE/SEI 7-10, Table 12.12-1 and depends upon location of component in building. Value is obtained by Mechanical Engineer from Project Structural Engineer.

hsx = Story Height Used in the Definition of Allowable Drift Δa: See Drawing Schedule for each component.

Retain "Calculation Factors, ASCE/SEI 7-05, Ch. 13 - Seismic Design Requirements for Nonstructural Components" and all subparagraphs below if ASCE/SEI 7-05 applies to this Project.

Calculation Factors, ASCE/SEI 7-05, Ch. 3 - Seismic Design Requirements for Nonstructural Components: All section, paragraph, equation, and table numbers refer to ASCE/SEI 7-05 unless otherwise noted.

Horizontal Seismic Design Force Fp: Calculated by Delegated-Design Contractor by ASCE/SEI 7-05, Equation 13.3-1. Factors below must be obtained for this calculation:

"Spectral Acceleration" value applies to all components on Project. Value is to be obtained by Mechanical Engineer from Project Structural Engineer and ASCE/SEI 7-05 Section 11.4.4.

SDS = Spectral Acceleration: <**Insert value**>. Value applies to all components on Project.

"Component Amplification Factor" is selected by Mechanical Engineer for each component as explained in ASCE/SEI 7-05, Table 13.6-1. List on Drawing Schedule for each component.

ap = Component Amplification Factor: See Drawing Schedule for each component.

"Component Importance Factor" is selected by Mechanical Engineer for each component as explained in ASCE/SEI 7-05 Section 13.1.3. List on Drawing Schedule for each component.

Ip = Component Importance Factor: See Drawing Schedule for each component.

Wp = Component Operating Weight: Obtain by Delegated-Design Contractor for each component from component submittal.

"Component Response Modification Factor" is selected by Mechanical Engineer for each component from ASCE/SEI 7-05, Table 13.6-1. List on Drawing Schedule for each component.

Rp = Component Response Modification Factor: See Drawing Schedule for each component.

z = Height in Structure of Point of Attachment of Component for Base: Determine by Delegated-Design Contractor for each component from Project Drawings. For items at or below the base, "z" shall be taken as zero.

h = Average Roof Height of Structure for Base: Determine by Delegated-Design Contractor from Project Drawings.

Vertical Seismic Design Force: Calculated by Delegated-Design Contractor using method explained in ASCE/SEI 7-05, Paragraph 13.3.1.

Seismic Relative Displacement Dp: Calculated by Delegated-Design Contractor using methods explained in ASCE/SEI 7-05, Paragraph 13.3.2. Factors below must be obtained for this calculation:

"Deflection at building level x of Structure A" value is obtained by Mechanical Engineer from Project Structural Engineer for each component in building as defined in ASCE/SEI 7-05 Section 12.8.6 and depends upon location of component in building. List on Drawing Schedule for each component.

δxA = Deflection at Building Level x of Structure A: See Drawing Schedule for each component.

"Deflection at building level y of Structure A" value is obtained by Mechanical Engineer from Project Structural Engineer for each component in building as defined in ASCE/SEI 7-05 Section 12.8.6 and depends upon location of component in building. List on Drawing Schedule for each component.

δyA = Deflection at Building Level y of Structure A: See Drawing Schedule for each component.

"Deflection at building level y of Structure A" value is obtained by Mechanical Engineer from Project Structural Engineer for each component in building as defined in ASCE/SEI 7-05 Section 12.8.6 and depends upon location of component in building. List on Drawing Schedule for each component.

δyB = Deflection at Building Level y of Structure B: See Drawing Schedule for each component.

hx = Height of Level x to which Upper Connection Point Is Attached: Determine for each component by Delegated-Design Contractor from Project Drawings and manufacturer's data.

hy = Height of Level y to which Upper Connection Point Is Attached: Determine for each component by Delegated-Design Contractor from Project Drawings and manufacturer's data.

"Allowable story drift for Structure A" value is obtained by Mechanical Engineer from Project Structural Engineer for each component in building in accordance with ASCE/SEI 7-05, Equation 12.12-1 and depends upon location of component in building. List on Drawing Schedule for each component.

ΔaA = Allowable Story Drift for Structure A: See Drawing Schedule for each component.

"Allowable story drift for Structure B" value is obtained by Mechanical Engineer from Project Structural Engineer for each component in building in accordance with ASCE/SEI 7-05, Equation 12.12-1 and depends upon location of component in building. List on Drawing Schedule for each component.

ΔaB = Allowable Story Drift for Structure B: See Drawing Schedule for each component.

"Story Height used in the definition of allowable drift" value is obtained by Mechanical Engineer from Project Structural Engineer for each component in building in accordance with ASCE/SEI 7-05, Table 12.12-1 and depends upon location of component in building. List on Drawing Schedule for each component.

hsx = Story Height Used in the Definition of Allowable Drift Δa: See Drawing Schedule for each component.

Retain "Wind-Load Design Calculations" Paragraph and applicable subparagraph below if wind-load reinforcement design services have been delegated to Contractor.

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

ASCE/SEI 7 is generally applicable in most locations, but it is Mechanical Engineer's responsibility to determine the applicable building codes and editions thereof, and applicable wind-load design standards that apply to this 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. Mechanical engineer must delete all non-applicable editions throughout the Section.

If a calculation method other than that prescribed in ASCE/SEI 7 is to be used, Mechanical Engineer must revise the Section Text to provide alternative appropriate calculation parameters and instruction 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-force calculation method required by authorities having jurisdiction**>. Where "ASCE/SEI 7" 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.

Data 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 seismic load calculations for equipment requiring both seismic 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 Mechanical 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 Mechanical Engineer on HVAC Vibration-Control and Seismic-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 such as louvers is to be calculated by Delegated-Design Contractor using methods in ASCE/SEI 7-16, Ch. 30. Perform calculations in accordance with one of the following, as applicable:

PART 1: Low-Rise Buildings.

PART 2: Low-Rise Buildings (Simplified).

PART 3: Buildings with "h" less than 60 feet (18.3 m).

PART 4: Buildings with "h" greater than 60 feet (18.3 m) and less than 160 feet (48.8 m).

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 Mechanical 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 Mechanical Engineer from Project Drawings.

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

"Basic Wind Speed" value is obtained by Mechanical Engineer from Wind Hazard map in ASCE/SEI 7-16 Section 26.5 or ASCE/SEI 7-10 or other source approved by authorities having jurisdiction.

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

"Wind directionality factor" value is obtained by Mechanical Engineer from ASCE/SEI 7-16 or 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 Mechanical Engineer from ASCE/SEI 7-16 or 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 Mechanical Engineer from ASCE/SEI 7-16 or 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**>.

"Ground elevation factor" value is obtained by Mechanical Engineer from ASCE/SEI 7-16 or ASCE/SEI 7-10 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 Mechanical 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 Mechanical Engineer from 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 Mechanical Engineer from ASCE/SEI 7-16 or ASCE/SEI 7-10 Section 26.12 or other source approved by authorities having jurisdiction.

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

"Internal pressure coefficient" is obtained by Mechanical Engineer from ASCE/SEI 7-16 or ASCE/SEI 7-10 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 such as louvers are 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 (18.3 m).

PART 4: Buildings with "h" less than 160 feet (48.8 m).

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 Mechanical 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 Mechanical Engineer from Project Drawings.

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

"Basic Wind Speed" value is obtained by Mechanical Engineer from Wind Hazard map in ASCE/SEI 7-10, Figs. 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 Mechanical 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 Mechanical 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 Mechanical 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 Mechanical Engineer from ASCE/SEI 7-10 Section 26.10.1 or other source approved by authorities having jurisdiction.

Kz = Velocity Pressure Exposure Coefficient: <**Insert coefficient**>.

Kh = Velocity Pressure Exposure Coefficient: <**Insert coefficient**>.

qz = Velocity Pressure: Value calculated by delegated wind-load design Contractor using methods detailed in ASCE/SEI 7-16 or ASCE/SEI 7-10 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 or ASCE/SEI 7-10 Section 26.10.1 or other source approved by authorities having jurisdiction.

"Gust-effect factor" is obtained by Mechanical 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 Mechanical 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 Mechanical 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 force subparagraph below if ASCE/SEI 7-05 applies to this Project.

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

"Importance factor" value is determined by Mechanical 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 Mechanical Engineer from Project Drawings.

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

"Basic Wind Speed" value is obtained by Mechanical 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 Mechanical 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 Mechanical 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 Mechanical 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 Mechanical 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 Mechanical 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 Mechanical 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 Mechanical Engineer from ASCE/SEI 7-05, Figures 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 seismic restraints for suspended HVAC components or anchorage of floor-, roof-, or wall-mounted HVAC 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 HVAC component will not cause failure of any other essential architectural, mechanical, or electrical building component.
				2. Fire/Smoke Resistance: Seismic-[**and wind-load-**]restraint devices 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 or UL 723, 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 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:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158095).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457158096).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158098).

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.

Pad Material: Oil and water resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.

Surface Pattern: Smooth, ribbed, or 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 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 "Surface Pattern" Subparagraph below if the sandwich-core material has a surface pattern.

Surface Pattern: Smooth, ribbed, or 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.

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. Double-Deflection, 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:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158107).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457158108).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158110).

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- and water-resistant neoprene rubber, silicone rubber, 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:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158119).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457158120).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158122).

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. 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:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158151).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457158153).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158155).

Approved equivalent.

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 psig (3447 kPa).

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

* + - 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:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158163).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457158164).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158166).

Approved equivalent.

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.

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 psig (3447 kPa).

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:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158173).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457158174).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158176).

Approved equivalent.

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 psig (3447 kPa).

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.

* + - 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:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158184).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457158185).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158187).

Approved equivalent.

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 psig (3447 kPa).

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.

* + - 1. PIPE-RISER RESILIENT SUPPORT

Copy "All-Directional, Acoustical Pipe Anchor Consisting of Two Steel Tubes Separated by a Minimum 1/2-inch- (13-mm-) 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- (13-mm-) 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:

[Kinetics Noise Control, Inc](http://www.specagent.com/Lookup?uid=123457158244).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158245).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457158246).

Approved equivalent.

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

Maximum Load Per Support: 500 psig (3447 KPa) on isolation material providing equal isolation in all directions.

* + - 1. RESILIENT PIPE GUIDES

Copy "Telescopic Arrangement of Two Steel Tubes or Post and Sleeve Arrangement Separated by a Minimum 1/2-inch- (13-mm-) 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- (13-mm-) Thick Neoprene: <**Insert drawing designation**>.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13714) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158250).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457158251).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158253).

Approved equivalent.

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:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158208).

[nVent (CADDY)](http://www.specagent.com/Lookup?uid=123457158210).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457158209).

Approved equivalent.

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 psig (172 to 690 kPa).

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. 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:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158212).

[nVent (CADDY)](http://www.specagent.com/Lookup?uid=123457158214).

[Vibration Management Corp](http://www.specagent.com/Lookup?uid=123457158213).

Approved equivalent.

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 psig (3447 kPa).

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 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**] <**Insert frequency**>.

Operating Pressure Range: 25 to 100 psig (172 to 690 kPa).

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:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158130).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457158131).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158132).

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.

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

* + - 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:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158193).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457158194).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158196).

Approved equivalent.

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.

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:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158138).

[nVent (CADDY)](http://www.specagent.com/Lookup?uid=123457158142).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158139).

Approved equivalent.

* + - * 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 seismically prequalified in accordance with ACI 355.2 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: Seismically prequalified in accordance with ICC-ES AC446 testing.

Anchors in Masonry: Design in accordance with TMS 402.

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

Resilient Cushion: Maximum 1/4-inch (6-mm) air gap, and minimum 1/4 inch (6 mm) 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:

[Hilti, Inc](http://www.specagent.com/Lookup?uid=123457158860).

[nVent (CADDY)](http://www.specagent.com/Lookup?uid=123457158858).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158864).

Approved equivalent.

* + - * 1. Description: Shop- or field-fabricated bracing assembly made of AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe as per NFPA 13, 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:

[Eaton (B-line)](http://www.specagent.com/Lookup?uid=123457158865).

[nVent (CADDY)](http://www.specagent.com/Lookup?uid=123457158866).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158867).

Approved equivalent.

* + - * 1. Seismic-Restraint Cables: [**ASTM A1023/A1023M 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 seismic-restraining cable service; with fittings attached by means of poured socket, swaged socket or mechanical (Flemish eye) loop.
				2. Restraint cable assembly with cable fittings must comply with ASCE/SEI 19. 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:](http://www.specagent.com/Lookup?ulid=13726) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Hilti, Inc](http://www.specagent.com/Lookup?uid=123457158870).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158871).

[nVent (CADDY)](http://www.specagent.com/Lookup?uid=123457158869).

Approved equivalent.

Retain "Hanger-Rod Stiffener" Paragraph below for strengthening resistance of hanger rods against seismic and wind forces that may cause buckling of rods; delete if detailed on Drawings. Use with either rigid- or cable-type bracing assemblies when required to counter seismic and wind 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. Non-metallic stiffeners are unacceptable.
				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:

[Eaton (B-line)](http://www.specagent.com/Lookup?uid=123457158221).

[Hilti, Inc](http://www.specagent.com/Lookup?uid=123457158222).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158224).

Approved equivalent.

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 for anchor and as tested according to ASTM E488/E488M.

* + - * 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:

[Eaton (B-line)](http://www.specagent.com/Lookup?uid=123457158275).

[Hilti, Inc](http://www.specagent.com/Lookup?uid=123457158225).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158227).

Approved equivalent.

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/E488M.

* + - * 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 (7.46 kW) 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:

[Eaton (B-line)](http://www.specagent.com/Lookup?uid=123457158498).

[Hilti, Inc](http://www.specagent.com/Lookup?uid=123457158499).

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158500).

Approved equivalent.

* + - * 1. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC466 testing.
				2. Comply with ANSI/MSS SP-58.
			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:

[Mason Industries, Inc](http://www.specagent.com/Lookup?uid=123457158083).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457158086).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158087).

Approved equivalent.

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

Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) 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/A36M. 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 (25-mm) 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/A36M. 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 (25-mm) 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/A36M. 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. RESTRAINED ISOLATION ROOF-CURB RAILS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=6163) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[nVent (CADDY)](http://www.specagent.com/Lookup?uid=123457158081).

[Vibration Eliminator Co., Inc](http://www.specagent.com/Lookup?uid=123457158279).

[Vibration Mountings & Controls, Inc](http://www.specagent.com/Lookup?uid=123457158280).

Approved equivalent.

* + - * 1. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic[**and wind**] forces.
				2. Upper Frame: To provide continuous support for equipment and to be captive to resiliently resist seismic[**and wind**] forces.
				3. Lower Support Assembly: To be formed sheet metal section containing adjustable and removable steel springs that support the upper frame. Lower support assembly to have a means for attaching to building structure and a wood nailer for attaching roof materials, and to be insulated with a minimum of 2 inches (50 mm) of rigid, glass-fiber insulation on inside of assembly. Mount adjustable, restrained-spring isolators on elastomeric vibration isolation pads and provide access ports, for level adjustment, with removable waterproof covers at all isolator locations. Locate isolators so they are accessible for adjustment at any time during the life of the installation without interfering with integrity of roof.
				4. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch (6 mm) thick.
				5. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashedcounter flashed over roof materials.
1. EXECUTION
	* + 1. EXAMINATION
				1. Examine areas and equipment to receive vibration isolation and seismic[**and wind**] 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, 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 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[**, wind load,**] and seismic loads within specified loading limits.
			1. INSTALLATION OF VIBRATION-CONTROL[**, WIND-LOAD CONTROL,**] AND SEISMIC-RESTRAINT DEVICES
				1. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Devices Schedules, where indicated on Drawings, or where Specifications indicate they are to be installed on specific equipment and systems.
				2. Provide seismic-restraint [**and wind-load control**]devices for systems and equipment where indicated in Equipment Schedules or Seismic-Restraint Devices Schedules, where indicated on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
				3. 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."
				4. Installation of vibration isolators[**, wind-load restraints,**] must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
				5. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
				6. Equipment Restraints:

Indicate type and quantity of snubbers and seismic-restraint devices described in three subparagraphs below, on Drawings, in Equipment Schedules, or in HVAC Vibration-Control and Seismic-Restraint Device Schedule on Drawings.

Install seismic snubbers on HVAC 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 (3.2 mm).

Install seismic-restraint[**, and wind-load-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 (12 and 24 m) are recommended by MSS SP-127. Revise these dimensions based on the configuration of piping.

Space lateral supports a maximum of [**40 feet (12 m)**] <**Insert dimension**> o.c., and longitudinal supports a maximum of [**80 feet (24 m)**] <**Insert dimension**> o.c.

Brace a change of direction longer than 12 feet (3.7 m).

* + - * 1. Install seismic-[**and wind-load-**]restraint cables so they do not bend across edges of adjacent equipment or building structure.
				2. 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.
				3. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
				4. 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.
				5. 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.
				6. Mechanical Anchor Bolts:

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 Structural Engineer 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-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. ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

Coordinate this article with Drawings.

* + - * 1. Provide flexible connections in piping systems where they cross structural seismic joints and other point where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7. Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties" for piping flexible connections.
			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 tank 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. 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 and bases, concrete inertia bases, and restrained isolation roof-curb rails with requirements of isolated equipment specified in this and other Sections. Where dimensions of these bases are indicated on Drawings, dimensions 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**] [**Engage**] a qualified testing agency to perform tests and inspections.

Retain "Manufacturer's Field Service" Paragraph below to require a factory-authorized service representative to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a factory-authorized service representative 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 factory-authorized service agent.

Perform tests and inspections[**with the assistance of a factory-authorized service representative 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, through 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.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

* + - * 1. Units will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. VIBRATION ISOLATION SCHEDULE
				1. Fans and Air Handling Units:
				2. Fans and Air Handling Units:

Equip fans and air handling units, located above the ground floor and not indicated to be provided with a concrete inertia block or be ceiling mounted or suspended with vibration elimination equipment as follows:

Provide an integral structural steel base with a common steel member running the full length of the fan and motor, with built-in motor slide rails, so as to form a common support for fan unit and motor, with spring type isolators, unless otherwise indicated.

Provide spring unit isolators, or steel rail type isolator bases with spring type isolators, for floor mounted units with motors mounted on the casings or frames.

Equip fans and handling units located on the ground floor, with the exception of medium or high pressure units not specified to be provided with a concrete inertia block, or be ceiling mounted or suspended, with unit isolators or steel rail type isolator bases.

Floor Mounted Utility Fan Sets:

Provide unit isolators or steel rail type isolator bases.

Utility Sets with Overhung Scrolls: Provide steel rail type isolator bases, with built-in reaction units to compensate for overhang.

Concrete Inertia Blocks for Fans and Air-Handling Units:

Provide inertia blocks, 1-1/2 times the weight of supported equipment, motor and drive for the following:

Fans and air handling units, operating at a static pressure up to 5 inches w.g., driven by electric motor 30 to 100 HP inclusive, or having wheel diameters 45 to 100 inches inclusive.

Fans and air handling units, operating at a static pressure of 5 inches w.g. or more, driven by motors 30 to 60 HP inclusive.

Provide inertia blocks, 2 times the weight of supported equipment, motor and drive for the following:

Fans and air handling units, operating at a static pressure up to 5 inches w.g., driven by motors over 100 HP.

Fans and air handling units, operating at a static pressure of 5 inches w.g. or more, driven by motors 75 HP and larger.

Ceiling Suspended Fans and Air Handling Units: Provide combination rubber and spring type isolators, designed for insertion in a split hanger rod. Provide isolators with an efficiency as specified under the paragraph entitled “APPLICATION” of this Section, with no deflection greater than 1-1/2 inches required.

* + - * 1. Pumps - Base Mounted and Unitary Types:
				2. Pumps - Base Mounted and Unitary Types:

Located Above the Ground Floor:

Driven by Electric Motors 5 to 15 HP: Provide structural steel rails, running full length of bed plate, with housed type spring isolators, and in the case of close coupled pumps, rails shall extend full length under and over hangoverhang so as to compensate for the cantilever effect. Provide isolators designed for a minimum 1/2 inch static deflection.

Driven by Electric Motors 20 to 40 HP: Provide inertia blocks, minimum of 1-1/2 times the weight of equipment.

Driven by Electric Motors 50 HP and Larger: Provide inertia blocks, minimum of 2 times the weight of equipment.

* + - * 1. Centrifugal Compressors, Evaporative Condensers and Packaged Cooling Towers: Provide housed spring type isolators, complete with vertical resilient limit stops, so as to prevent spring extension when equipment is unloaded. Approved isolators: Amber Booth Type CT, Korfund Type WSCL, Mason Industries Type SLR, Vibration Eliminator Type FRS, Vibration Mountings Type, designed for a minimum 3/4 inch static deflection.
				2. Direct Connected Reciprocating Compressors and Packaged Chillers: Provide spring unit isolators or steel rail type isolator bases with spring isolators. Spring isolators: Complete with vertical hold down feature to limit upward travel, when equipment is unloaded.
				3. Absorption Machines: Provide 1/2 inch thick rubber or neoprene pads.
				4. Remote Installed Refrigerant Compressor Units, Self Contained Belt Driven or Direct Driven Condensing Units and Floor Mounted Product Coolers: Provide steel rail type bases with built-in, metal housed, rubber-in-shear unit isolators, permanently fixed in place and provided with adjustable snubber devices. Provide rail bases on Ground Floor designed for 1/4 inch static deflection and above Ground Floor 1/2 inch static deflection.
				5. Ceiling Suspended Product Coolers: Provide combination rubber and spring type isolators, designed for insertion in a split hanger rod. Provide isolators with an efficiency as specified under the paragraph entitled “APPLICATION” of this section, with no deflection greater than 1-1/2 inch required.
				6. Ceiling Suspended Product Coolers: Provide combination rubber and spring type isolators, designed for insertion in a split hanger rod. Provide isolators with an efficiency as specified under the paragraph entitled “APPLICATION” of this section, with no deflection greater than 1-1/2 inch required.

END OF SECTION 230548