SECTION 230923.43 - WEATHER STATIONS

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.

PART 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 weather stations connected to direct-digital controls for HVAC.
				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 230923.43.

* + - 1. DEFINITIONS

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

* + - * 1. I/O: Input/output.
				2. RS-232: A TIA standard for asynchronous serial data communications between terminal devices.
				3. RS-485: A TIA standard for multipoint communications using two twisted pairs.
			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:

Construction details, material descriptions, dimensions of individual components and profiles, and finishes.

Operating characteristics, electrical characteristics, and furnished accessories indicating control signal over range, 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.

Installation operation and maintenance instructions including factors affecting performance.

* + - * 1. Shop Drawings:

Include plans, elevations, sections, and [**mounting**]details.

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.

Retain "Field quality-control reports" paragraph below if Contactor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For weather stations to include in operation and maintenance manuals.

PART 2 - PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products.

* + - 1. WEATHER STATION
				1. Manufacturers: Subject to compliance with requirements, provide products by the following:

WeatherHawk.

Approved equivalent.

Requirements in remaining paragraphs are based on WeatherHawk's Series 500."

* + - * 1. Description:

Weather station shall measure and record wind speed and direction, air temperature and relative humidity, barometric pressure, solar radiation, and rain.

Design weather station for applications with minimal visual impact, high reliability, and a long interval between routine servicing.

Weather station shall use solid-state sensors with no moving parts.

Weather station shall not be impaired by heavy snowfall or freezing conditions that produce rime ice. Provide a thermostatically controlled heater element in the sensor head that keeps the wind sensor elements and the precipitation sensor surface free of snow and ice to minus 62 deg F.

Weather station shall directly connect to host device, or wirelessly connect to a host device through a fully integrated, industrial-grade, 916-MHz spread spectrum radio-frequency communications technology. Where required by application, replace 916-MHz radio-frequency components with 922-MHz and 2.4-GHz radio-frequency components to comply with local, regional, and national radio-frequency licensing requirements.

RS-232 serial data I/O shall be located on the bottom of the weather station and used as a second serial communications port, for programming and testing the system, or for direct data downloads using a personal computer or personal digital assistant.

Weather station shall be provided with a mounting system supplied by weather station manufacturer that is suitable for the installation.

* + - * 1. Sensor Technology:

Wind speed and direction shall use acoustic techniques. Sensor shall consist of three equally spaced ultrasonic transducers in a horizontal plane. Values of any two array paths shall enable computation of both wind speed and direction, and a signal processing technique shall enable the measurement to be calculated using the two array paths of the best quality.

Rain shall be measured using a stainless-steel piezometric impact surface that counts the raindrops and measures their acoustic signature, integrating that information to provide a near-real-time value for rainfall amount and rate.

Barometric pressure, relative humidity, air temperature, and solar radiation measurements shall be made by scientific grade sensors.

Air-temperature and relative-humidity sensors shall be combined in an integrated, user-replaceable unit that requires no calibration.

Relative humidity sensor shall be a thin-polymer, capacitive sensor.

Air-temperature sensor shall be a capacitive ceramic sensor.

Barometric pressure shall be measured with a capacitive silicon, temperature-corrected, strain gage.

Solar radiation shall be measured by a silicon pyranometer with a cut filter limiting the spectral exposure to the 300- to 1100-nm wavelength.

* + - * 1. Performance:

Air Temperature:

Range: Minus 60 to 140 deg F.

Accuracy: Within 0.9 deg F.

Resolution: 0.1 deg F.

Relative Humidity:

Range: Zero to 100 percent.

Accuracy: Within 3 percent over the range of zero to 90 percent and within 5 percent between 90 to 100 percent.

Resolution: 0.1 percent.

Barometric Pressure:

Range: 17.72- to 32.48-in. Hg.

Accuracy: 0.015-in. Hg between 32 to 86 deg F.

Resolution: 0.03-in. Hg between minus 60 to 140 deg F.

Solar Radiation:

Spectral Range: 300 to 1100 nm.

Reproducibility: Within 2 percent.

Output: 0.2 mV per watts per square meters.

Range: Zero to 1000 W per square meters.

Temperature Range: Minus 40 to 130 deg F.

Rain:

Collecting Area: 9.3 sq. in..

Range: Zero to 7.87 inches per hour.

Accuracy: Within 5 percent.

Resolution: 0.001 inch.

Wind Direction:

Azimuth: Zero to 360 degrees.

Response Time: 250 ms.

Accuracy: Within 2 degrees.

Resolution: 1 degree.

Wind Speed:

Range: Zero to 134 mph.

Response Time: 0.25 second.

Accuracy: Greater of 0.67 mph or 2 percent.

Resolution: 0.22 mph.

Data Storage: 60 days of hourly data.

* + - * 1. Output Signals:

RS-232 or RS-485 serial interface directly from weather station to host.

In applications that cannot accept a serial signal, provide a serial-to-analog converter.

Serial-to-Analog Converter:

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

Manufacturers: Subject to compliance with requirements, provide products by the following:

Nokeval Oy.

Approved equivalent.

Requirements in remaining paragraphs are based on Nokeval's 7470 Series."

Serial converter designed to add analog outputs for measuring instruments that have only serial output.

Configure to give analog outputs from all measuring sensors and calculated parameters.

Each converter shall have four analog outputs with a 4- to 20-mA signal.

Provide multiple converters for applications requiring more points.

Converter requires a 24-V dc power supply.

* + - * 1. Communication Interface:

Weatherproof serial cables shall be used to connect the RS-232 I/O on the weather station. Cables shall use nickel-plated brass DB-9 connectors for corrosion resistance and include a Sanoprene jacket suitable for both high-ultraviolet and direct-burial environments.

An RF4xx spread spectrum radio-frequency transceiver shall be provided with every wireless weather station.

* + - * 1. Unit shall be provided with a 120-V ac, 60-Hz power supply, a serial cable, and an antenna.
				2. Software:

Data Transfer Protocols, Software, and Data Interface Hardware: Weather stations that communicate using a proprietary protocol shall be provided with a software development kit to enable a qualified software developer in development of software drivers for third-party devices or software.

Manufacturer shall submit description and pricing information of software application offerings for weather station management, data acquisition and logging, report generation, and data display for review and consideration.

PART 3 - EXECUTION

* + - 1. EXAMINATION
				1. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
				2. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.
				3. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. INSTALLATION
				1. Install products level, plumb, parallel, and perpendicular with building construction.
				2. Properly support weather station, 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 forces that are consistent with building code structural design requirements.
				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.

* + - * 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 components 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. 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.
			3. ADJUSTMENT, CALIBRATION, AND TESTING
				1. Description:

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

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

For each analog signal, make a three-point test of calibration for both linearity and accuracy.

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

Provide diagnostic and test equipment for calibration and adjustment.

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

Calibrate each weather station 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. FIELD QUALITY CONTROL

Retain "Testing Agency" and "Manufacturer's Field Service" paragraphs below to identify who shall perform tests and inspections. If retaining second option in "Testing Agency" paragraph or if retaining "Manufacturer's Field Service" paragraph, retain "Field quality-control reports" paragraph in "Informational Submittals" Article.

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 to test and inspect components, assemblies, and equipment installations, including connections.
				2. Prepare test and inspection reports.
			1. STARTUP SERVICE
				1. Engage a company field advisor to perform startup service.
			2. MAINTENANCE SERVICE

Verify with Owner that maintenance service is required for Project.

* + - * 1. Maintenance Service: 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 company field advisor to train Director’s Representative's maintenance personnel to adjust, operate, and maintain weather stations.
				2. Provide a complete set of instructional videos covering each product specified and installed and showing the following:

Software programming.

Calibration and test procedures.

Operation and maintenance requirements and procedures.

Troubleshooting procedures.

* + - * 1. Coordinate video with operation and maintenance manuals and classroom instruction for use by Director’s Representative in operating, maintaining, and troubleshooting.
				2. Record videos on DVD disks.
				3. Director’s Representative shall have right to make additional copies of video for internal use without paying royalties.

END OF SECTION 230923.43