SECTION 238214 - CHILLED BEAMS

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:

Passive chilled beams.

Active chilled beams.

Multiservice chilled beams.

* + - 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 construction details, material descriptions, dimensions of individual components and profiles, and finishes for chilled beams.

Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories for chilled beams.

Submit sufficient information needed for direct comparison to each entry scheduled on Drawings.

Submit manufacturer's velocity and temperature profiles beneath passive chilled beams under conditions obtained in accordance with BS EN 14518 test procedures to show compliance.

* + - * 1. Shop Drawings: For chilled beams.

Include plans, elevations, sections, and **[mounting] [attachment]** details.

Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Include diagrams for power, signal, and control wiring.

Retain "Samples for Initial Selection" and "Samples for Verification" paragraphs below for two-stage Samples.

* + - * 1. Samples for Initial Selection: For units with factory-applied finishes.
				2. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

Chilled-Beam Finishes: **<Insert size>**.

* + - * 1. Product Schedule: For chilled beams.**[ Use same designations indicated on Drawings.]**

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

* + - * 1. Delegated-Design Submittal: For chilled beams.

Include design calculations for selecting mounting**[ and seismic restraints]**.

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

* + - * 1. Coordination Drawings: Floor plans, reflected ceiling plans, sections, and other details, or BIM model, drawn to scale, showing the items described in this Section and coordinated with all building trades.

Retain "Seismic Qualification Data" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Data: Certificates, for chilled beams, accessories, and components, from manufacturer.

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

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

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

* + - * 1. Field quality-control reports.
				2. Sample Warranty: For manufacturer's warranty.
			1. QUALITY ASSURANCE

Retain "Manufacturer Qualifications" paragraph below to require specific qualifications for manufacturers that are acceptable to furnish chilled beams.

* + - * 1. Manufacturer Qualifications:

Shipped chilled-beam products with similar requirements to those indicated for a continuous period of **[five] [10] <Insert number>** years within time of bid.

Chilled-beam products that have been successfully tested and in use on at least **[three] [five] <Insert number>** completed projects.

Having complete published catalog literature, installation, and operation and maintenance manuals for all products intended for use.

Having full-time in-house employees for the following:

Product research and development.

Product and application engineering.

Product manufacturing, testing, and quality control.

Technical support for system installation training, startup, commissioning, and troubleshooting.

Director’s Representative training.

Retain "Mockups" paragraph below for sensitive applications to require advance review of the expected installation.

* + - * 1. Mockups: Build mockups to set quality standards for materials and execution.

Build mockups to show a finished installation for each of the following applications:

Retain first two subparagraphs below or revise to suit Project.

For each different chilled beam type indicated on Drawings.

**<Insert mockup item>**.

Retain first subparagraph below to require mock-ups to be operational.

Mockups shall be fully operational.

Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

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.

* + - 1. PERFORMANCE REQUIREMENTS

Retain "Seismic Performance" paragraph below with "Seismic Qualification Data" paragraph in "Informational Submittals" Article for projects requiring seismic design. Delete paragraph 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.

* + - * 1. Seismic Performance: Chilled beams shall withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7] <Insert requirement>**. See Section 230548 "Vibration and Seismic Controls for HVAC."

Retain first subparagraph below to define the term "withstand" as it applies to this Project. Definition varies with type of building and occupancy and is critical to valid certification. Option is used for essential facilities where equipment must operate immediately after an earthquake.

The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified**[and the unit will be fully operational after the seismic event]**."

Coordinate "Component Importance Factor" subparagraph below with Section 230548 "Vibration and Seismic Controls for HVAC".

Component Importance Factor: **[1.5] [1.0]**.

* + - * 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
				2. Capacities and Characteristics:

See Drawings.

* + - 1. PASSIVE CHILLED BEAMS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=6801) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Halton Company](http://www.specagent.com/Lookup?uid=123457157849).

[Price Industries](http://www.specagent.com/Lookup?uid=123457157862).

[SEMCO, LLC; part of FlaktGroup](http://www.specagent.com/Lookup?uid=123457157850).

[Swegon Inc](http://www.specagent.com/Lookup?uid=123457157851).

[Titus; brand of Johnson Controls International PLC, Global Products](http://www.specagent.com/Lookup?uid=123457157861).

Approved equivalent.

* + - * 1. Source Limitation: Obtain chilled beams from single manufacturer.
				2. Description: Sheet metal casing with discharge grille, cooling hydronic coil assembly, **[and]** mounting brackets **[, and accessories ]**suitable for location and mounting arrangement indicated on Drawings.
				3. Performance:

Retain "ASHRAE 55 Compliance" subparagraph below to comply with ASHRAE 55 requirements for space conditions. Requirement is added assurance that resulting passive beam performance is within acceptable space comfort conditions. Performance of some passive chilled beams could result in uncomfortable space conditions if not properly designed for application. Consult manufacturers to determine compliance with requirement and for additional performance information.

ASHRAE 55 Compliance: Location and performance of passive chilled beams indicated on Drawings are to result in environmental space conditions in compliance with ASHRAE 55.

* + - * 1. Components:

Casing:

Retain "Materials, Exposed Units" or "Materials, Recessed Units" subparagraph below, or both, to suit Project.

Materials, Exposed Units: Minimum **[0.0375-inch-] <Insert thickness>** thick, **[galvanized-]**steel sheet.

Materials, Recessed Units: Minimum **[0.0375-inch-] <Insert thickness>** thick, **[galvanized-]**steel sheet.

Mounting Brackets: Factory installed along long side of units, with not less than four supports located near corners of units; field adjustable.

Discharge Air Grille:

**[Perforated face with 50 percent free area] [or] [linear bars, extending full length of long dimension, spaced not more than 1/2 inch o.c.] [See Drawings for face type] <Insert requirements>**.

Hinged on **[one] [or] [two]** sides to open from room side.

Removable from room side**[ without use of tools]**.

Hydronic Coil: Copper tube mechanically bonded to aluminum fins and mounted in a galvanized-steel coil casing; rated for minimum working pressure of **[300 psig] <Insert pressure>**.

Tube Thickness: Minimum **[0.0016-inch] <Insert thickness>** thick.

Fluid Tube Velocity (at Chilled-Water Design Flow Rate):

Maximum: **[4 fps] <Insert velocity>**.

Minimum: **[1 fps] <Insert velocity>**.

Fin Thickness: Minimum **[0.006-inch] <Insert thickness>** thick.

Fin Spacing: No closer than **[10] [12] <Insert spacing>** fins per inch.

Field Piping Connections: **[Press] [Push-on] [Solder] [Threaded]** ends with terminations oriented for field connection, as indicated on Drawings.

Retain any of first three subparagraphs below to suit Project. If requirements vary by unit, indicate requirements on Drawings.

Include coil with manual air vent **[and drain fitting] [and drain fitting with valve]**.

Include coil face with removable lint screen that is easily accessible for inspection and cleaning from room side.

Include vertical-oriented coil(s) with drain pan constructed of **[galvanized ]**steel and sloped at least 1 percent toward a NPS 1/2 capped drain connection.

Factory Piping: **[ASTM B88, Type L] [ASTM B88, Type M] <Insert type>** copper tube with ASME B16.22 wrought-copper fittings.

* + - * 1. Finish: **[Baked enamel] [Powder coat] [See Drawings] <Insert finish>**.

Color: Manufacturer's **[standard] [custom]** paint color, as selected by Architect.

Appearance of Finished Work: Variations in same piece are unacceptable.**[ Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.]**

* + - * 1. Accessories:

Retain any accessory subparagraphs below. If accessories vary by unit, indicate accessories on Drawings.

Hoses: NPS 1/2; **[18 inches] [24 inches] [36 inches] <Insert length>** long; PTFE-lined flexible hose wrapped in a stainless steel braided jacket and fitted with NPT threaded swivel ends; rated for 300 psig.

**<Insert accessory>**.

* + - * 1. Source Quality Control:

Retain "Capacity" subparagraph below to test passive chilled beams in accordance with BS EN 14518. Not all manufacturers listed can comply with this requirement. Consult manufacturers to determine compliance with requirement. See the Evaluations for additional information regarding industry test standards for passive chilled beams.

Capacity: Tested and certified by manufacturer in accordance with BS EN 14518 to comply with scheduled performance.

* + - 1. ACTIVE CHILLED BEAMS
				1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Dadanco USA.

Halton Company.

Price Industries.

SEMCO, LLC; part of FlaktGroup.

Swegon Inc.

Titus; brand of Johnson Controls International PLC, Global Products.

Approved equivalent.

* + - * 1. Source Limitation: Obtain chilled beams from single manufacturer.
				2. Description: Sheet metal casing with primary-air, secondary-air, and mixed-air plenums; air nozzles; air inlet grille; supply-air discharge slot(s); cooling**[ and heating]** hydronic coil assembly; **[and]** mounting brackets **[; and accessories ]**suitable for location and mounting arrangement indicated on Drawings.

Retain "Maximum Overall Height (Exposed Units)" or "Maximum Overall Height (Recessed Units)" subparagraph below, or both, to suit Project. If requirements vary by unit types, indicate requirements on Drawings.

Maximum Overall Height (Exposed Units): [See Drawings] <Insert dimension>.

Maximum Overall Height (Recessed Units): [See Drawings] <Insert dimension>.

* + - * 1. Components:

Casing:

Retain "Materials, Exposed Units" or "Materials, Recessed Units" subparagraph below, or both, to suit Project.

Materials, Exposed Units: Minimum **[0.0375-inch-] <Insert thickness>** thick, **[galvanized-]**steel sheet.

Materials, Recessed Units: Minimum **[0.0375-inch-] <Insert thickness>** thick, **[galvanized-]**steel sheet.

Mounting Brackets: Factory installed along long side of units, with not less than four supports located near corners of units; field adjustable.

Commissioning Ports: Equip chilled beams with commissioning ports for field measurement of static pressure differential between primary-air plenum and room. Include an airflow calibration chart attached to each chilled beam.

Casing Leakage: Factory seal casing joints, seams, and penetrations of casing positive-pressure plenums to be airtight. Leakage in primary-air plenum shall not exceed **[5] <Insert number>** percent of airflow rate indicated on Drawings.

Primary-Air Plenum Duct Connections: Round or oval collar of sufficient length to accommodate a slip-on field-installed duct. Size as indicated on Drawings

Retain "Insulation" subparagraph below to protect cold surfaces from surface condensation.

Insulation: Exterior or interior portions of casing capable of forming surface condensation shall be insulated with **[mineral-fiber] [or] [fiber-free]** insulation to prevent condensation.

Retain "Blank (Filler) Sections" subparagraph below to suit Project.

Blank (Filler) Sections: Where indicated on Drawings, chilled-beam manufacturer shall furnish blank (filler) sections to match external appearance of adjoining active portions.

Retain "Multiple Section Mating and Alignment" subparagraph below to suit Project.

Multiple Section Mating and Alignment: Where multiple sections are required to join end to end to make a longer contiguous unit, manufacturer to provide means to join multiple sections, so they appear as a single unit with no obvious obstructions or visual cues of multiple sections.

Air Nozzles: Quantity, size, and arrangement selected by chilled-beam manufacturer for performance indicated on Drawings. Primary air supplied through nozzles shall induce room (secondary) air across hydronic coil, and two air steams shall mix to supply conditioned air to room.

Two options (metal or plastic) in "Material" subparagraph below vary by manufacturer. Consult manufacturers for additional information and availability. Retain both options to be less restrictive.

Material: **[Metal] [or] [plastic, complying with NFPA 90A and UL 94 V-0]**.

Retain first subparagraph below for field-replaceable nozzles. Consult manufacturers for additional information and availability. Not all manufacturers offer field-replaceable nozzles.

Field replaceable**[ with different size nozzles to accommodate changes to performance]**.

Inlet Air Grille: Mounted on face of chilled beam and arranged for room (secondary) air to enter grille and hydronic coil before mixing with primary air.

**[Perforated face with 50 percent free area] [or] [linear bars, extending full length of long dimension, spaced not more than 1/2 inch o.c.] [See Drawings for face type] <Insert requirements>**.

Hinged on **[one] [or] [two]** sides to open from room side.

Removable from room side**[ without use of tools]**.

Supply-Air Discharge Slot(s): Size and arrangement selected by chilled-beam manufacturer for performance indicated on Drawings.

Material: Extruded aluminum or formed steel.

Retain "Field-Adjustable Discharge-Air Pattern" subparagraph below to include field-adjustable air pattern. Requirement is not available from all manufacturers on all units offered. Consult manufacturer for availability.

Field-Adjustable Discharge-Air Pattern: Include field-adjustable air pattern control to adjust the direction of the discharge air.

Hydronic Coil: Copper tube mechanically bonded to aluminum fins and mounted in a galvanized-steel coil casing; rated for minimum working pressure of **[300 psig] <Insert pressure>**.

Tube Thickness: Minimum **[0.016-inch] <Insert thickness>** thick.

Fluid Tube Velocity (at Chilled-Water Design Flow Rate):

Maximum: **[4 fps] <Insert velocity>**.

Minimum: **[1 fps] <Insert velocity>**.

Fin Thickness: Minimum **[0.006-inch] <Insert thickness>** thick.

Fin Spacing: No closer than **[10] [12] <Insert spacing>** fins per inch.

Field Piping Connections: **[Press] [Push-on] [Solder] [Threaded]** ends with terminations oriented for field connection, as indicated on Drawings.

Piping Arrangement: Two pipe**[ or four pipe, as indicated on Drawings.]**

Retain any of first three subparagraphs below to suit Project. If requirements vary by unit, indicate requirements on Drawings.

Include coil with manual air vent **[and drain fitting] [and drain fitting with valve]**.

Include coil face with removable lint screen that is easily accessible for inspection and cleaning from room side.

Include vertical-oriented coil(s) with drain pan constructed of **[galvanized ]**steel and sloped at least 1 percent toward a NPS 1/2 capped drain connection.

Factory Piping: **[ASTM B88, Type L] [ASTM B88, Type M] <Insert type>** copper tube with ASME B16.22 wrought-copper fittings.

* + - * 1. Finish: **[Baked enamel] [Powder coat] [See Drawings] <Insert finish>**.

Color: Manufacturer's **[standard] [custom]** paint color, as selected by Director’s Representative.

Appearance of Finished Work: Variations in same piece are unacceptable.**[ Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.]**

* + - * 1. Accessories:

Retain any accessory subparagraphs below. If accessories vary by unit, indicate accessories on Drawings.

Hoses: NPS 1/2; **[18 inches] [24 inches] [36 inches] <Insert length>** long; PTFE-lined flexible hose wrapped in a stainless steel braided jacket and fitted with NPT threaded swivel ends; rated for 300 psig.

Primary Airflow Automated Dampers: Modulating inlet damper with low-voltage electric actuator for connection to external controls.

Primary Airflow Manual Dampers: Integral damper assembly with locking handle for field adjustment.

Primary Airflow Regulators: Factory set to airflow rate indicated on Drawings; capable of maintaining constant airflow rate within **[10] <Insert number>** percent of setpoint.

**<Insert accessory>**.

* + - * 1. Source Quality Control: Comply with ASHRAE 200, AHRI 1240, and AHRI 1241.

Rate capacity of coils in accordance with AHRI 410, with capacities established in accordance with ASHRAE 200.

* + - 1. MULTISERVICE CHILLED BEAMS
				1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Halton Company.

Price Industries.

Titus; brand of Johnson Controls International PLC, Global Products.

Approved equivalent.

* + - * 1. Source Limitation: Obtain chilled beams from single manufacturer.
				2. Description: Sheet metal casing with primary-air, secondary-air, and mixed-air plenums; air nozzles; air inlet grille; supply-air discharge slot(s); cooling**[ and heating]** hydronic coil assembly; **[and]** mounting-bracket supports **[and accessories ]**suitable for location and mounting arrangement indicated on Drawings.

Retain "Maximum Overall Height (Exposed Units)" or "Maximum Overall Height (Recessed Units)" subparagraph below, or both, to suit Project. If requirements vary by unit types, indicate requirements on Drawings.

Maximum Overall Height (Exposed Units): **[See Drawings] <Insert dimension>**.

Maximum Overall Height (Recessed Units): **[See Drawings] <Insert dimension>**.

* + - * 1. Components:

Casing:

Retain "Materials, Exposed Units" or "Materials, Recessed Units" subparagraph below, or both, to suit Project.

Materials, Exposed Units: Minimum **[0.0375-inch-] <Insert thickness>** thick, **[galvanized-]**steel sheet.

Materials, Recessed Units: Minimum **[0.0375-inch-] <Insert thickness>** thick, **[galvanized-]**steel sheet.

Mounting Brackets: Factory installed along long side of units, with not less than four supports located near corners of units; field adjustable.

Commissioning Ports: Equip chilled beams with commissioning ports for field measurement of static pressure differential between primary air plenum and room. Include with commissioning ports an airflow calibration chart attached to each chilled beam.

Casing Leakage: Factory seal casing joints, seams, and penetrations of casing positive-pressure plenums to be airtight. Leakage in primary-air plenum shall not exceed **[5] <Insert number>** percent of airflow rate indicated on Drawings.

Primary-Air Plenum Duct Connections: Round or oval collar of sufficient length to accommodate a slip-on field-installed duct. Size as indicated on Drawings

Retain "Insulation" subparagraph below to protect cold surfaces from surface condensation.

Insulation: Exterior or interior portions of casing capable of forming surface condensation shall be insulated with **[mineral-fiber] [or] [fiber-free]** insulation to prevent condensation.

Retain "Blank (Filler) Sections" subparagraph below to suit Project.

Blank (Filler) Sections: Where indicated on Drawings, chilled-beam manufacturer shall furnish blank (filler) sections to match external appearance of adjoining active portions.

Retain "Multiple Section Mating and Alignment" subparagraph below to suit Project.

Multiple Section Mating and Alignment: Where multiple sections are required to join end to end to make a longer contiguous unit, manufacturer to provide means to join multiple sections, so they appear as a single unit with no obvious obstructions or visual cues of multiple sections.

Air Nozzles: Quantity, size, and arrangement selected by chilled-beam manufacturer for performance indicated on Drawings. Primary air supplied through nozzles shall induce room (secondary) air across hydronic coil, and two air steams shall mix to supply conditioned air to room.

Two options (metal or plastic) in "Material" subparagraph below vary by manufacturer. Consult manufacturers for additional information and availability. Retain both options to be less restrictive.

Material: **[Metal] [or] [plastic, complying with NFPA 90A and UL 94 V-0]**.

Retain first subparagraph below for field-replaceable nozzles. Consult manufacturers for additional information and availability. Not all manufacturers offer field-replaceable nozzles.

Field replaceable**[ with different size nozzles to accommodate changes to performance]**.

Inlet Air Grille: Mounted on face of chilled beam and arranged for room (secondary) air to enter grille and hydronic coil before mixing with primary air.

**[Perforated face with 50 percent free area] [or] [linear bars, extending full length of long dimension, spaced not more than 1/2 inch o.c.] [See Drawings for face type] <Insert requirements>**.

Hinged on **[one] [or] [two]** sides to open from room side.

Removable from room side**[ without use of tools]**.

Supply-Air Discharge Slot(s): Size and arrangement selected by chilled-beam manufacturer for performance indicated on Drawings.

Material: Extruded aluminum or formed steel.

Retain "Field-Adjustable Discharge-Air Pattern" subparagraph below to include field-adjustable air pattern. Requirement is not available from all manufacturers on all units offered. Consult manufacturer for availability.

Field-Adjustable Discharge-Air Pattern: Include field-adjustable air pattern control to adjust the direction of the discharge air.

Hydronic Coil: Copper tube mechanically bonded to aluminum fins and mounted in a galvanized-steel coil casing; rated for minimum working pressure of **[300 psig] <Insert pressure>**.

Tube Thickness: Minimum **[0.016-inch] <Insert thickness>** thick.

Fluid Tube Velocity (at Chilled-Water Design Flow Rate):

Maximum: **[4 fps] <Insert velocity>**.

Minimum: **[1 fps] <Insert velocity>**.

Fin Thickness: Minimum **[0.006-inch] <Insert thickness>** thick.

Fin Spacing: No closer than **[10] [12] <Insert spacing>** fins per inch.

Field Piping Connections: **[Press] [Push-on] [Solder] [Threaded]** ends with terminations oriented for field connection, as indicated on Drawings.

Piping Arrangement: Two pipe**[ or four pipe, as indicated on Drawings.]**

Retain any of first three subparagraphs below to suit Project. If requirements vary by unit, indicate requirements on Drawings.

Include coil with manual air vent **[and drain fitting] [and drain fitting with valve]**.

Include coil face with removable lint screen that is easily accessible for inspection and cleaning from room side.

Include vertical-oriented coil(s) with drain pan constructed of **[galvanized ]**steel and sloped at least 1 percent toward a NPS 1/2 capped drain connection.

Factory Piping: **[ASTM B88, Type L] [ASTM B88, Type M] <Insert type>** copper tube with ASME B16.22 wrought-copper fittings.

* + - * 1. Finish: **[Baked enamel] [Powder coat] [See Drawings] <Insert finish>**.

Color: Manufacturer's **[standard] [custom]** paint color, as selected by Director’s Representative.

Appearance of Finished Work: Variations in same piece are unacceptable.**[ Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.]**

* + - * 1. Other Building Services Integrated into Chilled Beams:

Retain any of subparagraphs below and revise to suit Project. If requirements vary by unit, indicate requirements on Drawings. Building services that are integrated into chilled beams are often customized to suit Project-specific requirements. Consult chilled-beam manufacturers for design assistance. See the Evaluations for additional discussion.

Retain "Fire Alarm System Devices" subparagraph below to integrate fire alarm system devices into chilled beams.

Fire Alarm System Devices:

Notification Appliances, Audible: <**Insert requirement**>.

Notification Appliances, Visual: <**Insert requirement**>.

Heat Detectors: <**Insert requirement**>.

Smoke Detectors: <**Insert requirement**>.

Retain "Sprinklers" subparagraph below to integrate sprinklers into chilled beams. See Section 211313 "Wet-Pipe Sprinkler Systems" for system requirements and model text that could be used to indicate requirements.

Sprinklers: **<Insert requirement>**.

Retain "Lighting" subparagraph below to integrate lighting into chilled beams. See Section 265119 "LED Interior Lighting" for requirements and model text that could be used to indicate requirements.

Lighting: **<Insert requirement>**.

Retain "Occupancy Sensors" subparagraph below to integrate occupancy sensors into chilled beams. See Section 260923 "Lighting Control Devices" for requirements and model text that could be used to indicate requirements.

Occupancy Sensors: **<Insert requirement>**.

Retain "Speakers" subparagraph below to integrate speakers into chilled beams. See Section 275116 "Public Address Systems" for system requirements and model text that could be used to indicate requirements.

Speakers: **<Insert requirement>**.

Retain "Video Cameras" subparagraph below to integrate video cameras into chilled beams.

Video Cameras: **<Insert requirement>**.

**<Insert building service>**.

* + - * 1. Accessories:

Retain any accessory subparagraphs below. If accessories vary by unit, indicate accessories on Drawings.

Hoses: NPS 1/2; **[18 inches] [24 inches] [36 inches] <Insert length>** long; PTFE-lined flexible hose wrapped in a stainless steel braided jacket and fitted with NPT threaded swivel ends; rated for 300 psig.

Primary Airflow Automated Dampers: Modulating inlet damper with low-voltage electric actuator for connection to external controls.

Primary Airflow Manual Dampers: Integral damper assembly with locking handle for field adjustment.

Primary Airflow Regulators: Factory set to airflow rate indicated on Drawings; capable of maintaining constant airflow rate within **[10] <Insert value>** percent of setpoint.

**<Insert accessory>.**

* + - * 1. Source Quality Control: Comply with ASHRAE 200, AHRI 1240, and AHRI 1241.

Rate capacity of coils in accordance with AHRI 410, with capacities established in accordance with ASHRAE 200.

* + - 1. GENERAL PROTECTION REQUIREMENTS
				1. Protect finishes on exposed surfaces from damage by applying a removable, temporary protective covering at the factory before shipping.
				2. Protect coil and piping openings with removable end caps before shipping.

Retain paragraph below for active chilled beams.

* + - * 1. Protect duct connection openings with removable end caps before shipping.
1. EXECUTION
	* + 1. EXAMINATION
				1. Examine areas to receive chilled beams for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

Retain optional text in first paragraph below for active chilled beams.

* + - * 1. Examine roughing-in for **[duct, ]**piping and wiring to verify actual locations of connections before installation.
				2. Proceed with installation only after unsatisfactory conditions have been corrected.
			1. INSTALLATION
				1. Install chilled beams level and plumb.

Revise first paragraph below to delete or insert types of construction that penetrate or are supported by ceilings.

* + - * 1. Coordinate layout and installation of chilled beams and suspension-system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, communications system, security system, and partition assemblies.

Retain "Seismic Restraints" paragraph below for installation of equipment with seismic restraints.

* + - * 1. Seismic Restraints: Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
				2. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
				3. Install continuous-thread hanger rods of size required to support chilled-beam weight. Laterally brace chilled beams to prevent movement.
			1. PIPING CONNECTIONS

Coordinate piping installations with Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Comply with requirements for piping specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Comply with requirements for general-duty valves specified in **[Section 230523.11 "Globe Valves for HVAC Piping,"] [Section 230523.12 "Ball Valves for HVAC Piping,"] [and] [Section 230523.15 "Gate Valves for HVAC Piping."]**
				3. Make piping connections to chilled-beam units at locations indicated on Drawings.
				4. Where installing piping adjacent to chilled beams, allow space for service and maintenance.
			1. DUCT CONNECTIONS

Retain this article for active chilled beams.

Coordinate ductwork installations with Drawings and with requirements specified in ductwork systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Comply with requirements for ductwork specified in **[Section 233113 "Metal Ducts."] [and] [Section 233346 "Flexible Ducts."]** Drawings indicate general arrangement of ductwork.
				2. Make ductwork connections to chilled-beam units at locations indicated on Drawings.
				3. Where installing ductwork adjacent to chilled beams, allow space for service and maintenance.
			1. ELECTRICAL CONNECTIONS
				1. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
				2. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

Retain first paragraph below only when electrical components are field installed in chilled-beam configuration for insertion into ceiling systems.

* + - * 1. Comply with NECA 1.

Retain "Wiring Method" or "Wiring within Enclosures" paragraph below and coordinate with Drawings. Delete both if wiring methods for system are indicated on Drawings or if chilled-beam configuration does not include electrical components.

* + - * 1. Wiring Method: Install concealed cables in raceways and cable trays. Do not install cable within consoles, cabinets, desks, and counters.**[ In accessible ceiling spaces and in gypsum board partitions, unenclosed wiring method may be used.] [Conceal conductors and cables in accessible ceilings, walls, and floors.]** Do not conceal raceways and cables in unfinished spaces.

Retain first subparagraph below if retaining first option in "Wiring Method" paragraph above.

Install plenum cable in environmental air spaces, including plenum ceilings.

Comply with requirements for cable trays specified in Section 260536 "Cable Trays for Electrical Systems.

Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

* + - * 1. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
			1. CONTROLS
				1. Comply with requirements for controls specified in Section 230923 "Direct Digital Control (DDC) System for HVAC**[ and Section 230993.11 "Sequence of Operations for HVAC DDC]**."
			2. MULTISERVICE CHILLED-BEAM CONNECTIONS

Retain this article for multiservice active chilled beams. Coordinate with Part 2 "Multiservice Chilled Beams" Article.

Retain "Fire Alarm System Devices" paragraph below if fire alarm devices are integrated into chilled beams. Coordinate locations with fire alarm system Drawings and reflected ceiling plan.

* + - * 1. Fire Alarm System Devices: Comply with requirements for fire alarm system installation.

Retain "Sprinklers" paragraph below if sprinklers are integrated into chilled beams. Coordinate locations with wet pipe sprinkler system Drawings and reflected ceiling plan.

* + - * 1. Sprinklers: Comply with requirements for sprinkler head installation in Section 211313 "Wet-Pipe Sprinkler Systems."

Retain "Lighting" paragraph below if lighting is integrated into chilled beams. Coordinate locations with interior lighting Drawings and reflected ceiling plan.

* + - * 1. Lighting: Comply with requirements for lighting-fixture installation in Section 265119 "LED Interior Lighting."

Retain "Occupancy Sensors" paragraph below when occupancy sensors are integrated into chilled beams. Coordinate locations with interior lighting Drawings and reflected ceiling plan.

* + - * 1. Occupancy Sensors: Comply with the requirements for occupancy sensor installation in Section 260923 "Lighting Control Devices."

Retain "Speakers" paragraph below when voice address system speakers are integrated into chilled beams. Coordinate locations with public address and notification system Drawings and reflected ceiling plan.

* + - * 1. Speakers: Comply with requirements for speaker installation in Section 275116 "Public Address Systems."
			1. IDENTIFICATION

Retain first paragraph below when chilled beams include electrical components.

* + - * 1. Identify electrical system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
				2. Identify hydronic piping and valves. Comply with requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."
			1. CLEANING AND PROTECTION
				1. Protect exposed surfaces of chilled beams from damage with factory-installed protective covering. Maintain covering in place until start of unit testing and balancing.
				2. Protect chilled beam water connections with factory-installed protective covers, and keep them covered until making final field piping connections.

Retain first paragraph below for active chilled beams.

* + - * 1. Protect chilled-beam air connections with factory-installed protective covers and keep them covered until making final field duct connections.
				2. Clean chilled beams inside and out to a factory-new condition.
				3. Reject damaged chilled beams and replace with new units.
				4. Only if acceptable to the Director’s Representative, minor damage to finishes may be repaired as required to restore beams to factory-new appearance. Any variation in visual appearance between factory and repaired finish shall be rejected.
			1. FIELD QUALITY CONTROL

Retain one of first four paragraphs below to identify who will perform tests and inspections. If retaining second option in first "Testing Agency" paragraph, or if retaining "Manufacturer's Field Service" or "Perform the following tests and inspections" paragraph, retain "Field quality-control reports" paragraph in "Informational Submittals" Article.

Retain "Testing Agency" paragraph below to require Contractor to hire an independent testing agency.

* + - * 1. Testing Agency: 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 to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform tests and inspections" paragraph below to require Contractor to perform tests and inspection, and retain option to require Contractor to arrange for the assistance of a factory-authorized service agent.

* + - * 1. **Perform tests and inspections[ with the Company Field Advisor per OGS Spec Section 014216]**.

Retain test requirements in "Tests and Inspections" paragraph below with any combination of paragraphs above.

* + - * 1. Tests and Inspections:

Leak Test: After installation, fill system with water under **[design ]**pressure and test for leaks. Repair leaks and retest until no leaks exist.

* + - * 1. Chilled beam will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. ADJUSTING
				1. Occupancy Adjustments: When requested within **[12] <Insert number>** months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **[two] <Insert number>** visits to Project during other-than-normal occupancy hours for this purpose.
			2. DEMONSTRATION
				1. **[Engage a Company Field Advisor per OGS Spec Section 014216to train] [Train]** Director’s Representative's Facility’s maintenance personnel to adjust, operate, and maintain chilled beams.

END OF SECTION 238214