SECTION 221123.13 - DOMESTIC-WATER PACKAGED BOOSTER 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.

This Section may include provisions for LEED 2009, LEED v4, ASHRAE 189.1, IgCC, and Green Globes. Some sustainable design requirements are either mandatory or optional and may be inserted into the Section Text using the hypertext links. Other requirements that are associated with sustainable design, and may be considered "best practice" or retained even if a sustainable design standard is not a project requirement, are discussed in the Evaluations.

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 for and descriptions of pumps specified in this Section are from HI 1.1-1.2 and HI 2.1-2.2.

Simplex, constant-speed booster pumps.

Multiplex, constant-speed booster pumps.

Simplex, variable-speed booster pumps.

Multiplex, variable-speed booster pumps.

* + - 1. DEFINITIONS

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

* + - * 1. PID: Proportional Integral Derivative.
				2. VFC: Variable-frequency controller.
			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 details, material descriptions, and dimensions of individual components and profiles.

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

* + - * 1. Shop Drawings: For booster pumps.

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

* + - * 1. Delegated-Design Submittal: For domestic-water packaged booster pumps.

Include design calculations for selecting vibration isolators[**and seismic restraints**] and for designing vibration isolation bases.

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 booster 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.

* + - 1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For booster pumps to include in emergency, operation, and maintenance manuals.
			2. DELIVERY, STORAGE, AND HANDLING
				1. Retain protective coatings and flange's protective covers during storage.
			3. COORDINATION
				1. Coordinate sizes and locations of concrete bases with actual equipment provided.
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. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

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: Booster pumps shall withstand the effects of earthquake motions determined according to [**ASCE/SEI 7**] <**Insert requirement**>.

Retain 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 booster pump will remain in place without separation of any parts from the booster pump when subjected to the seismic forces specified[**and the booster pump will be fully operational after the seismic event**]."

* + - 1. SIMPLEX, CONSTANT-SPEED BOOSTER PUMPS

Booster pumps and components in this article are for NPS 3 (DN 80) and smaller piping.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=3687) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Advanced Mechanical Technologies](http://www.specagent.com/Lookup?uid=123457131167).

[AMTROL, Inc](http://www.specagent.com/Lookup?uid=123457131154).

[Armstrong Pumps, Inc](http://www.specagent.com/Lookup?uid=123457131155).

[Bell & Gossett; a Xylem brand](http://www.specagent.com/Lookup?uid=123457131165).

[Canariis Corporation](http://www.specagent.com/Lookup?uid=123457131156).

[Delta P Carver](http://www.specagent.com/Lookup?uid=123457131168).

[Goulds Water Technology; a Xylem brand](http://www.specagent.com/Lookup?uid=123457131166).

[Grundfos Pumps Corporation U.S.A](http://www.specagent.com/Lookup?uid=123457131157).

[Hydronic Modules Company](http://www.specagent.com/Lookup?uid=123457131158).

[ITT Flowtronex](http://www.specagent.com/Lookup?uid=123457131159).

[Metropolitan Industries, Inc](http://www.specagent.com/Lookup?uid=123457131161).

[PACO Pumps; Grundfos Pumps Corporation, USA](http://www.specagent.com/Lookup?uid=123457131162).

Or equal.

* + - * 1. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pump, piping, valves, specialties, and controls, and mounted on base.
				2. Pump:

Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, close-coupled, single-stage, overhung-impeller, centrifugal pump.

Casing: Radially split; [**bronze**] [**cast iron**] [**stainless steel**].

Impeller: Closed, [**ASTM B584 cast bronze**] [**stainless steel**] <**Insert material**>; statically and dynamically balanced and keyed to shaft.

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

Seal: Mechanical.

Orientation: Mounted [**horizontally**] [**or**] [**vertically**].

* + - * 1. Motor: Single speed, with [**grease-lubricated**] [**or**] [**pre-greased, permanently shielded**], ball-bearings, and directly mounted to pump casing. Select motor that will not overload through full range of pump performance curve.
				2. Piping: [**Copper tube and copper fittings**] [**Stainless-steel pipe and fittings**] [**Stainless-steel pipe and fitting headers and copper tube and copper fittings between headers and pump**] [**Galvanized-steel pipe and cast-iron fittings**].
				3. Valves:

Shutoff Valves 2 inch and Smaller: [**Gate valve**] [**or**] [**two-piece, full-port ball valve**], in pump suction and discharge piping.

Shutoff Valves 2-1/2 inch and Larger: Gate valve in pump suction and discharge piping.

Check Valve 2 inch and Smaller: [**Silent**] [**or**] [**swing**] type in pump discharge piping.

Check Valve 2-1/2 inch and Larger: Silent type in pump discharge piping.

Control Valve: Adjustable, automatic, [**pilot-operated**] [**or**] [**direct-acting**], pressure-reducing type in pump discharge piping.

Retain "Control Valve" subparagraph and one of two "Check Valve" subparagraphs above or delete all three and retain "Control Valve" subparagraph below.

Control Valve: Combination adjustable, automatic, [**pilot-operated**] [**or**] [**direct-acting**] pressure-reducing-and-check type in pump discharge piping.

Thermal-Relief Valve: Temperature-and-pressure relief type in pump discharge piping.

* + - * 1. Dielectric Fittings: With insulating material to isolate joined dissimilar metals.
				2. Hydropneumatic Tank: Precharged[**, ASME-construction,**] diaphragm or bladder tank made of materials complying with NSF 61 and NSF 372.
				3. Control Panel: Factory installed and connected as an integral part of booster pump; automatic for single-pump, constant-speed operation, with load control and protection functions.

Control Logic: [**Electromechanical system with switches, relays**] [**Solid-state system with transducers, programmable microprocessor**], and other devices in the controller.

Retain first "Motor Controller" subparagraph below for electromechanical system.

Motor Controller: NEMA ICS 2, general-purpose, Class A, full-voltage, combination-magnetic type with undervoltage release feature, motor-circuit-protector-type disconnect, and short-circuit protective device.

Some manufacturers may offer low-voltage controls. Revise "Control Voltage" subparagraph below if required.

Control Voltage: [**24**] [**120**] V ac, with integral control-power transformer.

Retain "Motor Controller" subparagraph below for solid-state system.

Motor Controller: NEMA ICS 2, solid-state, reduced-voltage type.

Some manufacturers may offer low-voltage controls. Revise "Control Voltage" subparagraph below if required.

Control Voltage: [**24**] [**120**] V ac, with integral control-power transformer.

Enclosure: NEMA 250, [**Type 1**] [**Type 3R**] [**Type 4**] [**Type 12**] <**Insert type**>.

Motor Overload Protection: Overload relay in each phase.

Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.

Pump operation in electromechanical systems can be current- or pressure-sensing method. Retain third option in "Pump Operation" subparagraph below only if requiring solid-state control.

Pump Operation: [**Current-**] [**or**] [**pressure-**]sensing method.

Time Delay: Controls pump on-off operation; adjustable from [**1 to 300**] <**Insert number(s)**> seconds.

Instrumentation: Suction and discharge pressure gauges.

Light: Running light for pump.

Thermal-bleed cutoff.

[**Low-suction-pressure**] [**Water-storage-tank, low-level**] cutout.

Optional features in four subparagraphs below are available. Revise to suit Project.

High-suction-pressure cutout.

Low-discharge-pressure cutout.

High-discharge-pressure cutout.

Direct Digital Control (DDC) System for HVAC: Provide auxiliary contacts for interface to [**BACnet**] [**LonWorks**] <**Insert system**> DDC system.

On-off status of pump.

Alarm status.

* + - * 1. Base: Structural steel.

If Project has more than one constant-speed booster pump, delete "Capacities and Characteristics" paragraph below and schedule constant-speed booster pumps on Drawings. See sample schedule in the Evaluations.

* + - * 1. Capacities and Characteristics:

Minimum Pressure Rating: [**125**] [**150**] <**Insert number**> psig.

Booster-Pump Capacity: <**Insert number**> gpm.

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

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

Minimum Inlet Pressure: <**Insert number**> psig.

Maximum Inlet Pressure: <**Insert number**> psig.

Discharge Pressure: <**Insert number**> psig.

Low-Suction-Pressure Shutoff: <**Insert number**> psig.

High-Suction-Pressure Shutoff: <**Insert number**> psig.

Low-Discharge-Pressure Shutoff: <**Insert number**> psig.

High-Discharge-Pressure Shutoff: <**Insert number**> psig.

Inlet Size: <**Insert number**> NPS.

Outlet Size: <**Insert number**> NPS.

Control Valve:

Minimum Size: <**Insert number**> NPS.

Maximum Pressure Drop: <**Insert number**> psig.

Electrical Characteristics:

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

Volts: [**120**] [**240**] [**277**] [**480**] <**Insert number**> V.

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

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

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

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

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

Hydropneumatic Tank:

Minimum Water Volume Capacity: <**Insert number**> gal..

Pressure Rating: [**125**] [**150**] [**250**] <**Insert number**>psig.

Air Precharge: <**Insert number**> psig.

* + - 1. MULTIPLEX, CONSTANT-SPEED BOOSTER PUMPS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=3688) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Advanced Mechanical Technologies](http://www.specagent.com/Lookup?uid=123457131183).

[Armstrong Pumps, Inc](http://www.specagent.com/Lookup?uid=123457131170).

[Bell & Gossett; a Xylem brand](http://www.specagent.com/Lookup?uid=123457131180).

[Canariis Corporation](http://www.specagent.com/Lookup?uid=123457131171).

[Grundfos Pumps Corporation U.S.A](http://www.specagent.com/Lookup?uid=123457131169).

[Hydronic Modules Company](http://www.specagent.com/Lookup?uid=123457131172).

[ITT Flowtronex](http://www.specagent.com/Lookup?uid=123457131173).

[Metropolitan Industries, Inc](http://www.specagent.com/Lookup?uid=123457131174).

[PACO Pumps; Grundfos Pumps Corporation, USA](http://www.specagent.com/Lookup?uid=123457131175).

[Patterson Pump Company; a Gorman-Rupp company](http://www.specagent.com/Lookup?uid=123457131182).

[SyncroFlo, Inc](http://www.specagent.com/Lookup?uid=123457131176).

Or equal.

* + - * 1. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pumps, piping, valves, specialties, and controls, and mounted on base.

Retain one of five "Pumps" paragraphs below.

* + - * 1. Pumps:

Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, close-coupled, single-stage, overhung-impeller, centrifugal pump.

Casing: Radially split; [**bronze**] [**cast iron**] [**stainless steel**].

Impeller: Closed, [**ASTM B584 cast bronze**] [**stainless steel**] <**Insert material**>; statically and dynamically balanced and keyed to shaft.

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

Seal: Mechanical.

Orientation: Mounted [**horizontally**] [**or**] [**vertically**].

* + - * 1. Pumps:

Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, frame-mounted, separately coupled, single-stage, overhung-impeller, centrifugal pump.[**Include back-pullout design.**]

Casing: Radially split; [**bronze**] [**cast iron**] [**stainless steel**].

Impeller: Closed, [**ASTM B584 cast bronze**] [**stainless steel**] <**Insert material**>; statically and dynamically balanced and keyed to shaft.

Shaft and Shaft Sleeve: Stainless-steel[**or steel**] shaft, with copper-alloy shaft sleeve and deflector.

Seal: Mechanical.

Bearing: [**Grease-lubricated**] [**or**] [**pre-greased, permanently shielded**] ball type.

Coupling: Flexible, with metal guard.

* + - * 1. Pumps:

Type: In line, single stage as defined in HI 1.1-1.2 and HI 1.3 for in-line, single-stage, close-coupled, overhung-impeller, centrifugal pump.

Casing: Radially split; [**bronze**] [**cast iron**] [**stainless steel**].

Impeller: Closed, [**ASTM B584 cast bronze**] [**stainless steel**] <**Insert material**>; statically and dynamically balanced and keyed to shaft.

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

Seal: Mechanical.

Bearing: [**Grease-lubricated**] [**or**] [**pre-greased, permanently shielded**] ball type.

* + - * 1. Pumps:

Type: Vertical, multistage as defined in HI 1.1-1.2 and HI 1.3 for in-line, multistage, separately coupled, overhung-impeller, centrifugal pump.

Casing: Cast-iron or steel base and stainless-steel chamber.

Impeller: Closed, stainless steel; statically and dynamically balanced and keyed to shaft.

Shaft: Stainless steel.

Seal: Mechanical.

Bearing: Water-lubricated sleeve type.

* + - * 1. Pumps:

Type: Vertical, can, as defined in HI 2.1-2.2 and HI 2.3 for in-line, barrel or can, lineshaft, vertical pump.

Impeller: Closed, stainless steel; statically and dynamically balanced and keyed to shaft.

Bowls: [**Epoxy-coated cast iron**] [**Cast iron**] <**Insert material**>.

Shaft: Stainless steel.

Seals: Mechanical and stuffing-box types.

Bearings: Water-lubricated bushing type.

* + - * 1. Motors: Single speed, with [**grease-lubricated**] [**or**] [**pre-greased, permanently shielded**], ball-bearings. Select motors that will not overload through full range of pump performance curve.
				2. Piping: [**Copper tube and copper fittings**] [**Stainless-steel pipe and fittings**] [**Stainless-steel pipe and fitting headers and copper tube and copper fittings between headers and pump**] [**Galvanized-steel pipe and cast-iron fittings**].
				3. Valves:

Shutoff Valves 2 inch and Smaller: [**Gate valve**] [**or**] [**two-piece, full-port ball valve**], in each pump's suction and discharge piping.

Shutoff Valves 2-1/2 inch and Larger: Gate valve, in each pump's suction and discharge piping[**and in inlet and outlet headers**].

Check Valves 2 inch and Smaller: [**Silent**] [**or**] [**swing**] type in each pump's discharge piping.

Check Valves 2-1/2 inch and Larger: Silent type in each pump's discharge piping.

Control Valves: Adjustable, automatic, [**pilot-operated**] [**or**] [**direct-acting**], pressure-reducing type in each pump's discharge piping.

Retain "Control Valves" subparagraph and one of two "Check Valves" subparagraphs above or delete all three and retain "Control Valves" subparagraph below.

Control Valves: Combination adjustable, automatic, [**pilot-operated**] [**or**] [**direct-acting**] pressure-reducing-and-check type in each pump's discharge piping.

Thermal-Relief Valve: Temperature-and-pressure relief type in pump's discharge header piping.

* + - * 1. Dielectric Fittings: With insulating material to isolate joined dissimilar metals.
				2. Control Panel: Factory installed and connected as an integral part of booster pump; automatic for multiple-pump, constant-speed operation, with load control and protection functions.

Control Logic: [**Electromechanical system with switches, relays**] [**Solid-state system with transducers, programmable microprocessor**], and other devices in the controller.

Retain first "Motor Controller" subparagraph below for electromechanical system.

Motor Controller: NEMA ICS 2, general-purpose, Class A, full-voltage, combination-magnetic type with undervoltage release feature, motor-circuit-protector-type disconnect, and short-circuit protective device.

Some manufacturers may offer low-voltage controls. Revise "Control Voltage" subparagraph below if required.

Control Voltage: [**24**] [**120**] V ac, with integral control-power transformer.

Retain "Motor Controller" subparagraph below for solid-state system.

Motor Controller: NEMA ICS 2, solid-state, reduced-voltage type.

Some manufacturers may offer low-voltage controls. Revise "Control Voltage" subparagraph below if required.

Control Voltage: [**24**] [**120**] V ac, with integral control-power transformer.

Enclosure: NEMA 250, [**Type 1**] [**Type 3R**] [**Type 4**] [**Type 12**] <**Insert type**>.

Motor Overload Protection: Overload relay in each phase.

Starting Devices: Hand-off-automatic selector switch for each pump in cover of control panel, plus pilot device for automatic control.

Retain "Duplex, Automatic, Alternating Starter" or "Triplex, Sequence (Lead-Lag-Lag) Starter" subparagraph below.

Duplex, Automatic, Alternating Starter: Switches lead pump to lag main pump and to two-pump operation.

Triplex, Sequence (Lead-Lag-Lag) Starter: Switches lead pump to one lag main pump and to three-pump operation.

Pump operation in electromechanical systems can be current- or pressure-sensing method. Retain third option in "Pump Operation and Sequencing" subparagraph below only if requiring solid-state control.

Pump Operation and Sequencing: [**Current-**] [**or**] [**pressure-**]sensing method.

Time Delay: Controls pump on-off operation; adjustable from [**1 to 300**] <**Insert number(s)**> seconds.

Instrumentation: Suction and discharge pressure gauges.

Lights: Running light for each pump.

Alarm Signal Device: Sounds alarm when backup pumps are operating.

Time Delay: Controls alarm operation; adjustable from [**1 to 300**] <**Insert number(s)**> seconds, with [**automatic**] [**manual**] reset.

Thermal-bleed cutoff.

[**Low-suction-pressure**] [**Water-storage-tank, low-level**] cutout.

Optional features in four subparagraphs below are available. Revise to suit Project.

High-suction-pressure cutout.

Low-discharge-pressure cutout.

High-discharge-pressure cutout.

Direct Digital Control (DDC) System for HVAC: Provide auxiliary contacts for interface to [**BACnet**] [**LonWorks**] <**Insert system**> DDC system.

On-off status of each pump.

Alarm status.

* + - * 1. Base: Structural steel.

If Project has more than one constant-speed booster pump, delete "Capacities and Characteristics" paragraph below and schedule constant-speed booster pumps on Drawings. See sample schedule in the Evaluations.

* + - * 1. Capacities and Characteristics:

Minimum Pressure Rating: [**150**] [**250**] <**Insert number**> psig.

Booster-Pump Capacity: <**Insert number**> gpm.

Minimum Inlet Pressure: <**Insert number**> psig.

Maximum Inlet Pressure: <**Insert number**> psig.

Discharge Pressure: <**Insert number**> psig.

Low-Suction-Pressure Shutoff: <**Insert number**> psig.

High-Suction-Pressure Shutoff: <**Insert number**> psig.

Low-Discharge-Pressure Shutoff: <**Insert number**> psig.

High-Discharge-Pressure Shutoff: <**Insert number**> psig.

Header Size: <**Insert number**> NPS.

Lead Pump:

Capacity: <**Insert number**> gpm.

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

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

Control Valve:

Minimum Size: <**Insert number**> NPS.

Maximum Pressure Drop: <**Insert number**> psig.

Electrical Characteristics:

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

Volts: [**120**] [**240**] [**277**] [**480**] <**Insert number**> V.

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

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

Each of [**Two**] <**Insert number**> Lag Pumps:

Capacity: <**Insert number**> gpm.

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

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

Control Valve:

Minimum Size: <**Insert number**> NPS.

Maximum Pressure Drop: <**Insert number**> psig.

Electrical Characteristics:

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

Volts: [**120**] [**240**] [**277**] [**480**] <**Insert number**> V.

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

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

Booster-Pump Electrical Characteristics:

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

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

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

* + - 1. SIMPLEX, VARIABLE-SPEED BOOSTER PUMPS

Booster pumps and components in this article are for NPS 3 (DN 80) and smaller piping.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=3689) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Advanced Mechanical Technologies](http://www.specagent.com/Lookup?uid=123457131205).

[Canariis Corporation](http://www.specagent.com/Lookup?uid=123457131203).

[Delta P Carver](http://www.specagent.com/Lookup?uid=123457131204).

[Grundfos Pumps Corporation U.S.A](http://www.specagent.com/Lookup?uid=123457131198).

[Hydronic Modules Company](http://www.specagent.com/Lookup?uid=123457131199).

[ITT Flowtronex](http://www.specagent.com/Lookup?uid=123457131200).

[QuantumFlo, Inc](http://www.specagent.com/Lookup?uid=123457140997).

[TIGERFLOW Systems, Inc](http://www.specagent.com/Lookup?uid=123457131201).

Or equal.

* + - * 1. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pump, piping, valves, specialties, and controls, and mounted on base.
				2. Pump:

Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, close-coupled, single-stage, overhung-impeller, centrifugal pump.

Casing: Radially split; [**bronze**] [**cast iron**] [**stainless steel**].

Impeller: Closed, [**ASTM B584 cast bronze**] [**stainless steel**] <**Insert material**>; statically and dynamically balanced and keyed to shaft.

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

Seal: Mechanical.

Orientation: Mounted [**horizontally**] [**or**] [**vertically**].

* + - * 1. Motor: Single speed, with [**grease-lubricated**] [**or**] [**pre-greased, permanently shielded**], ball-bearings, and directly mounted to pump casing. Select motor that will not overload through full range of pump performance curve.
				2. Piping: [**Copper tube and copper fittings**] [**Stainless-steel pipe and fittings**] [**Stainless-steel pipe and fitting headers and copper tube and copper fittings between headers and pump**] [**Galvanized-steel pipe and cast-iron fittings**].
				3. Valves:

Shutoff Valves 2 inch and Smaller: [**Gate valve**] [**or**] [**two-piece, full-port ball valve**], in pump suction and discharge piping.

Shutoff Valves 2-1/2 inch and Larger: Gate valve in pump suction and discharge piping.

Check Valve 2 inch and Smaller: [**Silent**] [**or**] [**swing**] type in pump discharge piping.

Check Valve 2-1/2 inch and Larger: Silent type in pump discharge piping.

Thermal-Relief Valve: Temperature-and-pressure relief type in pump discharge piping.

* + - * 1. Dielectric Fittings: With insulating material to isolate joined dissimilar metals.
				2. Hydropneumatic Tank: Precharged [**, ASME-construction,**] diaphragm or bladder tank made of materials complying with NSF 61 and NSF 372.

Retain one of two "VFC" paragraphs below. First paragraph coordinates with electrical VFC specification. Second paragraph describes basic features of VFCs and can be used when VFC is not in a schedule on Drawings or is different from that specified in VFC specification. Coordinate either option with electrical engineer and manufacturers.

* + - * 1. VFC: Serving each pump in pump array.

Manufactured Units: Pulse-width modulated; [**constant torque**] [**and**] [**variable torque**] <**Insert application**> for [**Design A and Design B**] [**inverter-duty**] motors.

Output Rating: Three phase; 10 to [**60 Hz, with voltage proportional to frequency throughout voltage range**] [**66 Hz, with torque constant as speed changes**]; maximum voltage equals input voltage.

Unit Operating Requirements:

Internal Adjustability:

Minimum Speed: 5 to 25 percent of maximum rpm.

Maximum Speed: 80 to 100 percent of maximum rpm.

Acceleration: [**0.1 to 999.9**] <**Insert range**> seconds.

Deceleration: [**0.1 to 999.9**] <**Insert range**> seconds.

Current Limit: 30 to minimum of 150 percent of maximum rating.

Self-Protection and Reliability Features:

Surge suppression.

Loss of input signal protection.

Under- and overvoltage trips.

VFC and motor overload/overtemperature protection.

Critical frequency rejection.

Loss-of-phase protection.

Reverse-phase protection.

Motor-overtemperature fault.

Bidirectional autospeed search.

Torque boost.

Motor temperature compensation at slow speeds.

Panel-mounted operator station.

Historical logging information and displays.

Digital indicating devices.

Control Signal Interface: Electric.

PID control interface.

DDC System for HVAC Protocols for Network Communications: [**ASHRAE 135**] <**Insert protocol type**>.

Line Conditioning:

Input line conditioning.

Output filtering.

EMI/RFI filtering.

Bypass is not available from all manufacturers; consult manufacturers.

Bypass Systems:

Bypass Mode: [**Manual operation only**] [**Field-selectable automatic or manual**].

Retain one of two "Bypass Controller" subparagraphs below. Bypass is not available from all manufacturers; consult manufacturers.

Bypass Controller: Two-contactor style, with bypass and output isolating contactors[**and isolating switch**].

Bypass Controller: Three-contactor style, with bypass and input and output isolating contactors[**and isolating switch**].

Bypass Contactor Configuration: [**Full-voltage (across the line)**] [**Reduced-voltage (autotransformer)**] <**Insert type**> type.

Instrumentation: Suction and discharge pressure gauges.

Light: Running light for pump.

Thermal-bleed cutoff.

[**Low-suction-pressure**] [**Water-storage-tank, low-level**] cutout.

Optional features in four subparagraphs below are available. Revise to suit Project.

High-suction-pressure cutout.

Low-discharge-pressure cutout.

High-discharge-pressure cutout.

Direct Digital Control (DDC) System for HVAC: Provide auxiliary contacts for interface to [**BACnet**] [**LonWorks**] <**Insert system**> DDC system.

On-off status of each pump.

Alarm status.

* + - * 1. Base: Structural steel.

If Project has more than one variable-speed booster pump, delete "Capacities and Characteristics" paragraph below and schedule variable-speed booster pumps on Drawings. See sample schedule in the Evaluations.

* + - * 1. Capacities and Characteristics:

Minimum Pressure Rating: [**125**] [**150**] <**Insert number**> psig.

Booster-Pump Capacity: <**Insert number**> gpm.

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

Speed: <**Insert rpm**>.

Minimum Inlet Pressure: <**Insert number**> psig.

Maximum Inlet Pressure: <**Insert number**> psig.

Discharge Pressure: <**Insert number**> psig.

Low-Suction-Pressure Shutoff: <**Insert number**> psig.

High-Suction-Pressure Shutoff: <**Insert number**> psig.

Low-Discharge-Pressure Shutoff: <**Insert number**> psig.

High-Discharge-Pressure Shutoff: <**Insert number**> psig.

Inlet Size: <**Insert number**> NPS.

Outlet Size: <**Insert number**> NPS.

Electrical Characteristics:

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

Volts: [**120**] [**240**] [**277**] [**480**] <**Insert number**> V.

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

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

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

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

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

Hydropneumatic Tank:

Minimum Water Volume Capacity: <**Insert number**> gal..

Pressure Rating: [**125**] [**150**] [**250**] <**Insert number**> psig.

Air Precharge: <**Insert number**> psig.

* + - 1. MULTIPLEX, VARIABLE-SPEED BOOSTER PUMPS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=3690) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Advanced Mechanical Technologies](http://www.specagent.com/Lookup?uid=123457131196).

[Armstrong Pumps, Inc](http://www.specagent.com/Lookup?uid=123457131185).

[Bell & Gossett; a Xylem brand](http://www.specagent.com/Lookup?uid=123457131193).

[Canariis Corporation](http://www.specagent.com/Lookup?uid=123457131186).

[Delta P Carver](http://www.specagent.com/Lookup?uid=123457131187).

[Flo Fab Inc](http://www.specagent.com/Lookup?uid=123457131197).

[Goulds Water Technology; a Xylem brand](http://www.specagent.com/Lookup?uid=123457131194).

[Grundfos Pumps Corporation U.S.A](http://www.specagent.com/Lookup?uid=123457131189).

[ITT Flowtronex](http://www.specagent.com/Lookup?uid=123457131188).

[Patterson Pump Company; a Gorman-Rupp company](http://www.specagent.com/Lookup?uid=123457131195).

[QuantumFlo, Inc](http://www.specagent.com/Lookup?uid=123457140996).

[SyncroFlo, Inc](http://www.specagent.com/Lookup?uid=123457131191).

Or equal.

* + - * 1. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pumps, piping, valves, specialties, and controls, and mounted on base.

Retain one of five "Pumps" paragraphs below; first paragraph describes a common type.

* + - * 1. Pumps:

Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, close-coupled, single-stage, overhung-impeller, centrifugal pump.

Casing: Radially split; [**bronze**] [**cast iron**] [**stainless steel**].

Impeller: Closed, [**ASTM B584 cast bronze**] [**stainless steel**] <**Insert material**>; statically and dynamically balanced and keyed to shaft.

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

Seal: Mechanical.

Orientation: Mounted [**horizontally**] [**or**] [**vertically**].

* + - * 1. Pumps:

Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, frame-mounted, separately coupled, single-stage, overhung-impeller, centrifugal pump.[**Include back-pullout design.**]

Casing: Radially split; [**bronze**] [**cast iron**] [**stainless steel**].

Impeller: Closed, [**ASTM B584 cast bronze**] [**stainless steel**] <**Insert material**>; statically and dynamically balanced and keyed to shaft.

Shaft and Shaft Sleeve: Stainless-steel[**or steel**] shaft, with copper-alloy shaft sleeve and deflector.

Seal: Mechanical.

Bearing: [**Grease-lubricated**] [**or**] [**pre-greased, permanently shielded**] ball type.

Coupling: Flexible, with metal guard.

* + - * 1. Pumps:

Type: In line, single stage as defined in HI 1.1-1.2 and HI 1.3 for in-line, single-stage, close-coupled, overhung-impeller, centrifugal pump.

Casing: Radially split; [**bronze**] [**cast iron**] [**stainless steel**].

Impeller: Closed, [**ASTM B584 cast bronze**] [**stainless steel**] <**Insert material**>; statically and dynamically balanced and keyed to shaft.

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

Seal: Mechanical.

Bearing: [**Grease-lubricated**] [**or**] [**pre-greased, permanently shielded**] ball type.

* + - * 1. Pumps:

Type: Vertical, multistage as defined in HI 1.1-1.2 and HI 1.3 for in-line, multistage, separately coupled, overhung-impeller, centrifugal pump.

Casing: Cast-iron or steel base and stainless-steel chamber.

Impeller: Closed, stainless steel; statically and dynamically balanced and keyed to shaft.

Shaft: Stainless steel.

Seal: Mechanical.

Bearing: Water-lubricated sleeve type.

* + - * 1. Pumps:

Type: Vertical, can, as defined in HI 2.1-2.2 and HI 2.3 for in-line, barrel or can, lineshaft, vertical pump.

Impeller: Closed, stainless steel; statically and dynamically balanced and keyed to shaft.

Bowls: [**Epoxy-coated cast iron**] [**Cast iron**] <**Insert material**>.

Shaft: Stainless steel.

Seals: Mechanical and stuffing-box types.

Bearings: Water-lubricated bushing type.

* + - * 1. Motors: Single speed, with [**grease-lubricated**] [**or**] [**pre-greased, permanently shielded**], ball-bearings. Select motors that will not overload through full range of pump performance curve.
				2. Piping: [**Copper tube and copper fittings**] [**Stainless-steel pipe and fittings**] [**Stainless-steel pipe and fitting headers and copper tube and copper fittings between headers and pump**] [**Galvanized-steel pipe and cast-iron fittings**].
				3. Valves:

Shutoff Valves 2 inch and Smaller: [**Gate valve**] [**or**] [**two-piece, full-port ball valve**], in each pump's suction and discharge piping.

Shutoff Valves 2-1/2 inch and Larger: Gate valve in each pump's suction and discharge piping[**and in inlet and outlet headers**].

Check Valves 2 inch and Smaller: [**Silent**] [**or**] [**swing**] type in each pump's discharge piping.

Check Valves 2-1/2 inch and Larger: Silent type in each pump's discharge piping.

Thermal-Relief Valve: Temperature-and-pressure relief type in pump's discharge header piping.

* + - * 1. Dielectric Fittings: With insulating material to isolate joined dissimilar metals.

Retain one of two "VFC" paragraphs below. First paragraph coordinates with electrical VFC specification. Second paragraph describes basic features of VFC and can be used when VFC is not in a schedule on Drawings or is different from that specified in VFC specification. Coordinate either option with electrical engineer and manufacturers.

* + - * 1. VFC: Serving each pump in pump array.

Manufactured Units: Pulse-width modulated; [**constant torque**] [**and**] [**variable torque**] <**Insert application**> for [**Design A and Design B**] [**inverter-duty**] motors.

Output Rating: Three phase; 10 to [**60 Hz, with voltage proportional to frequency throughout voltage range**] [**66 Hz, with torque constant as speed changes**]; maximum voltage equals input voltage.

Unit Operating Requirements:

Internal Adjustability:

Minimum Speed: 5 to 25 percent of maximum rpm.

Maximum Speed: 80 to 100 percent of maximum rpm.

Acceleration: [**0.1 to 999.9**] <**Insert range**> seconds.

Deceleration: [**0.1 to 999.9**] <**Insert range**> seconds.

Current Limit: 30 to minimum of 150 percent of maximum rating.

Self-Protection and Reliability Features:

Surge suppression.

Loss of input signal protection.

Under- and overvoltage trips.

VFC and motor overload/overtemperature protection.

Critical frequency rejection.

Loss-of-phase protection.

Reverse-phase protection.

Motor-overtemperature fault.

Bidirectional autospeed search.

Torque boost.

Motor temperature compensation at slow speeds.

Panel-mounted operator station.

Historical logging information and displays.

Digital indicating devices.

Control Signal Interface: Electric.

Proportional Integral Derivative (PID) control interface.

DDC System for HVAC Protocols for Network Communications: [**ASHRAE 135**] <**Insert protocol type**>.

Line Conditioning:

Input line conditioning.

Output filtering.

EMI/RFI filtering.

Bypass is not available from all manufacturers; consult manufacturers.

Bypass Systems:

Bypass Mode: [**Manual operation only**] [**Field-selectable automatic or manual**].

Retain one of two "Bypass Controller" subparagraphs below. Bypass is not available from all manufacturers; consult manufacturers.

Bypass Controller: Two-contactor style, with bypass and output isolating contactors[**and isolating switch**].

Bypass Controller: Three-contactor style, with bypass and input and output isolating contactors[**and isolating switch**].

Bypass Contactor Configuration: [**Full-voltage (across the line)**] [**Reduced-voltage (autotransformer)**] <**Insert type**> type.

Instrumentation: Suction and discharge pressure gauges.

Lights: Running light for each pump.

Alarm Signal Device: Sounds alarm when backup pumps are operating.

Time Delay: Controls alarm operation; adjustable from [**1 to 300**] <**Insert number(s)**> seconds, with [**automatic**] [**manual**] reset.

Thermal-bleed cutoff.

[**Low-suction-pressure**] [**Water-storage-tank, low-level**] cutout.

Optional features in four subparagraphs below are available. Revise to suit Project.

High-suction-pressure cutout.

Low-discharge-pressure cutout.

High-discharge-pressure cutout.

Direct Digital Control (DDC) System for HVAC: Provide auxiliary contacts for interface to [**BACnet**] [**LonWorks**] <**Insert system**> DDC system.

On-off status of each pump.

Alarm status.

* + - * 1. Base: Structural steel.

If Project has more than one variable-speed booster pump, delete "Capacities and Characteristics" paragraph below and schedule variable-speed booster pumps on Drawings. See sample schedule in the Evaluations.

* + - * 1. Capacities and Characteristics:

Minimum Pressure Rating: [**150**] [**250**] <**Insert number**> psig.

Booster-Pump Capacity: <**Insert number**> gpm.

Minimum Inlet Pressure: <**Insert number**> psig.

Maximum Inlet Pressure: <**Insert number**> psig.

Discharge Pressure: <**Insert number**> psig.

Low-Suction-Pressure Shutoff: <**Insert number**> psig.

High-Suction-Pressure Shutoff: <**Insert number**> psig.

Low-Discharge-Pressure Shutoff: <**Insert number**> psig.

High-Discharge-Pressure Shutoff: <**Insert number**> psig.

Header Size: <**Insert number**> NPS.

Lead Pump:

Capacity: <**Insert number**> gpm.

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

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

Electrical Characteristics:

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

Volts: [**120**] [**240**] [**277**] [**480**] <**Insert number**> V.

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

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

Each of [**Two**] <**Insert number**> Lag Pumps:

Capacity: <**Insert number**> gpm.

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

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

Electrical Characteristics:

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

Volts: [**120**] [**240**] [**277**] [**480**] <**Insert number**> V.

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

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

Booster-Pump Electrical Characteristics:

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

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

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

* + - 1. MOTORS
				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.

Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in NFPA 70.

* + - 1. SOURCE QUALITY CONTROL
				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. ASME Compliance: Comply with ASME B31.9 for piping.
				3. UL Compliance for Packaged Pumping Systems:

UL 508, "Industrial Control Equipment."

UL 508A, "Industrial Control Panels."

UL 778, "Motor-Operated Water Pumps."

UL 1995, "Heating and Cooling Equipment."

Retain paragraph below if required. Verify availability of pumping systems selected.

* + - * 1. Booster pumps shall be listed and labeled as packaged pumping systems by testing agency acceptable to authorities having jurisdiction.
1. EXECUTION
	* + 1. EXAMINATION
				1. Examine roughing-in for booster pumps to verify actual locations of piping connections before booster-pump installation.
			2. INSTALLATION
				1. Booster-Pump Mounting:

Retain first subparagraph below to require equipment to be installed on cast-in-place concrete equipment bases.

Install booster pumps on cast-in-place concrete equipment base(s).

* + - * 1. Support connected domestic-water piping so weight of piping is not supported by booster pumps.
			1. PIPING CONNECTIONS

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

* + - * 1. Booster-Pump Piping Connections: Connect domestic-water piping to booster pumps. Install suction and discharge pipe equal to or greater than size of system suction and discharge [**headers**] [**piping**].

Install shutoff valves on piping connections to booster-pump suction and discharge [**headers**] [**piping**]. Install ball, butterfly, or gate valves same size as suction and discharge [**headers**] [**piping**].

Install union, flanged, or grooved-joint connections on suction and discharge [**headers**] [**piping**] at connection to domestic-water piping.

Install valved bypass, same size as and between piping, at connections to booster-pump suction and discharge [**headers**] [**piping**].

Install flexible connectors, same size as piping, on piping connections to booster-pump suction and discharge [**headers**] [**piping**].

Where installing piping adjacent to booster pumps, allow space for service and maintenance.

* + - 1. ELECTRICAL CONNECTIONS
				1. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
			2. CONTROL CONNECTIONS
				1. Install control and electrical power wiring to field-mounted control devices.
			3. IDENTIFICATION
				1. Identify system components.
				2. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

* + - 1. FIELD QUALITY CONTROL

Retain one of first four paragraphs below. Retain first "Testing Agency" paragraph below if Owner will hire an independent testing agency.

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 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 factory-authorized service agent.

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

Perform visual and mechanical inspection.

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

Operational Test: After electrical circuitry has been energized, start booster pumps to confirm proper motor rotation and booster-pump operation.

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

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

* + - * 1. Pumps and controls will be considered defective if they do 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.

<**Insert startup steps if any**>.

* + - 1. ADJUSTING
				1. Adjust booster pumps to function smoothly and lubricate as recommended by manufacturer.
				2. Adjust pressure set points.
				3. Occupancy Adjustments: When requested within [**12**] <**Insert number**> months of date of Substantial Completion, provide on-site assistance in adjusting booster pump 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 014216 to train ’Facility’s maintenance personnel to adjust, operate, and maintain booster pumps.

END OF SECTION 221123.13