SECTION 230923.33 - VIBRATION 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 vibration switches and combination switch and transmitters connected to direct digital control systems 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 230923.33.

* + - 1. DEFINITIONS

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

* + - * 1. RMS: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.
			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 default control signal with loss of power, calibration data specific to each unique application, and electrical power requirements.

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 and cable.

* + - 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.

* + - 1. MECHANICAL VIBRATION SWITCHES
				1. Manufacturers: Subject to compliance with requirements, provide products by the following:

Johnson Controls

Metrix Instrument Co.

Siemens

Approved equivalent.

Requirements in remaining paragraphs are based on Metrix's "Model 5550."

* + - * 1. Description: Inertia-sensitive armature mechanism trips on high vibration and operates snap action switch.
				2. Performance:

Frequency Range: Zero to 3600 rpm.

Vibration Range: Zero to [**2**] [**5**] [**10**] g.

Temperature Limits: Minus 40 to 158 deg F.

Electrical Rating: 15 A at 125- or 480-V ac.

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

Start Delay: 20 to 30 seconds, by applying reset voltage at start signal to prevent switch from tripping.

Retain first paragraph below for hazardous environments.

* + - * 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for hazardous environments Class I, Groups B, C, and D; Class II, Groups E, F, and G.
				2. Operator Interface:

Vibration Set-Point Adjustment: Zero to 100 percent of range.

Push-button reset on switch face and reset coil for remote reset.

* + - * 1. Enclosure Construction:

Cast aluminum.

NEMA 250, [**Type 4**] [**or**] [**Type 4X**].

Electrical Connection: Screw terminals.

Conduit Connection: 3/4-inch trade size.

* + - 1. ELECTRONIC VIBRATION SWITCHES
				1. Manufacturers: Subject to compliance with requirements, provide products by the following:

Johnson Controls

Metrix Instrument Co.

Siemens

Approved equivalent.

Requirements in remaining paragraphs are based on Metrix's "Model 5477."

* + - * 1. Description:

Accelerometer-based velocity response.

Single set point.

* + - * 1. Performance:

Frequency Range: 3 to 500 Hz.

Vibration Range: Zero to 1.0 inch per second.

Temperature Limits: Minus 4 to 167 deg F.

Electrical Rating: 5-A inductive, 60-A surge for one cycle; normally open-triac leakage is 10 mA.

Trip Logic: Field-selectable, normally open-/normally closed-triac, non-latching, automatic reset.

Start Trip Timer: 30 seconds.

Monitor Trip Delay: 3 seconds.

Retain first paragraph below for hazardous environments.

* + - * 1. 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.
				2. Operator Interface:

Vibration Set-Point Adjustment: Externally adjustable with tamperproof gradual dial.

Trip Indicator: Flashing red LED.

Digital Display: 2.5-digit numerical display of vibration level.

* + - * 1. Enclosure Construction:

Cast aluminum.

Screw-on cover.

NEMA 250, Type 4.

Electrical Connection: Two wires, 24 inches long.

Conduit Connection: 1/2-inch trade size, sealed entry.

Flange mounting adapter, as applicable.

* + - 1. COMBINATION VIBRATION SWITCH AND TRANSMITTERS
				1. Manufacturers: Subject to compliance with requirements, provide products by the following:

Johnson Controls

Metrix Instrument Co.

Siemens

Approved equivalent.

Requirements in remaining paragraphs are based on Metrix's "PRO6000 Series. ?Microprocessor based with fully programmable options.

* + - * 1. Description:

Input sensitivity.

Full-scale vibration range.

Mode: Peak or rms.

Trip delay.

Start delay.

Relay State: Latching or non-latching.

Relay: Non-energized, normally open or energized, normally closed.

* + - * 1. Accelerometer integral to unit with capability of multiple remote sensor inputs.

Instrument furnished with programming and setup software.

* + - * 1. Performance:

Frequency Range for Integral Accelerometer: 2 to 1000 Hz.

Ambient Temperature Limits: Minus 40 to 185 deg F.

Humidity: 100 percent condensing.

* + - * 1. Analog Output Current Signal:

Two-wire, 4- to 20-mA dc current source.

Signal capable of operating into 1000-ohm load.

* + - * 1. Digital Output Signal: [**Single**] [**Dual**] relay(s).
				2. Operator Interface:

USB or keypad configurable.

Digital Display: Two lines of display.

* + - * 1. Enclosure Construction:

Cast aluminum.

Screw-on cover.

NEMA 250, Type 4X.

Electrical Connection: Screw terminals.

Conduit Connection: 3/4-inch trade size.

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. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.
				3. Proceed with installation only after unsatisfactory conditions have been corrected.

Retain "Vibration Instrument Applications" Article below unless requirements for instruments for different applications are indicated on Drawings.

* + - 1. VIBRATION INSTRUMENT APPLICATIONS

Copy and edit paragraph below to suit each unique application requiring a different instrument type.

* + - * 1. <**Insert application**>: [**Mechanical switch**] [**Electronic switch**] [**Combination switch and transmitter**].
			1. INSTALLATION
				1. Install products level, plumb, parallel, and perpendicular with building construction.
				2. Use manufacturer's mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.
				3. Properly support instrument 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.
				4. 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. 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. IDENTIFICATION
				1. Identify system components, wiring, cabling, and terminals. Each piece of wire 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 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 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 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.

* + - * 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 set points indicated.
			1. ADJUSTING
				1. Occupancy Adjustments: When requested within [**12**] <**Insert number**> months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to [**two**] <**Insert number**> visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 230923.33