SECTION 230923.19 - MOISTURE 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 moisture 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 230923.19.

* + - 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, including the following:

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.

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. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: 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. MOISTURE SWITCHES
				1. Humidistat for Duct Applications:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9824) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Johnson Controls

[Schneider Electric USA, Inc](http://www.specagent.com/Lookup?uid=123456944521).

Siemens Industry, Inc., Building Technologies Division

Approved equivalent.

Requirements in remaining subparagraphs are based on TAC's "Model HC-201."

Description:

Two-position control.

Field-adjustable set point.

Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Performance:

Relative Humidity Range: 15 to 95 percent.

Relative Humidity Differential: 5 percent.

Ambient Temperature: 40 to 135 deg F (4 to 57 deg C).

Voltage: 120-V ac.

Current: 7.2 FLA.

Switch Type: SPDT snap switch.

Construction:

Enclosure: Metal, NEMA 250, Type 1.

Electrical Connections: Screw terminals.

* + - * 1. Humidistat for Space Applications:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9825) Subject to compliance with requirements, provide products by the following:

Johnson Controls

[Schneider Electric USA, Inc](http://www.specagent.com/Lookup?uid=123456944522).

Siemens Industry, Inc., Building Technologies Division

Approved equivalent.

Requirements in remaining subparagraphs are based on TAC's "Model HC-101."

Description:

Two-position control.

Field-adjustable set point.

Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Performance:

Relative Humidity Range: 10 to 90 percent.

Relative Humidity Differential: 5 percent.

Ambient Temperature: 40 to 135 deg F (4 to 57 deg C).

Voltage: 24-V ac.

Pilot Duty: 60 VA.

Switch Type: SPDT snap switch.

Construction:

Enclosure: Plastic, NEMA 250, Type 1.

Electrical Connections: Cable, 6 inches (150 mm) long.

* + - 1. MOISTURE SENSORS AND TRANSMITTERS
				1. Sensors and Transmitters with Digital Display:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9826) Subject to compliance with requirements, provide products by the following:

Johnson Controls

Siemens Industry, Inc., Building Technologies Division

[Vaisala](http://www.specagent.com/Lookup?uid=123456944523).

Approved equivalent.

Requirements in remaining subparagraphs are based on Vaisala's "Model HMT100 Series."

Performance:

Accuracy including non-linearity, hysteresis, and repeatability: Within 2 percent from zero to 90 percent relative humidity and within 2.5 percent from 90 to 100 percent relative humidity when operating between 60 to 77 deg F (16 to 25 deg C).

Relative Humidity Range: Zero to 100 percent.

Factory calibrated and NIST traceable with certificate included.

Construction:

Provide housing with integral sensor for room applications.

Provide housing with remote sensor probe for ducted applications.

Duct Sensor Body: 300 series stainless steel or chrome-plated aluminum, at least 2 inches (50 mm) long for duct-mounted applications.

Provide sensor with cable for field installation in conduit.

For duct-mounted applications, thread the sensor assembly for connection to a threaded mounting flange.

Provide general-purpose humidity sensor unless application requires special requirements. Provide sensor with sintered stainless-steel filter for duct applications.

Housing shall be ABS/PC plastic or powder-coated aluminum.

Housing Classification: NEMA 250, Type 4 or 4X.

Provide housing with wall-mounting plate.

Output Signal: 2-wire, 4- to 20-mA output signal with a drive capacity of at least 500 ohms at 24-V dc.

Provide unit with a digital display of relative humidity in percent.

Retain one of two "Sensor and Transmitter without Display" paragraphs below.

* + - * 1. Sensor and Transmitter without Display:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9827) Subject to compliance with requirements, provide products by the following:

Johnson Controls

Siemens Industry, Inc., Building Technologies Division

[Vaisala](http://www.specagent.com/Lookup?uid=123456944524).

Approved equivalent.

Requirements in remaining subparagraphs are based on Vaisala's "HMW 60 Series" for space applications and its "HMD 60 Series" for duct and equipment applications.

Performance:

Accuracy including non-linearity, hysteresis, and repeatability: Within 2 percent from zero to 90 percent relative humidity and within 3 percent from 90 to 95 percent relative humidity when operating at 68 deg F (20 deg C).

Relative Humidity Range:

Duct: Zero to 100 percent.

Space: Zero to 95 percent relative.

Factory calibrated and NIST traceable with certificate included.

Construction for Space Applications:

Housing with integral sensor.

Housing shall be ABS plastic or powder-coated aluminum.

Enclosure: NEMA 250, Type 4.

Provide housing with a wall-mounting plate.

Construction for Duct and Equipment Applications:

Housing with integral sensor.

Duct Sensor Body: 300 series stainless steel.

Provide sensor with sintered stainless-steel filter for duct applications.

Housing shall be cast aluminum.

Enclosure: NEMA 250, Type 4.

Output Signal: Two-wire, 4- to 20-mA output signal with drive capacity of at least 500 ohms at 24-V dc.

* + - * 1. Sensor and Transmitter without Display:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=10017) Subject to compliance with requirements, provide products by the following:

Johnson Controls

[MAMAC Systems, Inc](http://www.specagent.com/Lookup?uid=123456950100).

Siemens Industry, Inc., Building Technologies Division

Approved equivalent.

Requirements in remaining subparagraphs are based on MAMAC's "Model HU-224" for space applications and its "Model HU-225" for duct applications.

Performance:

Relative Humidity Range: Zero to 100 percent.

Accuracy: Within [**2**] [**or**] [**3**] percent.

Operating Temperatures: Minus 30 to 130 deg F (Minus 1 to 54 deg C).

Hysteresis: Within 1 percent.

Construction:

Duct-type sensor for duct-mounted applications. Integral-type sensor for room or space applications.

Sensor Body: 300 series stainless steel, 6 inches (150 mm) long for duct-mounted applications.

For outdoor[**and duct**] applications, install circuitry in a NEMA 250, Type 4 or 4X enclosure.

Output Signal:

Two-wire, 4- to 20-mA output signal with a drive capacity of at least 600 ohms at 24-V dc.

Non-interacting zero and span adjustments.

* + - * 1. Combination Humidity and Temperature Sensor and Transmitter with Display:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=9828) Subject to compliance with requirements, provide products by the following:

Johnson Controls

Siemens Industry, Inc., Building Technologies Division

[Vaisala](http://www.specagent.com/Lookup?uid=123456944525).

Approved equivalent.

Requirements in remaining subparagraphs are based on Vaisala's "Model HMT330 Series."

Description:

Factory package consisting of humidity and temperature sensor, digital display, keypad user interface, installation hardware, interconnecting sensor cabling, installation instructions, and operating manual.

Each transmitter shall be individually calibrated and provided with NIST traceable calibration certifications.

Provide a service cable for connecting to a notebook computer and Microsoft Windows compatible software.

Display:

Alphanumeric display of the following on the face of the enclosure:

Percent relative humidity.

Absolute humidity.

Mixing ratio.

Dry-bulb temperature.

Wet-bulb temperature.

Dew point temperature.

Enthalpy.

Visual display of measurement trends, and minimum and maximum values over a one-year period.

Electronics Enclosure:

Integral to sensors for wall- (room-)mounted applications and remote from temperature and humidity sensors for duct and equipment applications.

NEMA 250, Type 4 or 4X.

Labeled terminal strip for field wiring connections.

Trade size threaded conduit connection.

Programming:

Transmitter parameters shall be field programmable through keypad on the face of the enclosure.

Programmed parameters shall be stored in nonvolatile EEPROM.

Output Signals:

Three Analog Outputs: 4 to 20 mA or zero to 10-V dc for each output.[**Option to use a serial communication interface.**]

Temperature Sensor:

Temperature range matched to application, but not less than minus 40 to 140 deg F (minus 40 to 60 deg C).

Within 0.5 deg F (0.3 deg C) accuracy over the temperature range of 50 to 100 deg F (10 to 38 deg C) and within 1 deg F (0.6 deg C) over the remainder of the range.

Provide duct installation kit for duct applications.

Humidity Sensor:

Relative Humidity Measurement Range: Zero to 100 percent.

Response time in still air within 40 seconds.

Accuracy including non-linearity, hysteresis, and repeatability:

For Temperature Between 59 and 77 Deg F (15 to 25 Deg C) and Relative Humidity between Zero and 90 Percent: Within 1 percent.

For Temperature between 59 and 77 Deg F (15 to 25 Deg C) and Relative Humidity between 90 and 100 Percent: Within 1.7 percent.

For Temperature between Minus 4 and 104 Deg F (Minus 20 to 40 Deg C): Within 1 percent plus 0.008 times relative humidity reading.

For Temperature between Minus 40 and 356 Deg F (Minus 40 to 180 Deg C): Within 1.5 percent plus 0.015 times the relative humidity reading.

Sintered, stainless-steel filter, protecting sensor.

Provide duct installation kit for duct applications.

Power Supply:

Field Power: 120-V ac, 60 Hz unless otherwise required by the application.

Internal Power: As required by transmitter.

1. EXECUTION
	* + 1. EXAMINATION
				1. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
				2. Examine roughing-in for instruments installed in duct systems 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. MOISTURE INSTRUMENT APPLICATIONS

Copy and edit paragraph below for each unique application requiring a different humidity sensor and transmitter. Delete if instrument types are indicated on Drawings.

* + - * 1. <**Insert application**>: [**Sensor and transmitter with digital display**] [**Sensor and transmitter without display**] [**Combination humidity and temperature sensor and transmitter with display**].
			1. INSTALLATION, GENERAL
				1. Install products level, plumb, parallel, and perpendicular with building construction.
				2. Properly support instruments, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and 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 excessive force or by oversized wrenches.

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

Coordinate access door locations to permit access for service and maintenance where installation in concealed locations is required.

* + - * 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. 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. ELECTRIC 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. MOISTURE INSTRUMENTS INSTALLATION
				1. Mounting Location: Rough-in instrument-mounting locations before setting instruments and routing, cable, wiring, tubing, and conduit to final location.
				2. Mounting Height:

Mount instruments in user-occupied space to match mounting height of light switches unless otherwise indicated on Drawings. Mounting height shall comply with codes and accessibility requirements.

Mount switches and transmitters located in mechanical equipment rooms and other similar space 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. 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 of ceiling directly below instruments concealed above ceilings**] [on face of access doors for instruments in concealed locations].
			2. CHECKOUT PROCEDURES
				1. Check installed products before continuity tests and calibration.
				2. Check instruments for proper location and accessibility.
				3. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that impact performance.
			3. 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, make a three-point test of calibration for both linearity and accuracy.

Equipment and procedures used for calibration shall meet instrument manufacturer's written instructions.

Provide diagnostic and test equipment for calibration and adjustment.

Field instruments and equipment used to test and calibrate installed instruments shall have accuracy 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 indicated by 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-resistance source.

* + - * 1. Digital Signals:

Check digital signals using a jumper wire.

Check digital signals using an ohmmeter to test for contact.

* + - * 1. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.
				2. Switches: Calibrate switches to make or break contact at set points indicated.
				3. 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 systems and equipment Installer**] [**manufacturer's authorized service representative**]. Include [**monthly**] [**quarterly**] [**semiannual**] [**annual**] preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper <**Insert equipment**> 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 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.
				5. Director’s Representative shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION 230923.19