SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

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:

Bimetallic-actuated thermometers.

Filled-system thermometers.

Liquid-in-glass thermometers.

Light-activated thermometers.

Thermowells.

Dial-type pressure gages.

Gage attachments.

Test plugs.

Test-plug kits.

Sight flow indicators.

* + - * 1. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

* + - 1. Section 221113 "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
			2. Section 221119 "Domestic Water Piping Specialties" for water meters.
			3. Section 221513 "General-Service Compressed-Air Piping" for compressed air gages.
			4. 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).

Retain "Product Certificates" paragraph below to require submittal of product certificates from manufacturers.

* + - * 1. Product Certificates: For each type of meter and gage.
				2. Product Data: For each type of product.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.
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. BIMETALLIC-ACTUATED THERMOMETERS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=1681) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Ashcroft Inc](http://www.specagent.com/Lookup?uid=123457058244).

[Ernst Flow Industries](http://www.specagent.com/Lookup?uid=123457058245).

[Marsh Bellofram](http://www.specagent.com/Lookup?uid=123457058246).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058247).

[Nanmac Corporation](http://www.specagent.com/Lookup?uid=123457058248).

[Noshok](http://www.specagent.com/Lookup?uid=123457058253).

[Palmer Wahl Instrumentation Group](http://www.specagent.com/Lookup?uid=123457058254).

[REOTEMP Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058250).

[Tel-Tru Manufacturing Company](http://www.specagent.com/Lookup?uid=123457058255).

[Trerice, H. O. Co](http://www.specagent.com/Lookup?uid=123457058256).

[WATTS](http://www.specagent.com/Lookup?uid=123457058257).

[Weiss Instruments, Inc](http://www.specagent.com/Lookup?uid=123457058249).

Approved equivalent.

* + - * 1. Standard: ASME B40.200.

Case in first paragraph below will typically be the sealed (dry) type. Hermetically sealed cases are available.

* + - * 1. Case: [**Liquid-filled**] [**and**] [**sealed**] type(s); stainless steel with [**3 inch**] [**5 inch**] <**Insert dimension**> nominal diameter.
				2. Dial: [**Nonreflective aluminum**] <**Insert material**> with permanently etched scale markings and scales in [**deg F**].
				3. Connector Type(s): Union joint, [**adjustable angle**] [**rigid, back**] [**and**] [**rigid, bottom**] <**Insert type**>, with unified-inch screw threads.
				4. Connector Size: [**1/2 inch**] <**Insert dimension**>, with ASME B1.1 screw threads.
				5. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
				6. Window: [**Plain glass**] [**or**] [**plastic**] <**Insert material**>.
				7. Ring: Stainless steel.
				8. Element: Bimetal coil.
				9. Pointer: Dark-colored metal.
				10. Accuracy: Plus or minus [**1**] [**1.5**] <**Insert number**> percent of scale range.
			1. FILLED-SYSTEM THERMOMETERS
				1. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1682) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Ashcroft Inc](http://www.specagent.com/Lookup?uid=123457058262).

[Marsh Bellofram](http://www.specagent.com/Lookup?uid=123457058263).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058264).

[Palmer Wahl Instrumentation Group](http://www.specagent.com/Lookup?uid=123457058261).

[REOTEMP Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058265).

[Trerice, H. O. Co](http://www.specagent.com/Lookup?uid=123457058266).

[Weiss Instruments, Inc](http://www.specagent.com/Lookup?uid=123457058267).

Approved equivalent.

Standard: ASME B40.200.

Case: Sealed type, [**cast aluminum or drawn steel**] <**Insert material**>; [**4-1/2 inch**] [**5 inch**] [**6 inch**] <**Insert dimension**> nominal diameter.

Element: Bourdon tube or other type of pressure element.

Movement: Mechanical,[**dampening type,**] with link to pressure element and connection to pointer.

Dial: Nonreflective aluminum with permanently etched scale markings graduated in [**deg F**] [**deg F and deg C**].

Pointer: Dark-colored metal.

Window: [**Glass**] [**or**] [**plastic**] <**Insert material**>.

Ring: [**Metal**] [**Stainless steel**] <**Insert material**>.

Connector Type(s): Union joint, [**adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device**] [**rigid, back**] [**and**] [**rigid, bottom**]; with ASME B1.1 screw threads.

Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

Design for Thermowell Installation: Bare stem.

Accuracy: Plus or minus [**1**] <**Insert number**> percent of scale range.

* + - * 1. Direct-Mounted, Plastic-Case, Vapor-Actuated Thermometers:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1683) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Ashcroft Inc](http://www.specagent.com/Lookup?uid=123457058269).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058270).

[REOTEMP Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058268).

Approved equivalent.

Standard: ASME B40.200.

Case: Sealed type, [**plastic**] <**Insert material**>; [**4-1/2 inch**] [**5 inch**] [**6 inch**] <**Insert dimension**> nominal diameter.

Element: Bourdon tube or other type of pressure element.

Movement: Mechanical, with link to pressure element and connection to pointer.

Dial: Nonreflective aluminum with permanently etched scale markings graduated in [**deg F**] [**deg F and deg C**].

Pointer: Dark-colored metal.

Window: [**Glass**] [**or**] [**plastic**] <**Insert material**>.

Ring: [**Metal**] [**or**] [**plastic**] <**Insert material**>.

Connector Type(s): Union joint, [**adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device**] [**rigid, back**] [**and**] [**rigid, bottom**]; with ASME B1.1 screw threads.

Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

Design for Thermowell Installation: Bare stem.

Accuracy: Plus or minus [**1**] <**Insert number**> percent of scale range.

* + - * 1. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1685) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AMETEK, Inc](http://www.specagent.com/Lookup?uid=123457058279).

[Ashcroft Inc](http://www.specagent.com/Lookup?uid=123457058275).

[Marsh Bellofram](http://www.specagent.com/Lookup?uid=123457058271).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058276).

[Palmer Wahl Instrumentation Group](http://www.specagent.com/Lookup?uid=123457058272).

[REOTEMP Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058273).

[Trerice, H. O. Co](http://www.specagent.com/Lookup?uid=123457058277).

[Weiss Instruments, Inc](http://www.specagent.com/Lookup?uid=123457058274).

[WIKA Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058278).

Approved equivalent.

Standard: ASME B40.200.

Case: Sealed type, [**cast aluminum or drawn steel**] <**Insert material**>; [**4-1/2 inch**] [**6 inch**] <**Insert dimension**> nominal diameter with [**back**] [**front**] flange and holes for panel mounting.

Element: Bourdon tube or other type of pressure element.

Movement: Mechanical, with link to pressure element and connection to pointer.

Dial: Nonreflective aluminum with permanently etched scale markings graduated in [**deg F**] [**deg F and deg C**].

Pointer: Dark-colored metal.

Window: [**Glass**] [**or**] [**plastic**] <**Insert material**>.

Ring: [**Metal**] [**Stainless steel**] <**Insert material**>.

Connector Type(s): Union joint, [**back**] [**bottom**]; with ASME B1.1 screw threads.

Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

Design for Thermowell Installation: Bare stem.

Accuracy: Plus or minus [**1**] <**Insert number**> percent of scale range.

* + - * 1. Remote-Mounted, Plastic-Case, Vapor-Actuated Thermometers:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1686) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[AMETEK, Inc](http://www.specagent.com/Lookup?uid=123457058284).

[Ashcroft Inc](http://www.specagent.com/Lookup?uid=123457058280).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058281).

[REOTEMP Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058282).

[Trerice, H. O. Co](http://www.specagent.com/Lookup?uid=123457058283).

Approved equivalent.

Standard: ASME B40.200.

Case: Sealed type, [**plastic**] <**Insert material**>; [**4-1/2 inch**] [**6 inch**] <**Insert dimension**> nominal diameter with [**back**] [**front**] flange and holes for panel mounting.

Element: Bourdon tube or other type of pressure element.

Movement: Mechanical, with link to pressure element and connection to pointer.

Dial: Nonreflective aluminum with permanently etched scale markings graduated in [**deg F**] [**deg F and deg C**].

Pointer: Dark-colored metal.

Window: [**Glass**] [**or**] [**plastic**] <**Insert material**>.

Ring: [**Metal**] [**or**] [**plastic**] <**Insert material**>.

Connector Type(s): Union joint, threaded, [**back**] [**bottom**]; with ASME B1.1 screw threads.

Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

Design for Thermowell Installation: Bare stem.

Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

* + - 1. LIQUID-IN-GLASS THERMOMETERS
				1. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1688) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Trerice, H. O. Co](http://www.specagent.com/Lookup?uid=123457058285).

Approved equivalent.

Standard: ASME B40.200.

Case: [**Cast aluminum**] <**Insert material**>; 6 inch nominal size.

Case Form: [**Back angle**] [**Straight**] unless otherwise indicated.

Tube: Glass with magnifying lens and blue[**or red**] organic liquid.

Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in [**deg F**] [**deg F and deg C**].

Window: Glass or plastic.

Stem: Aluminum or brass and of length to suit installation.

Design for Thermowell Installation: Bare stem.

Connector: 3/4 inch, with ASME B1.1 screw threads.

Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

* + - * 1. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1689) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Flo Fab Inc](http://www.specagent.com/Lookup?uid=123457058286).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058287).

[Tel-Tru Manufacturing Company](http://www.specagent.com/Lookup?uid=123457058288).

[WATTS](http://www.specagent.com/Lookup?uid=123457058291).

[Weiss Instruments, Inc](http://www.specagent.com/Lookup?uid=123457058289).

[Weksler Glass Thermometer Corp](http://www.specagent.com/Lookup?uid=123457058292).

[WIKA Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058290).

Approved equivalent.

Standard: ASME B40.200.

Case: [**Plastic**] <**Insert material**>; 6 inch nominal size.

Case Form: [**Back angle**] [**Straight**] unless otherwise indicated.

Tube: Glass with magnifying lens and blue[**or red**] organic liquid.

Tube Background: Nonreflective with permanently etched scale markings graduated in [**deg F**] [**deg F and deg C**].

Window: Glass or plastic.

Stem: Aluminum or brass and of length to suit installation.

Design for Thermowell Installation: Bare stem.

Connector: 3/4 inch, with ASME B1.1 screw threads.

Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

* + - * 1. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1690) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Flo Fab Inc](http://www.specagent.com/Lookup?uid=123457058297).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058293).

[Palmer Wahl Instrumentation Group](http://www.specagent.com/Lookup?uid=123457058294).

[Tel-Tru Manufacturing Company](http://www.specagent.com/Lookup?uid=123457058295).

[Trerice, H. O. Co](http://www.specagent.com/Lookup?uid=123457058299).

[Weiss Instruments, Inc](http://www.specagent.com/Lookup?uid=123457058298).

[Weksler Glass Thermometer Corp](http://www.specagent.com/Lookup?uid=123457058301).

[Winters Instruments - U.S](http://www.specagent.com/Lookup?uid=123457058296).

Approved equivalent.

Standard: ASME B40.200.

Case: [**Cast aluminum**] <**Insert material**>; [**7 inch**] [**9 inch**] nominal size unless otherwise indicated.

Case Form: [**Adjustable angle**] [**Back angle**] [**Straight**] <**Insert form**> unless otherwise indicated.

Tube: Glass with magnifying lens and blue[**or red**] organic liquid.

Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in [**deg F**] [**deg F and deg C**].

Window: [**Glass**] [**or**] [**plastic**] <**Insert material**>.

Stem: [**Aluminum**] <**Insert material**> and of length to suit installation.

Design for Thermowell Installation: Bare stem.

Connector: 1-1/4 inches, with ASME B1.1 screw threads.

Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

* + - * 1. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1691) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Ernst Flow Industries](http://www.specagent.com/Lookup?uid=123457058302).

[Marsh Bellofram](http://www.specagent.com/Lookup?uid=123457058303).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058308).

[Palmer Wahl Instrumentation Group](http://www.specagent.com/Lookup?uid=123457058304).

[REOTEMP Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058305).

[WATTS](http://www.specagent.com/Lookup?uid=123457058309).

[Weiss Instruments, Inc](http://www.specagent.com/Lookup?uid=123457058306).

[Weksler Glass Thermometer Corp](http://www.specagent.com/Lookup?uid=123457058311).

[WIKA Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058307).

Approved equivalent.

Standard: ASME B40.200.

Case: [**Plastic**] <**Insert material**>; [**7 inch**] [**9 inch**] nominal size unless otherwise indicated.

Case Form: [**Adjustable angle**] [**Back angle**] [**Straight**] <**Insert form**> unless otherwise indicated.

Tube: Glass with magnifying lens and blue[**or red**] organic liquid.

Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in [**deg F**] [**deg F and deg C**].

Window: [**Glass**] [**or**] [**plastic**] <**Insert material**>.

Stem: [**Aluminum**] [**Brass**] [**Stainless steel**] [**Aluminum, brass, or stainless steel**] <**Insert material**> and of length to suit installation.

Design for Thermowell Installation: Bare stem.

Connector: 1-1/4 inches, with ASME B1.1 screw threads.

Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

* + - 1. LIGHT-ACTIVATED THERMOMETERS

Thermometers in this article are not included in ASME B40.200. All manufacturers' products are not the same but are installed the same and are used for the same applications.

* + - * 1. Direct-Mounted, Light-Activated Thermometers:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1692) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Flo Fab Inc](http://www.specagent.com/Lookup?uid=123457058312).

[REOTEMP Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058313).

[Trerice, H. O. Co](http://www.specagent.com/Lookup?uid=123457058314).

[Weiss Instruments, Inc](http://www.specagent.com/Lookup?uid=123457058315).

[Weksler Glass Thermometer Corp](http://www.specagent.com/Lookup?uid=123457058318).

[WIKA Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058316).

[Winters Instruments - U.S](http://www.specagent.com/Lookup?uid=123457058317).

Approved equivalent.

Case: [**Plastic**] [**Metal**] <**Insert material**>; [**7 inch**] [**9 inch**] nominal size unless otherwise indicated.

Scale(s): [**Deg F**] [**Deg F and deg C**].

Case Form: [**Adjustable angle**] <**Insert form**>.

Connector: [**1-1/4 inches**] <**Insert dimension**>, with ASME B1.1 screw threads.

Stem: [**Aluminum**] <**Insert material**> and of length to suit installation.

Design for Thermowell Installation: Bare stem.

Display: Digital.

Accuracy: Plus or minus 2 deg F.

* + - * 1. Remote-Mounted, Light-Activated Thermometers:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1694) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058319).

[Weiss Instruments, Inc](http://www.specagent.com/Lookup?uid=123457058320).

[Winters Instruments - U.S](http://www.specagent.com/Lookup?uid=123457058321).

Approved equivalent.

Case: Plastic, for wall mounting.

Scale(s): [**Deg F**] [**Deg F and deg C**].

Sensor: Bulb and thermister wire.

Design for Thermowell Installation: Bare stem.

Display: Digital.

Accuracy: Plus or minus 2 deg F.

* + - 1. THERMOWELLS

ASME B40.200 uses the following symbols for thermowell materials: "CNR" for copper nickel (90-10), "CUNI" for copper nickel (70-30), "CRES" for corrosion-resistant steel, "NICU" for nickel copper, "ALBR" for aluminum bronze, and "CSA" for steel. Other materials are allowed.

* + - * 1. Thermowells:

Standard: ASME B40.200.

Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.

Material for Use with Copper Tubing: [**CNR**] [**or**] [**CUNI**] <**Insert material**>.

Material for Use with Steel Piping: [**CRES**] [**CSA**] <**Insert material**>.

Type: Stepped shank unless straight or tapered shank is indicated.

External Threads: 1/2, 3/4, and 1 inch, ASME B1.20.1 pipe threads.

Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.

Bore: Diameter required to match thermometer bulb or stem.

Insertion Length: Length required to match thermometer bulb or stem.

Lagging Extension: Include on thermowells for insulated piping and tubing.

Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

* + - * 1. Heat-Transfer Medium: [**Mixture of graphite and glycerin**] <**Insert material**>.
			1. PRESSURE GAGES
				1. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1695) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Ametek U.S. Gauge](http://www.specagent.com/Lookup?uid=123457058426).

[Ashcroft Inc](http://www.specagent.com/Lookup?uid=123457058322).

[Ernst Flow Industries](http://www.specagent.com/Lookup?uid=123457058323).

[Flo Fab Inc](http://www.specagent.com/Lookup?uid=123457058327).

[Marsh Bellofram](http://www.specagent.com/Lookup?uid=123457058328).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058329).

[Noshok](http://www.specagent.com/Lookup?uid=123457058330).

[Palmer Wahl Instrumentation Group](http://www.specagent.com/Lookup?uid=123457058331).

[REOTEMP Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058332).

[Tel-Tru Manufacturing Company](http://www.specagent.com/Lookup?uid=123457058333).

[Trerice, H. O. Co](http://www.specagent.com/Lookup?uid=123457058334).

[WATTS](http://www.specagent.com/Lookup?uid=123457058336).

Approved equivalent.

Standard: ASME B40.100.

Case: [**Liquid-filled**] [**Sealed**] [**Open-front, pressure relief**] [**Solid-front, pressure relief**] <**Insert type**> type(s); [**cast aluminum or drawn steel**] <**Insert material**>; [**4-1/2 inch**] [**6 inch**] <**Insert dimension**> nominal diameter.

Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

Match pressure connection size in first subparagraph below with gage attachment size.

Pressure Connection: Brass, with [**1/4 inch**] [**1/4 inch or 1/2 inch**] [**1/2 inch**], ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

Movement: Mechanical, with link to pressure element and connection to pointer.

Dial: Nonreflective aluminum with permanently etched scale markings graduated in [**psi**] [**psi and kPa**].

Pointer: Dark-colored metal.

Window: [**Glass**] [**or**] [**plastic**] <**Insert material**>.

Ring: [**Metal**] [**Brass**] [**Stainless steel**].

Accuracy: [**Grade A, plus or minus 1 percent of middle half of**] [**Grade B, plus or minus 2 percent of middle half of**] [**Grade C, plus or minus 3 percent of middle half of**] [**Grade D, plus or minus 5 percent of whole**] scale range.

* + - * 1. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1697) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Ametek U.S. Gauge](http://www.specagent.com/Lookup?uid=123457058427).

[Ashcroft Inc](http://www.specagent.com/Lookup?uid=123457058339).

[Flo Fab Inc](http://www.specagent.com/Lookup?uid=123457058340).

[Marsh Bellofram](http://www.specagent.com/Lookup?uid=123457058341).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058342).

[Noshok](http://www.specagent.com/Lookup?uid=123457058343).

[Palmer Wahl Instrumentation Group](http://www.specagent.com/Lookup?uid=123457058344).

[REOTEMP Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058345).

[Tel-Tru Manufacturing Company](http://www.specagent.com/Lookup?uid=123457058346).

[Trerice, H. O. Co](http://www.specagent.com/Lookup?uid=123457058350).

[Weiss Instruments, Inc](http://www.specagent.com/Lookup?uid=123457058347).

[Weksler Glass Thermometer Corp](http://www.specagent.com/Lookup?uid=123457058353).

Approved equivalent.

Standard: ASME B40.100.

Case: [**Sealed**] <**Insert type**> type; [**plastic**] <**Insert material**>; [**4-1/2 inch**] [**6 inch**] <**Insert dimension**> nominal diameter.

Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

Match pressure connection size in first subparagraph below with gage attachment size.

Pressure Connection: Brass, with [**1/4 inch**] [**1/4 inch or 1/2 inch**] [**1/2 inch**], ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

Movement: Mechanical, with link to pressure element and connection to pointer.

Dial: Nonreflective aluminum with permanently etched scale markings graduated in [**psi**] [**psi and kPa**].

Pointer: Dark-colored metal.

Window: [**Glass**] [**or**] [**plastic**] <**Insert material**>.

Accuracy: [**Grade A, plus or minus 1 percent of middle half of**] [**Grade B, plus or minus 2 percent of middle half of**] [**Grade C, plus or minus 3 percent of middle half of**] [**Grade D, plus or minus 5 percent of whole**] scale range.

* + - * 1. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1698) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Ametek U.S. Gauge](http://www.specagent.com/Lookup?uid=123457058428).

[Ashcroft Inc](http://www.specagent.com/Lookup?uid=123457058357).

[Ernst Flow Industries](http://www.specagent.com/Lookup?uid=123457058358).

[Flo Fab Inc](http://www.specagent.com/Lookup?uid=123457058359).

[Marsh Bellofram](http://www.specagent.com/Lookup?uid=123457058360).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058361).

[Noshok](http://www.specagent.com/Lookup?uid=123457058354).

[Palmer Wahl Instrumentation Group](http://www.specagent.com/Lookup?uid=123457058362).

[REOTEMP Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058363).

[Tel-Tru Manufacturing Company](http://www.specagent.com/Lookup?uid=123457058364).

[Trerice, H. O. Co](http://www.specagent.com/Lookup?uid=123457058366).

[WATTS](http://www.specagent.com/Lookup?uid=123457058368).

Approved equivalent.

Standard: ASME B40.100.

Case: [**Liquid-filled**] [**Sealed**] <**Insert type**> type; [**cast aluminum or drawn steel**] [**metal**] <**Insert material**>; [**4-1/2 inch**] [**6 inch**] <**Insert dimension**> nominal diameter with [**back**] [**front**] flange and holes for panel mounting.

Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

Match pressure connection size in first subparagraph below with gage attachment size.

Pressure Connection: Brass, with [**1/4 inch**] [**1/4 inch or 1/2 inch**] [**1/2 inch**], ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

Movement: Mechanical, with link to pressure element and connection to pointer.

Dial: Nonreflective aluminum with permanently etched scale markings graduated in [**psi**] [**psi and kPa**].

Pointer: Dark-colored metal.

Window: [**Glass**] [**or**] [**plastic**] <**Insert material**>.

Ring: [**Metal**] [**Stainless steel**] <**Insert material**>.

Accuracy: [**Grade A, plus or minus 1 percent of middle half of**] [**Grade B, plus or minus 2 percent of middle half of**] [**Grade C, plus or minus 3 percent of middle half of**] [**Grade D, plus or minus 5 percent of whole**] scale range.

* + - * 1. Remote-Mounted, Plastic-Case, Dial-Type Pressure Gages:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=1699) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Ametek U.S. Gauge](http://www.specagent.com/Lookup?uid=123457058429).

[Ashcroft Inc](http://www.specagent.com/Lookup?uid=123457058370).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058371).

[Noshok](http://www.specagent.com/Lookup?uid=123457058372).

[Palmer Wahl Instrumentation Group](http://www.specagent.com/Lookup?uid=123457058373).

[REOTEMP Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058374).

[Tel-Tru Manufacturing Company](http://www.specagent.com/Lookup?uid=123457058375).

[Trerice, H. O. Co](http://www.specagent.com/Lookup?uid=123457058379).

[Weiss Instruments, Inc](http://www.specagent.com/Lookup?uid=123457058378).

[WIKA Instrument Corporation](http://www.specagent.com/Lookup?uid=123457058376).

[Winters Instruments - U.S](http://www.specagent.com/Lookup?uid=123457058377).

Approved equivalent.

Standard: ASME B40.100.

Case: [**Sealed**] <**Insert type**> type; [**plastic**] <**Insert material**>; [**4-1/2 inch**] [**6 inch**] <**Insert dimension**> nominal diameter with [**back**] [**front**] flange and holes for panel mounting.

Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

Match pressure connection size in first subparagraph below with gage attachment size.

Pressure Connection: Brass, with [**1/4 inch**] [**1/4 inch or 1/2 inch**] [**1/2 inch**], ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

Movement: Mechanical, with link to pressure element and connection to pointer.

Dial: Nonreflective aluminum with permanently etched scale markings graduated in [**psi**] [**psi and kPa**].

Pointer: Dark-colored metal.

Window: [**Glass**] [**or**] [**plastic**] <**Insert material**>.

Accuracy: [**Grade A, plus or minus 1 percent of middle half of**] [**Grade B, plus or minus 2 percent of middle half of**] [**Grade C, plus or minus 3 percent of middle half of**] [**Grade D, plus or minus 5 percent of whole**] scale range.

* + - 1. GAGE ATTACHMENTS

Match attachment size in two paragraphs below with pressure-gage-connection size.

* + - * 1. Snubbers: ASME B40.100, brass; with [**1/4 inch**] [**1/4 inch or 1/2 inch**] [**1/2 inch**], ASME B1.20.1 pipe threads and [**piston**] [**porous-metal**]-type surge-dampening device. Include extension for use on insulated piping.
				2. Valves: [**Brass ball**] [**Brass or stainless-steel needle**], with [**1/4 inch**] [**1/4 inch or 1/2 inch**] [**1/2 inch**], ASME B1.20.1 pipe threads.
			1. TEST PLUGS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=1700) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[IMI Flow Design, Inc](http://www.specagent.com/Lookup?uid=123457058382).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058383).

[Nexus Valve, Inc](http://www.specagent.com/Lookup?uid=123457058390).

[Peterson Equipment Co., Inc](http://www.specagent.com/Lookup?uid=123457058385).

[Sisco Manufacturing Company, Inc](http://www.specagent.com/Lookup?uid=123457058386).

[Trerice, H. O. Co](http://www.specagent.com/Lookup?uid=123457058387).

[WATTS](http://www.specagent.com/Lookup?uid=123457058389).

[Weiss Instruments, Inc](http://www.specagent.com/Lookup?uid=123457058388).

[Weksler Glass Thermometer Corp](http://www.specagent.com/Lookup?uid=123457058391).

Approved equivalent.

* + - * 1. Description: Test-station fitting made for insertion into piping tee fitting.
				2. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
				3. Thread Size: [**1/4 inch**] [**or**] [**1/2 inch**], ASME B1.20.1 pipe thread.
				4. Minimum Pressure and Temperature Rating: [**500 psig at 200 deg F**] <**Insert ratings**>.
				5. Core Inserts: [**Chlorosulfonated polyethylene synthetic**] [**and**] [**EPDM**] self-sealing rubber.
			1. TEST-PLUG KITS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=1701) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[IMI Flow Design, Inc](http://www.specagent.com/Lookup?uid=123457058392).

[Miljoco Corporation](http://www.specagent.com/Lookup?uid=123457058393).

[Nexus Valve, Inc](http://www.specagent.com/Lookup?uid=123457058400).

[Peterson Equipment Co., Inc](http://www.specagent.com/Lookup?uid=123457058395).

[Sisco Manufacturing Company, Inc](http://www.specagent.com/Lookup?uid=123457058396).

[Trerice, H. O. Co](http://www.specagent.com/Lookup?uid=123457058397).

[WATTS](http://www.specagent.com/Lookup?uid=123457058399).

[Weiss Instruments, Inc](http://www.specagent.com/Lookup?uid=123457058398).

Approved equivalent.

* + - * 1. Furnish [**one**] <**Insert number**> test-plug kit(s) containing [**one**] [**two**] thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

Retain one of first two paragraphs below. If retaining both, indicate location of each on Drawings.

* + - * 1. Low-Range Thermometer: Small, bimetallic insertion type with [**1 inch to 2 inch-**] <**Insert dimension**> diameter dial and tapered-end sensing element. Dial range shall be at least [**25 to 125 deg F**] <**Insert temperature range**>.
				2. High-Range Thermometer: Small, bimetallic insertion type with [**1 inch to 2 inch-**] <**Insert dimension**> diameter dial and tapered-end sensing element. Dial range shall be at least [**0 to 220 deg F**] <**Insert temperature range**>.
				3. Pressure Gage: Small, Bourdon-tube insertion type with [**2 inch to 3 inch-**] <**Insert dimension**> diameter dial and probe. Dial range shall be at least [**0 to 200 psig**] <**Insert range**>.
				4. Carrying Case: Metal or plastic, with formed instrument padding.
			1. SIGHT FLOW INDICATORS

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=1702) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[ARCHON Industries, Inc](http://www.specagent.com/Lookup?uid=123457058401).

[Dwyer Instruments, Inc](http://www.specagent.com/Lookup?uid=123457058402).

[Ernst Flow Industries](http://www.specagent.com/Lookup?uid=123457058404).

[John C. Ernst Co., Inc](http://www.specagent.com/Lookup?uid=123457058403).

[KOBOLD Instruments, Inc. - USA](http://www.specagent.com/Lookup?uid=123457058407).

[OPW Engineered Systems; OPW Fluid Transfer Group; a Dover company](http://www.specagent.com/Lookup?uid=123457058408).

[Pentair Valves & Controls; Penberthy Brand](http://www.specagent.com/Lookup?uid=123457058405).

[Rosemount Inc.; Emerson Electric Company](http://www.specagent.com/Lookup?uid=123457058406).

Approved equivalent.

* + - * 1. Description: Piping inline-installation device for visual verification of flow.
				2. Construction: Bronze or stainless-steel body, with sight glass and [**ball, flapper, or paddle wheel**] <**Insert device**> indicator, and threaded or flanged ends.
				3. Minimum Pressure Rating: [**125 psig**] [**150 psig**] <**Insert value**>.
				4. Minimum Temperature Rating: [**200 deg F**] <**Insert temperature**>.
				5. End Connections for 2 inch and Smaller: Threaded.
				6. End Connections for 2-1/2 inch and Larger: Flanged.
1. EXECUTION
	* + 1. INSTALLATION
				1. Install thermowells with socket extending [**a minimum of 2 inches into fluid**] [**one-third of pipe diameter**] [**to center of pipe**] and in vertical position in piping tees.
				2. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
				3. Install thermowells with extension on insulated piping.
				4. Fill thermowells with heat-transfer medium.
				5. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
				6. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
				7. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
				8. Install remote-mounted pressure gages on panel.
				9. Install valve and snubber in piping for each pressure gage for fluids.
				10. Install test plugs in piping tees.
				11. Install thermometers in the following locations:

Inlet and outlet of each water heater.

Inlets and outlets of each domestic water heat exchanger.

Inlet and outlet of each domestic hot-water storage tank.

Inlet and outlet of each remote domestic water chiller.

<**Insert location**>.

* + - * 1. Install pressure gages in the following locations:

Building water service entrance into building.

Inlet and outlet of each pressure-reducing valve.

Suction and discharge of each domestic water pump.

<**Insert location**>.

* + - 1. CONNECTIONS
				1. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
			2. ADJUSTING
				1. Adjust faces of meters and gages to proper angle for best visibility.
			3. THERMOMETER SCHEDULE

Retain this article if more than one type of thermometer is required; delete if all thermometers are the same type.

Retain and revise applicable thermometer applications. Coordinate with materials specified in Part 2.

Retain option in first paragraph below to allow Contractor to select thermometer materials from those retained.

* + - * 1. Thermometers at inlet and outlet of each domestic water heater shall be[**one of**] the following:

Retain one or more of five subparagraphs below. If retaining more than one type of thermometer, indicate location of each on Drawings.

[**Liquid-filled**] [**Sealed**], bimetallic-actuated type.

[**Direct**] [**Remote**]-mounted, [**metal**] [**plastic**]-case, vapor-actuated type.

[**Metal**] [**Plastic**] case, [**compact**] [**industrial**]-style, liquid-in-glass type.

[**Direct**] [**Remote**]-mounted, light-activated type.

Test plug with [**chlorosulfonated polyethylene synthetic**] [**EPDM**] self-sealing rubber inserts.

Retain option in first paragraph below to allow Contractor to select thermometer materials from those retained.

* + - * 1. Thermometers at inlets and outlets of each domestic water heat exchanger shall be[**one of**] the following:

Retain one or more of five subparagraphs below. If retaining more than one type of thermometer, indicate location of each on Drawings.

[**Liquid-filled**] [**Sealed**], bimetallic-actuated type.

[**Direct**] [**Remote**]-mounted, [**metal**] [**plastic**]-case, vapor-actuated type.

[**Metal**] [**Plastic**] case, [**compact**] [**industrial**]-style, liquid-in-glass type.

[**Direct**] [**Remote**]-mounted, light-activated type.

Test plug with [**chlorosulfonated polyethylene synthetic**] [**EPDM**] self-sealing rubber inserts.

Retain option in first paragraph below to allow Contractor to select thermometer materials from those retained.

* + - * 1. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be[**one of**] the following:

Retain one or more of five subparagraphs below. If retaining more than one type of thermometer, indicate location of each on Drawings.

[**Liquid-filled**] [**Sealed**], bimetallic-actuated type.

[**Direct**] [**Remote**]-mounted, [**metal**] [**plastic**]-case, vapor-actuated type.

[**Metal**] [**Plastic**] case, [**compact**] [**industrial**]-style, liquid-in-glass type.

[**Direct**] [**Remote**]-mounted, light-activated type.

Test plug with [**chlorosulfonated polyethylene synthetic**] [**EPDM**] self-sealing rubber inserts.

Retain option in first paragraph below to allow Contractor to select thermometer materials from those retained.

* + - * 1. Thermometers at inlet and outlet of each remote domestic water chiller shall be[**one of**] the following:

Retain one or more of five subparagraphs below. If retaining more than one type of thermometer, indicate location of each on Drawings.

[**Liquid-filled**] [**Sealed**], bimetallic-actuated type.

[**Direct**] [**Remote**]-mounted, [**metal**] [**plastic**]-case, vapor-actuated type.

[**Metal**] [**Plastic**] case, [**compact**] [**industrial**]-style, liquid-in-glass type.

[**Direct**] [**Remote**]-mounted, light-activated type.

Test plug with [**chlorosulfonated polyethylene synthetic**] [**EPDM**] self-sealing rubber inserts.

Insert additional paragraphs for thermometer applications.

* + - * 1. Thermometer stems shall be of length to match thermowell insertion length.
			1. THERMOMETER SCALE-RANGE SCHEDULE

The IP and SI temperature values for the scale ranges presented in this article are not mathematical, rounded, conversions from IP to SI; rather they are the temperature ranges within each specific unit of measure that are available from most manufacturers.

Retain first option in each paragraph for thermometers with a single scale in either deg F or deg C; retain second option for thermometers with dual scales.

Scale ranges vary among types of thermometers and among manufacturers. Retain a scale range that covers more than service-fluid temperature range. Exact ranges listed are not mandatory.

Retain one or more of first three paragraphs below. If retaining more than one scale range, indicate location of each on Drawings.

* + - * 1. Scale Range for Domestic Cold-Water Piping: [**0 to 100 deg F**].
				2. Scale Range for Domestic Cold-Water Piping: [**0 to 150 deg F**].
				3. Scale Range for Domestic Cold-Water Piping: [**30 to 240 deg F**].

Retain one or more of first three paragraphs below. If retaining more than one scale range, indicate location of each on Drawings.

* + - * 1. Scale Range for Domestic Hot-Water Piping: [**0 to 250 deg F**].
				2. Scale Range for Domestic Hot-Water Piping: [**20 to 240 deg F**].
				3. Scale Range for Domestic Hot-Water Piping: [**30 to 240 deg F**].

Retain one or both paragraphs below. If retaining more than one scale range, indicate location of each on Drawings.

* + - * 1. Scale Range for Domestic Cooled-Water Piping: [**0 to 100 deg F**.
				2. Scale Range for Domestic Cooled-Water Piping: [**0 to 150 deg F**].

Insert additional paragraphs for thermometer scale ranges and applications.

* + - 1. PRESSURE-GAGE SCHEDULE

Retain this article if more than one type of pressure gage is required; delete if all pressure gages are the same type.

Retain and revise applicable pressure-gage applications. Coordinate with materials specified in Part 2.

Retain option in first paragraph below to allow Contractor to select pressure-gage materials from those retained.

* + - * 1. Pressure gages at discharge of each water service into building shall be[**one of**] the following:

Retain one or more of three subparagraphs below. If retaining more than one type of pressure gage, indicate location of each on Drawings.

[**Liquid-filled**] [**Sealed**] [**Open-front, pressure-relief**] [**Solid-front, pressure-relief**] <**Insert type**>, [**direct**] [**remote**]-mounted, metal case.

[**Sealed**] <**Insert type**>, [**direct**] [**remote**]-mounted, plastic case.

Test plug with [**chlorosulfonated polyethylene synthetic**] [**EPDM**] self-sealing rubber inserts.

Retain option in first paragraph below to allow Contractor to select pressure-gage materials from those retained.

* + - * 1. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be[**one of**] the following:

Retain one or more of three subparagraphs below. If retaining more than one type of pressure gage, indicate location of each on Drawings.

[**Liquid-filled**] [**Sealed**] [**Open-front, pressure-relief**] [**Solid-front, pressure-relief**] <**Insert type**>, [**direct**] [**remote**]-mounted, metal case.

[**Sealed**] <**Insert type**>, [**direct**] [**remote**]-mounted, plastic case.

Test plug with [**chlorosulfonated polyethylene synthetic**] [**EPDM**] self-sealing rubber inserts.

Retain option in first paragraph below to allow Contractor to select pressure-gage materials from those retained.

* + - * 1. Pressure gages at suction and discharge of each domestic water pump shall be[**one of**] the following:

Retain one or more of three subparagraphs below. If retaining more than one type of pressure gage, indicate location of each on Drawings.

[**Liquid-filled**] [**Sealed**] [**Open-front, pressure-relief**] [**Solid-front, pressure-relief**] <**Insert type**>, [**direct**] [**remote**]-mounted, metal case.

[**Sealed**] <**Insert type**>, [**direct**] [**remote**]-mounted, plastic case.

Test plug with [**chlorosulfonated polyethylene synthetic**] [**EPDM**] self-sealing rubber inserts.

Insert additional paragraphs for pressure-gage applications.

* + - 1. PRESSURE-GAGE SCALE-RANGE SCHEDULE

The IP and SI pressure values for the scale ranges presented in this article are not mathematical, rounded, conversions from IP to SI; rather they are the pressure ranges within each specific unit of measure that are available from most manufacturers.

Retain first option in each paragraph for pressure gages with a single scale in either psi or kPa; retain second option for pressure gages with dual scales.

Scale ranges vary among types of pressure gages and among manufacturers. Retain a scale range that covers more than service-fluid pressure range. Exact ranges listed are not mandatory.

Retain one or more of first three paragraphs below. If retaining more than one scale range, indicate location of each on Drawings.

* + - * 1. Scale Range for Water Service Piping: [**0 to 100 psi**].
				2. Scale Range for Water Service Piping: [**0 to 160 psi**].
				3. Scale Range for Water Service Piping: [**0 to 200 psi**].

Retain one or more of four paragraphs below. If retaining more than one scale range, indicate location of each on Drawings.

* + - * 1. Scale Range for Domestic Water Piping: [**0 to 100 psi**].
				2. Scale Range for Domestic Water Piping: [**0 to 160 psi**].
				3. Scale Range for Domestic Water Piping: [**0 to 200 psi**].
				4. Scale Range for Domestic Water Piping: [**0 to 300 psi**].

Insert additional paragraphs for pressure-gage scale ranges and applications.

END OF SECTION 220519