SECTION 230923.17 - LEVEL INSTRUMENTS

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 liquid-level switches, sensors, and transmitters.
				2. Related Requirements:

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

Section 230923 "Direct-Digital Control System for HVAC" for control equipment and software, relays, electrical power devices, uninterruptible power supply units, wire, and cable.

Section 230993 "Sequence of Operations for HVAC Controls" for requirements that relate to Section 230923.117.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.

Include operating characteristics; electrical characteristics; and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.

Include product description with complete technical data, performance curves, and product specification sheets.

* + - * 1. Shop Drawings:

Include details of product 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.

Include number-coded identification system for unique identification of wiring, cable, and tubing ends.

* + - * 1. Operation and Maintenance Data: For level instruments, to include in operation and maintenance manuals.
1. PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 016000 "Product Requirements."

* + - 1. PERFORMANCE REQUIREMENTS
				1. Environmental Conditions:

Instruments shall operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.

If instrument alone cannot comply with requirement, install instrument in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated[**and cooled**], filtered, and ventilated as required by instrument and application.

* + - 1. LEVEL SWITCHES
				1. Liquid-Level Switch (Magnetic Type with Float):

Retain "Products" Subparagraph and list of manufacturers and products below to require specific products or a comparable product from other manufacturers.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9831) Subject to compliance with requirements, provide products by the following:

Siemens Industry, Inc., Building Technologies Division

[W. E. Anderson; Dwyer Instruments, Inc](http://www.specagent.com/Lookup?uid=123457171628).

Approved equivalent.

Requirements in remaining subparagraphs below are based on W. E. Anderson's "Series L4."

Description:

Mounting Suitable for Application: Horizontal or vertical switch mounting.

Float arm with hinge design limits vertical movement to prevent sticking.

Replaceable float with threaded connection.

Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for hazardous environments (Class I, Groups C and D; Class II, Groups E, F, and G).

Performance:

Level Actuation and De-Actuation: 0.75-inch (20-mm) deadband.

Body Pressure Limit: 1000 psig (6895kPa) for brass body; 2000 psig (13790 kPa) for Type 316 stainless-steel body.

Float Pressure Limit: 150 psig (1034 kPa).

Temperature Range: Minus 4 to 275 deg F (Minus 20 to 135 deg C).

Electrical Rating: 10 A at 125/250-V ac.

Switch Type: [**SPDT**] [**DPDT**] snap switch.

Wetted Parts Construction:

Float and Rod: Type 316 stainless steel.

Body: [**Brass**] [**Type 316 stainless steel**].

Magnetic Keeper: [**Type 430 stainless steel**] [**Type 316 stainless steel**].

Process Connection: NPS 1-1/2 (DN 40) NPT.

Enclosure:

Die-cast aluminum alloy.

Threaded cover.

NEMA 250, Type 4.

Electrical Connection: Terminal block.

Conduit Connection: NPS 3/4 (NPS 20) NPT.

* + - * 1. Electrode-Type Liquid-Level Switches:

Retain "Products" Subparagraph and list of manufacturers and products below to require specific products or a comparable product from other manufacturers.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9832) Subject to compliance with requirements, provide products by the following:

[Proximity Controls; Dwyer Instruments, Inc](http://www.specagent.com/Lookup?uid=123457171630).

Siemens Industry, Inc.,

Building Technologies Division

Approved equivalent.

Requirements in remaining subparagraphs below are based on Proximity's "Model DPL110."

Description:

Conductivity technology.

Dual point level settings.

No moving parts.

Adjustable sensitivity.

Performance:

Pressure Limit: 30 psig (207 kPa).

Temperature Limit: 212 deg F (100 deg C).

Power Supply: 120-V ac, 50 or 60 Hz.

Electrical Rating: 5 A at 240-V ac.

Switch Type: SPDT snap switch.

Probes:

Electrodes: 0.125-inch (6-mm) diameter.

Material: Type 316 stainless steel.

Length: To suit application up to72 inches (1800 mm).

Process Connection: NPS 1 (DN 25) NPT.

Enclosure:

Polypropylene.

NEMA 250, Type 6.

Electrical Connection: Cable and standard octal socket.

* + - * 1. RF Admittance-Type Liquid-Level Switches:

Retain "Products" Subparagraph and list of manufacturers and products below to require specific products or a comparable product from other manufacturers.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9833) Subject to compliance with requirements, provide products by the following:

Johnson Controls

[Proximity Controls; Dwyer Instruments, Inc](http://www.specagent.com/Lookup?uid=123457171632).

Siemens Industry, Inc., Building Technologies Division

Approved equivalent.

<Insert manufacturer's name; product name or designation>.Requirements in remaining subparagraphs below are based on Proximity's "Series CLS2."

Description:

Capacitive technology.

No moving parts.

Not affected by sticky, dusty, or clingy materials that coat or build up on probe.

Immune to external radio frequency (RF) sources.

Sensitivity: Eight selectable settings.

Mounting: Horizontal or vertical.

Performance:

Pressure Limit: 365 psig (2517 kPa).

Ambient Temperature Range: Minus 40 to 185 deg F (Minus 40 to 85 deg C).

Process Temperature Range: Minus 40 to 250 deg F (Minus 40 to 121 deg C).

Universal Power Supply: 12- to 240-V ac and dc.

Electrical Rating: 8 A at 120- and 240-V ac.

Switch Type: SPDT snap switch, selectable for normally open or closed operation.

Response Time: 0.2 seconds.

Time Delay: Adjustable, zero to 60 seconds.

Probes:

Material: Type 316 stainless steel.

Insulator Material: PVDF.

Length: To suit application up to72 inches (1800 mm).

Process Connection: NPS 1 (DN 25) NPT.

Enclosure:

NEMA 250, Type 4X.

Electrical Connection: Screw terminals on removable terminal block.

Conduit Connection: NPS 1/2 (DN 15) NPT.

* + - * 1. Drain Pan Leak-Detection Float Switches, Inline Type:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13945) Subject to compliance with requirements, provide products by one of the following:

[Little Giant; a Franklin Electric brand](http://www.specagent.com/Lookup?uid=123457171911).

[RectorSeal HVAC; a CSW Industrials Company](http://www.specagent.com/Lookup?uid=123457171635).

Siemens Industry, Inc., Building Technologies Division

Approved equivalent.

Description: Inline float switch for direct mounting onto primary or secondary drain pan outlet, or for inline mounting in drainline pipe, to detect drain pan pre-overflow condition and trigger equipment shutdown.

Material:

Mechanical switch and float valve. Switch and cap assembly to be removable to permit access for cleaning and clearing of clogs.

Schedule 40 PVC housing.

1 inch x 3/4 inch x 1 inch (25 mm x 19 mm x 25 mm) slip tee housing.

3/4 inch x 1 inch (19 mm x 25.4 mm) slip PVC bushing.

3/4 inch x 3/4 inch (19 mm x 19 mm) slip PVC adaptor to fit standard 3/4 inch (19 mm) [**primary**] [**secondary**] drain-pan outlets.

[**Secondary drain pan, plug: 3/4 inch (19 mm) slip plug.**]

Alarm Action: Equipment shutdown via pre-wired 72-inch (1.8-m) 18 AWG cables suitable for 24 VAC Class 2 circuit.

Standard: UL 508 listed.

* + - * 1. Drain Pan Leak-Detection Float Switches, Right-Angle Type:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13946) Subject to compliance with requirements, provide products by one of the following:

[Little Giant; a Franklin Electric brand](http://www.specagent.com/Lookup?uid=123457171912).

[RectorSeal HVAC; a CSW Industrials Company](http://www.specagent.com/Lookup?uid=123457171913).

Siemens Industry, Inc., Building Technologies Division

Approved equivalent.

Description: Right-angle, L-shaped, float switch for direct mounting onto secondary drain pan outlet to detect drain pan pre-overflow condition and trigger equipment shutdown.

Material:

Mechanical switch and float valve. Switch and cap assembly to be removable to permit access for cleaning and clearing of clogs.

Schedule 40 PVC housing.

1 inch x 3/4 inch (25 mm x 19 mm) slip "L" housing.

3/4 inch x 3/4 inch (19 mm x 19 mm) slip PVC adapter.

Alarm Action: Equipment shutdown via pre-wired 72-inch (1.8-m) 18 AWG cables suitable for 24 VAC Class 2 circuit.

Standard: UL 508 listed.

* + - * 1. Drain Pan Leak-Detection Float Switches, In-Pan Type:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13947) Subject to compliance with requirements, provide products by one of the following:

[Little Giant; a Franklin Electric brand](http://www.specagent.com/Lookup?uid=123457171914).

[RectorSeal HVAC; a CSW Industrials Company](http://www.specagent.com/Lookup?uid=123457171915).

Siemens Industry, Inc., Building Technologies Division

Approved equivalent.

Description: In-pan type float switch for direct mounting in primary drain pan to detect drain pan pre-overflow condition and trigger equipment shutdown.

Material:

Mechanical switch and float valve, in sealed waterproof housing.

Corrosion-resistant clip to position and secure float switch to side of drain pan.

Alarm Action: Equipment shutdown via pre-wired 72-inch (1.8-m) 18 AWG cables suitable for 24 VAC Class 2 circuit.

Standard: UL 508 listed.

* + - 1. LEVEL TRANSMITTERS
				1. RF Admittance-Type Liquid-Level Sensor and Transmitter:

Retain "Products" Subparagraph and list of manufacturers and products below to require specific products or a comparable product from other manufacturers.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9834) Subject to compliance with requirements, provide products by the following:

[AMETEK, Inc](http://www.specagent.com/Lookup?uid=123457171634).

Johnson Controls

Siemens Industry, Inc., Building Technologies Division

Approved equivalent.

Requirements in remaining subparagraphs below are based on Ametek's "Universal II 508 series."

Description: Complete package with electronic unit, sensing element, connecting cable.

Continuous level transmitter shall produce an output signal that is proportional to level.

Measurement shall be free from effects of changes in temperature, density, or acoustic noise in vapor space above level.

Continuous measurement shall be independent of changes in material density and unaffected by presence of material clinging to sensing element.

No moving parts and no routine cleaning and recalibration necessary.

Electronic unit shall be integral to sensing element or mounted remotely up to 100 feet (30 m) away from sensor.

Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for hazardous environments (Class I, Groups C and D; Class II, Groups E, F, and G).

Sensor:

Material: Teflon-coated [**Type 304**] [**Type 316**] stainless steel.

Length: To suit installation.

Connection: NPS 3/4 (NPS 20) NPT[**or flanged**].

Electronic unit housed in NEMA 250, Type 4X enclosure.

Calibrated Range: Varies with application. At least [**10**] [**20**] <**Insert number**> percent beyond high- and low-level set point and alarm levels.

Accuracy: Within 1 percent of calibrated range.

Two wire, loop powered.

Supply Voltage: 11.5 to 50-V dc.

Maximum Load: 625 ohms at 24-V dc.

Output Signal: 4 to 20 mA dc.

Response Time: 0.5 to 30 seconds, adjustable.

Temperature Range: Minus 40 to 165 deg F (Minus 40 to 74 deg C).

Zero and Span Adjustments: Non-interacting.

Visual Indication: Continuous digital display of level.

Field-changeable failsafe condition and phasing in event measurement requires changes to optimize level reading.

Free from effects of radio frequency interference.

Free from harmful effects of static electricity on sensing element with discharges of up to 10 A without damage.

Adjustable time delay (signal dampening).

1. EXECUTION
	* + 1. EXAMINATION
				1. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
				2. Examine roughing-in for instruments to verify actual locations of connections before installation.
				3. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.
				4. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. INSTALLATION, GENERAL
				1. Install products level, plumb, parallel, and perpendicular with building construction.
				2. Properly support instruments, tubing, piping wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement, sway, or a break in attachment when subjected to a <**Insert value**> force.
				3. Fastening Hardware:

Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.

Tighten bolts and nuts firmly and uniformly. Do not overstress threads by using excessive force or oversized wrenches.

Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

* + - * 1. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Director’s Representative's access, confirm unrestricted ladder placement is possible under occupied condition.
				2. Mount switches and transmitters not subject to code, state, and federal accessibility requirements within a range of 42 to 72 inches (1.1 to 1.6 m) above the adjacent floor, grade or service catwalk, or platform.

Make every effort to mount at 60 inches (1.5 m).

* + - * 1. Corrosive Environments:

Use products that are suitable for environment to which they are subjected.

If possible, avoid or limit use of materials in corrosive environments.

When conduit is in contact with a corrosive environment, use Type 316 stainless-steel conduit and fittings or conduit and fittings that are coated with a corrosive-resistant coating that is suitable for environment.

Where instruments are located in a corrosive environment and are not corrosive resistant from manufacturer, field install products in a NEMA 250, Type 4X enclosure constructed of Type 316L stainless steel.

* + - 1. ELECTRICAL POWER
				1. Provide electrical power to products requiring electrical connections.
				2. Provide circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."
				3. Provide power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
				4. Provide raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."
			2. LEVEL INSTRUMENTS INSTALLATION
				1. Mounting Location: Rough-in instrument-mounting locations before setting instruments and routing, cable, wiring, tubing, and conduit to final location.
			3. IDENTIFICATION
				1. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
				2. Install engraved phenolic nameplate with instrument identification on face.
			4. CHECKOUT PROCEDURES
				1. Check out installed products before continuity tests, leak tests, and calibration.
				2. Check instruments for proper location and accessibility.
				3. Check instruments for proper installation on direction of elevation, orientation, insertion depth, or other applicable considerations that impact performance.
			5. ADJUSTMENT, CALIBRATION, AND TESTING
				1. Description:

Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.

Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.

For each analog instrument, perform a three-point calibration test for both linearity and accuracy.

Equipment and procedures used for calibration shall comply with instrument manufacturer's written recommendations.

Provide diagnostic and test equipment for calibration and adjustment.

Field instruments and equipment used to test and calibrate installed instruments shall have an accuracy of at least twice the instrument accuracy being calibrated. For example, an installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.

Calibrate each instrument according to instrument instruction manual supplied by manufacturer.

If, after calibration, indicated performance cannot be achieved, replace out-of-tolerance instruments.

Comply with field-testing requirements and procedures in ASHRAE Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.

* + - * 1. Analog Signals:

Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.

Check analog current signals using a precision current meter at zero, 50, and 100 percent.

Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

* + - * 1. Digital Signals:

Check digital signals using a jumper wire.

Check digital signals using an ohmmeter to test for contact.

* + - * 1. Switches: Calibrate switches to make or break contact at setpoints indicated.
				2. Transmitters:

Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.

Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistance source.

* + - 1. MAINTENANCE SERVICE

Verify, with Owner, that maintenance service is required for Project.

* + - * 1. Maintenance Service: In addition to the contractors 1-year project warranty requirements, beginning at Substantial Completion, maintenance service shall include [**three**] [**six**] [**nine**] [**12**] months' full maintenance by [**skilled employees of system and equipment Installer**] [**manufacturer's authorized service representative**]. Include [**monthly**] [**quarterly**] [**semiannual**] [**annual**] preventive maintenance, repair or replacement of worn or defective components, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
			1. DEMONSTRATION
				1. [**Engage a factory-authorized service company field advisor to train**] [**Train**] Director’s Representative's maintenance personnel to adjust, operate, and maintain instrumentation and control devices.
				2. Coordinate level instrument demonstration video with operation and maintenance manuals and classroom instruction for use by Director’s Representative in operating, maintaining, and troubleshooting.
				3. Record videos on DVD disks.
				4. Director’s Representative shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION 230923.17