SECTION 221123.21 - INLINE, DOMESTIC-WATER PUMPS

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

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:

Terminology and descriptions for pumps used in this Section are from HI 1.1-1.2, HI 1.3, and HI 5.1-5.6.

In-line, sealless centrifugal pumps.

Horizontally mounted, in-line, separately coupled centrifugal pumps.

Horizontally mounted, in-line, close-coupled centrifugal pumps.

Vertically mounted, in-line, close-coupled centrifugal pumps.

* + - 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 submitted and tabbed (for combined submittals).
				4. Product Data: For each type of product. Include construction materials, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

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: Detail pumps and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

Structural members to which pumps will be attached.

Size and location of initial access modules for acoustical tile.

Retain "Seismic Qualification Data" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Data: Certificates, for inline, domestic-water pumps, 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.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For inline, domestic-water pumps to include in operation and maintenance manuals.
			2. DELIVERY, STORAGE, AND HANDLING
				1. Retain shipping flange protective covers and protective coatings during storage.
				2. Protect bearings and couplings against damage.
				3. Comply with pump manufacturer's written instructions for handling.
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
				1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
				2. UL Compliance: UL 778 for motor-operated water pumps.
				3. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

Some states have more stringent requirements than those listed in NSF 61 and NSF 372 above. Consult authorities having jurisdiction and insert local requirements below.

* + - * 1. <Insert local jurisdiction requirement>.

Seismic Performance: Inline, domestic-water pumps shall withstand the effects of earthquake motions determined according to [ASCE/SEI 7] <Insert requirement>.

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.

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 when subjected to the seismic forces specified[**and the unit will be fully operational after the seismic event**]."

For life-safety components required to function after an earthquake (such as fire-sprinkler systems, components that contain hazardous content, and storage racks in structures open to the public), the Component Importance Factor is 1.5. For other components, the Component Importance Factor is 1.0 unless the structure is in Seismic Use Group III and component is necessary for continued operation of facility or failure of component could impair continued operation of facility, in which case the Component Importance Factor is 1.5.

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

See ASCE/SEI 7, Coefficients for Architectural Component Table and Seismic Coefficients for Mechanical and Electrical Components Table for requirements to be inserted in subparagraph below.

<**Insert requirements for Component Amplification Factor and Component Response Modification Factor**>.

* + - 1. HORIZONTALLY MOUNTED, IN-LINE, SEPARATELY COUPLED CENTRIFUGAL PUMPS
				1. Description: Factory-assembled and -tested, in-line, single-stage, separately coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shafts mounted horizontal.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=2072) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Armstrong Pumps, Inc](http://www.specagent.com/Lookup?uid=123457131232).

[Bell & Gossett; a Xylem brand](http://www.specagent.com/Lookup?uid=123457131240).

[Flo Fab Inc](http://www.specagent.com/Lookup?uid=123457131234).

[Grundfos Pumps Corp](http://www.specagent.com/Lookup?uid=123457131235).

[Taco Comfort Solutions](http://www.specagent.com/Lookup?uid=123457131238).

If Project has more than one type or configuration of horizontally mounted, in-line, separately coupled centrifugal pump, delete "Capacities and Characteristics" paragraph below and schedule pumps on Drawings.

* + - * 1. Capacities and Characteristics
				2. Capacity: <Insert **gpm**>.

Total Dynamic Head: <**Insert feet>.**

Inlet and Outlet Size: <Insert Size>.

Pump Speed: <Insert rpm>.

Pump Control: [Pressure switch] [Thermostat] [Timer].

Motor Horsepower: <Insert value>.

Electrical Characteristics:

Volts: [120] [240] <Insert number> V.

Phases: [**Single**] [**Three**] phase.

Hertz: 60 Hz.

Full-Load Amperes: <**Insert number**> A.

Minimum Circuit Ampacity: <**Insert number**> A.

Maximum Overcurrent Protection: <**Insert number**> A.

If NSF 61 and NSF 372 compliance are required as identified in "Performance Requirements" Article, coordinate "Pump Construction" paragraph below, and materials each subparagraph describes, with manufacturers' compliance ratings. Not all manufacturers offer each option. Consult manufacturers.

* + - * 1. Pump Construction:

Casing:

Radially split [**bronze**] [**cast iron**] [**or**] [**stainless steel**] with threaded companion-flange connections for pumps with 2 inch pipe connections and flanged connections for pumps with 2-1/2 inch pipe connections.

Built to permit servicing of pump internals without disturbing the casing or the suction and discharge piping.

Gauge port tappings at suction and discharge nozzles.

Impeller: [**Bronze**] [**or**] [**stainless steel**], statically and dynamically balanced, closed, and keyed to shaft.

Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.

Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

Seal: Mechanical, with [carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket] <Insert seal type>.

Bearings: [Grease-lubricated] [or] [permanently lubricated] ball type.

Minimum Working Pressure: [**125 psig**] [**175 psig**] <Insert pressure>.

Continuous Operating Temperature: [**200 deg F**] <**Insert temperature**>.

Coordinate options in "Motor" paragraph below with manufacturers. Not all manufacturers offer each option.

* + - * 1. Motor: Single speed, with permanently lubricated ball bearings; and [**resiliently**] [**or**] [**rigidly**] mounted to pump casing.
			1. HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS
				1. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.

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:

Armstrong Pumps, Inc.

Bell & Gossett, a Xylem brand.

Flo Fab Inc.

Grundfos Pumps Corp.

Taco Comfort Solutions.

If Project has more than one type or configuration of horizontally mounted, in-line, close-coupled centrifugal pump, delete "Capacities and Characteristics" paragraph below and schedule pumps on Drawings.

* + - * 1. Capacities and Characteristics:

Capacity: <Insert **gpm**>.

Total Dynamic Head: <**Insert feet**>.

Inlet and Outlet Size: <**Insert NPS**>.

Pump Control: [Pressure switch] [Thermostat] [Timer].

Pump Speed: <**Insert rpm**>.

Motor Horsepower: <**Insert value**>.

Electrical Characteristics:

Volts: [120] [240] <Insert number> V.

Phases: [**Single**] [**Three**] phase.

Hertz: [**60**] <**Insert number**> Hz.

Full-Load Amperes: <**Insert number**> A.

Minimum Circuit Ampacity: <**Insert number**> A.

Maximum Overcurrent Protection: <Insert number> A.

If NSF 61 and NSF 372 compliance are required as identified in "Performance Requirements" Article, coordinate "Pump Construction" paragraph below, and materials each subparagraph describes, with manufacturers' compliance ratings. Not all manufacturers offer each option. Consult manufacturers.

* + - * 1. Pump Construction:

Casing:

Radially split [**bronze**] [**brass**] [**or**] [**cast iron**] with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.

Built to permit servicing of pump internals without disturbing the casing or the suction and discharge piping.

Gauge port tappings at suction and discharge nozzles.

Impeller: [**Bronze**] [**or**] [**brass**], statically and dynamically balanced, closed, and keyed to shaft.

Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.

Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

Seal: Mechanical, with [carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket] <Insert seal type>.

Bearings: [Grease-lubricated] [or] [permanently lubricated] ball type.

Minimum Working Pressure: [**175 psig** ] <Insert pressure>.

Continuous Operating Temperature: [**225 deg F**] <**Insert temperature**>.

Coordinate options in "Motor" paragraph below with manufacturers. Not all manufacturers offer each option.

* + - * 1. Motor: Single speed, with grease-lubricated ball bearings; [**resiliently**] [**or**] [**rigidly**] mounted to pump casing.
			1. VERTICALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS
				1. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted vertical.

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:

Armstrong Pumps, Inc.

Bell & Gossett, a Xylem brand.

Grundfos Pumps Corp.

Taco Comfort Solutions.

If Project has more than one type or configuration of vertically mounted, in-line, close-coupled centrifugal pump, delete "Capacities and Characteristics" paragraph below and schedule pumps on Drawings.

* + - * 1. Capacities and Characteristics:

Capacity: <Insert **gpm**>.

Total Dynamic Head: <**Insert feet**>.

Casing Material: [**Bronze**] [**Cast iron**].

Impeller Material: [ASTM B584, cast bronze] [ASTM B584, cast bronze or stainless steel] [Stainless steel].

Minimum Operating Pressure: 175 psig.

Maximum Continuous Operating Temperature: 225 deg F.

Inlet and Outlet Size: <**Insert NPS**>.

Pump Control: [Pressure switch] [Thermostat] [Timer].

Pump Speed: <**Insert rpm**>.

Motor Horsepower: <**Insert value**>.

Electrical Characteristics:

Volts: [120] [240] <Insert number> V.

Phases: [**Single**] [**Three**] phase.

Hertz: [**60**] <**Insert number**> Hz.

Full-Load Amperes: <**Insert number**> A.

Minimum Circuit Ampacity: <**Insert number**> A.

Maximum Overcurrent Protection: <**Insert number**> A.

If NSF 61 and NSF 372 compliance are required as identified in "Performance Requirements" Article, coordinate "Pump Construction" paragraph below, and materials each subparagraph describes, with manufacturers' compliance ratings. Not all manufacturers offer each option. Consult manufacturers.

* + - * 1. Pump Construction:

Casing: Radially split [**bronze**] [**cast or ductile iron**], with wear rings and threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.[**Include pump manufacturer's base attachment for mounting pump on concrete base.**]

Impeller: [Bronze] [brass] [or] [stainless steel], statically and dynamically balanced, closed, and keyed to shaft.

Shaft and Shaft Sleeve: [Steel] [or] [stainless-steel] shaft, with copper-alloy shaft sleeve.

Shaft Coupling: Flexible or rigid type if pump is provided with coupling.

Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.

Bearings: Oil-lubricated; bronze-journal or ball type.

Minimum Working Pressure: [175 psig] <Insert pressure>.

Continuous Operating Temperature: [**225 deg F**] <**Insert temperature**>.

* + - * 1. Motor: Single speed, with grease-lubricated ball bearings; rigidly mounted to pump casing.
			1. MOTORS

Default motor characteristics are specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

* + - * 1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.

Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

* + - 1. CONTROLS

Coordinate this article with manufacturers. Not all manufacturers offer each type of control.

* + - * 1. Pressure Switches: Electric, adjustable for control of [**water-supply**] <**Insert application**> pump.

Type: Water-immersion pressure sensor, for installation in piping.

Enclosure: NEMA 250, [Type 4X] <Insert type>.

Operation of Pump: On or off.

Transformer: Provide if required.

Power Requirement: [24 V ac] [120 V ac] <Insert power>.

Settings: Start pump at <**Insert pressure**> and stop pump at <**Insert pressure**>.

* + - * 1. Thermostats: Electric; adjustable for control of [**hot-water circulation**] <**Insert application**> pump.

Type: Water-immersion temperature sensor, for installation in piping.

Range: **[50 to 125 deg F] [65 to 200 deg F] [100 to 240 deg F] <Insert temperature range**>.

Enclosure: NEMA 250, **[Type 4X] <Insert type**>.

Operation of Pump: On or off.

Transformer: Provide if required.

Power Requirement: [**24 V ac] [120 V ac] <Insert power**>.

Settings: Start pump at [**105 deg F**] [**110 deg F**] [**115 deg F**] <Insert temperature> and stop pump at [**120 deg F**] [**125 deg F**] <Insert temperature>.

Retain "Timers" paragraph below if applying controls to limit hot-water circulation pump operation to periods when hot water is required, which is required by LEED v4, IgCC, and ASHRAE 189.1.

Retain paragraph below to require these devices to be provided by pump manufacturer.

* + - * 1. Timers: Electric, for control of [**hot-water circulation**] <**Insert application**> pump.

Type: Programmable, **[seven-day] <Insert time**> clock with manual override on-off switch.

Enclosure: NEMA 250, [**Type 1] <Insert type**>, suitable for wall mounting.

Operation of Pump: On or off.

Transformer: Provide if required.

Power Requirement: [**24 V ac] [120 V ac] <Insert power**>.

Programmable Sequence of Operation: **[Up to two on-off cycles each day for seven days] <Insert operational sequence**>.

Devices in "Time-Delay Relays" paragraph below may alternatively be specified in Section 223400 "Fuel-Fired, Domestic Water Heaters."

* + - * 1. Time-Delay Relays: Electric, for control of hot-water circulation pump between water heater and connected hot-water storage tank.

Type: Adjustable time-delay relay.

Range: Up to five minutes.

Setting: Five minutes.

Enclosure: NEMA 250, [**Type 4X**] <**Insert type**>.

Operation of Pump: On or off.

Transformer: Provide if required.

Power Requirement: [**24 V ac**] [**120 V ac**] <**Insert power**>.

Programmable Sequence of Operation: Limit pump operation to periods of burner operation, plus maximum five minutes after the burner stops.

1. EXECUTION
	* + 1. EXAMINATION
				1. Examine roughing-in for domestic-water-piping system to verify actual locations of piping connections before pump installation.
			2. PUMP INSTALLATION
				1. Comply with ANSI Standard/HI 1.4.
				2. Mount pumps in orientation complying with manufacturer's written instructions.

Retain "Pump Mounting" paragraph below for vertically mounted, in-line, close-coupled centrifugal pumps with cast-iron base supported on slabs-on-grade.

* + - * 1. Pump Mounting:

Install vertically mounted, in-line, close-coupled centrifugal pumps with cast-iron base mounted on concrete base.

Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Install anchor bolts to elevations required for proper attachment to supported equipment.

* + - * 1. Install continuous-thread hanger rods and vibration isolation of size required to support pump weight.
				2. Install pressure switches in water-supply piping.
				3. Install thermostats in hot-water return piping.
				4. Install timers <Insert location>.
				5. Install time-delay relays in piping between water heaters and hot-water storage tanks.
			1. PIPING CONNECTIONS

Coordinate inline, domestic-water pump installations and specialty arrangements with Drawings and with requirements specified in inline, domestic-water piping. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and maintenance.
				2. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

Horizontally mounted, in-line, separately coupled centrifugal pumps.

Horizontally mounted, in-line, close-coupled centrifugal pumps.

Vertically mounted, in-line, close-coupled centrifugal pumps.

* + - * 1. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping.

Install pressure gauge[**and snubber**] at suction of each pump and pressure gauge[**and snubber**] at discharge of each pump. Install at integral pressure-gauge tappings where provided or install pressure-gauge connectors in suction and discharge piping around pumps.

* + - 1. CONTROL CONNECTIONS
				1. Install control and electrical power wiring to field-mounted control devices.
				2. Connect control wiring between temperature controllers and devices.

Retain paragraph below if applying controls to limit hot-water storage tank circulation pump operation to qualify for LEED v4 Prerequisite EA 2.

* + - * 1. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.
			1. IDENTIFICATION
				1. Identify system components.
			2. FIELD QUALITY CONTROL

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 Company Service Advisor to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a Company Field Advisor per OGS Spec Section 014216 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 Company Service Advisor.

* + - * 1. Perform tests and inspections [with the assistance of a Company Field Advisor per OGS Spec Section 014216].
				2. Tests and Inspections:

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

* + - * 1. Inline, domestic-water pump will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. STARTUP SERVICE
				1. Engage a Company Field Advisor per OGS Spec Section 014216 to perform startup service.

Complete installation and startup checks according to manufacturer's written instructions.

Check piping connections for tightness.

Clean strainers on suction piping.

Set [**pressure switches,] [thermostats,] [timers,] [and] [time-delay relays**] for automatic starting and stopping operation of pumps.

Perform the following startup checks for each pump before starting:

Verify bearing lubrication.

Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.

Verify that pump is rotating in the correct direction.

Prime pump by opening suction valves and closing drains and prepare pump for operation.

Start motor.

Open discharge valve slowly.

Adjust temperature settings on thermostats.

Adjust timer settings.

* + - 1. ADJUSTING
				1. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by manufacturer.
				2. Adjust initial temperature set points.
				3. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123.21