This master should be used by designers working on Port of Portland construction projects and by designers working for PDX tenants (“Tenants”). Usage notes highlight a few specific editing choices, however the entire section should be evaluated and edited to fit specific project needs.

Use expansion joints for applications specified herein, only if expansion of piping and movement of terminal points cannot be solved through the use of expansion loops, U-bends, and inherent flexibility of piping.

SECTION 230518 - EXPANSION COMPENSATION

1. GENERAL
	* + 1. DESCRIPTION
				1. This section describes the complete system of expansion joints, compensators, pipe guides, supports, braces, and anchors to building structure.
				2. Service: Steam, steam condensate, pumped steam condensate, heating hot water, and chilled water piping systems.
				3. Work of this section is Contractor-designed.
			2. RELATED WORK SPECIFIED ELSEWHERE
				1. Section 230529, Hangers and Supports for HVAC Piping and Equipment
				2. Section 230545, Seismic Restraints for HVAC Piping and Equipment
				3. Section 230590, Pressure Testing of HVAC Systems
				4. Section 232000, HVAC Piping
			3. SUBMITTALS
				1. Product Data: For all products specified herein and included in the Contractor’s design.
				2. Shop Drawings: Detailed materials list if including Contractor engineered and designed system of expansion joints, ball joints, compensators, pipe guides, supports, braces, and anchorage to building structure.
				3. Structural Details and Calculations: Structural details and calculations substantiating that building structure, anchorages, and fabricated steel braces can safely withstand maximum calculated loads.
				4. Component Certification: Certification that manufactured components can safely accept loads resulting from hydraulic tests and design operating conditions. Product calculations by a registered professional engineer licensed in the state of Oregon, or test results by an independent testing laboratory and certified by a registered professional engineer, are acceptable.
				5. Installation, Operation, and Maintenance Data: For all products specified herein.
				6. Hydraulic Procedure Testing: Procedures for hydraulic testing of piping systems with expansion joints and compensators.
				7. Pipe Stress Analysis: Results of pipe stress analysis stating all assumptions, stamped and signed by a registered professional engineer licensed in the state of Oregon.
				8. Operation and Maintenance Manuals and As-Constructed Drawings and Data.

Use only if Commissioning Section 019100 is included in the contract.

* + - * 1. Commissioning Plans and Related Documentation: For each system of expansion joints, expansion compensators, pipe guides, supports, braces, anchors, piping, pipe fittings, and couplings, submit commissioning plans and schedules; checkout, startup, operational, functional and final acceptance test plans, procedures, checklists, and reports; and operation and maintenance training plans.
			1. QUALITY ASSURANCE
				1. Design the expansion joints, pipe guides, ball joints, and related supports, braces, and anchorages to building structure to absorb thermal expansion and contraction of piping and terminal movement, as well as resist the static and dynamic loads due to fluid flow at design conditions, hydraulic testing at pressures specified in Section 230590 and seismic forces specified in Section 230545.
				2. The system of expansion joints, ball joints, guides, and related supports, braces, and anchorage to building structure shall be designed by a registered professional engineer licensed in the state of Oregon.
				3. Use expansion joints in straight lengths of rigid pipe; preferably welded steel, anchored and guided in accordance with best practices recommendations of Crocker and King, Piping Handbook.
				4. Avoid use of expansion joints in conjunction with U-bends or other piping systems with inherent flexibility, such as Victaulic piping with flexible couplings. If expansion joints are used in piping with bends, thorough analysis of pipe stresses and deflections shall be conducted and extra care and attention shall be paid to radial thrust capacity of pipe guides, braces, and anchors. If Victaulic piping is used, use rigid Victaulic couplings only.
				5. Design shall include:

Pipe stress analysis indicating loads, deflections, and pipe stress at critical points throughout the piping systems under the following conditions:

At hydraulic design test pressure and ambient water temperature.

At design operating temperature, pressure, and flow.

Model number, size, location, and details of expansion joints, ball joints, compensator guides, supports, braces, and anchorage to building structure, with calculations substantiating that the components and building can accept the calculated loads and deflections.

Detailed shop drawings with materials list stamped and signed by a registered professional engineer licensed in the state of Oregon.

Structural details and calculations stamped and signed by a registered professional structural engineer licensed in the state of Oregon.

1. PRODUCTS
	* + 1. EXPANSION JOINTS AND COMPENSATION (STEAM, PUMPED CONDENSATE, HOT WATER PIPING)
				1. Acceptable Manufacturers: Hyspan, Adsco, SF Pathway, Flexonics, or equal.
				2. Single and Dual Expansion Joints: Externally pressurized, pressure balanced, guided expansion joints with stainless steel bellows, heavy wall shroud, internal sleeve, limit stops, 750ºF temperature rating, 10,000 minimum cycle life at full travel, 150 psig steam pressure rating, flanged, with drain port and plug. Hyspan series 3500, or equal. Deflection allowance according to Contractor design.
			2. PIPE GUIDES (STEAM, CONDENSATE, PUMPED CONDENSATE, HOT WATER PIPING, CHILLED WATER PIPING)
				1. Acceptable Manufacturers: Anvil, Flexonics, Hyspan, Pipe Shields Inc., Unistrut, or equal.
				2. Spider Clamp Assembly: Heavy gauge pressed steel, fusion welded, bolted construction, black enamel finish. Hyspan series 9500, or equal.
			3. PIPE GUIDES (CHILLED PIPING)
				1. Pipe shield incorporated or manufactured by manufacturer of pipe racks.
				2. Heavy-duty split pipe clamp with spring loaded channel nuts suitable for installed pipe racks. Pipe Shields G2000, or equal.
			4. BALL JOINTS (STEAM, CONDENSATE, PUMPED CONDENSATE, CHILLED WATER)
				1. Acceptable Manufacturers: Hyspan or equal.
				2. Single Ball Joint: Steel casing and chrome plated ball with factory coating. Factory installed inner and outer ball seals. Flanged ball retainer, 500°F temperature rating, and 150 psig steam pressure rating with welded ends. Hyspan Barco Type N Style I. Allow deflection in accordance with Contractor’s design.
2. EXECUTION
	* + 1. INSTALLATION, OPERATION, AND TESTING
				1. Install, operate, and test Contractor-designed system of expansion joints, compensators, pipe guides, supports, braces, and anchorages to building structure in accordance with approved submittals of this section.
				2. Do not remove pre-set shipping bars until after installation is complete.
				3. Do not hydraulically test piping with expansion joint installed if piping has inherent flexibility. Piping with inherent flexibility will act like a spring, and will compress (or deflect) due to the thrust of expansion joint, unless expansion joint is mechanically restrained.

Choose between Commissioning and Testing articles. Use Commissioning if Section 019100 is included in the contract; otherwise use Testing.

* + - 1. COMMISSIONING
				1. Commission complete system of Contractor-designed expansion joints, ball joints, compensators, guides, supports, braces, and anchorage to building structure.
			2. TESTING
				1. Check out, start up, and test the complete system of Contractor-designed expansion joints, compensators, guides, supports, braces, and anchorage to building structure.

END OF SECTION 230518