CITY OF FORT WAYNE MASTER UPDATED: 11/16/18

SECTION 26 29 13

MOTOR CONTROLLERS

1. GENERAL
	1. DESCRIPTION
		1. Scope:
			1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required for motor controllers.

NTS: Retain applicable Controllers and add others as required.

* + - 1. Motor Controllers included:
				1. Fractional Horsepower Manual Controllers
				2. Manual motor controllers.
				3. Combination full-voltage magnetic motor controllers.
				4. Combination reduced-voltage soft start motor controllers.
				5. Enclosures.
				6. Accessories.
				7. Identification.
		1. Coordination:
			1. To properly size circuit breakers, controllers, and control power transformers, obtain motor nameplate data on equipment being furnished under this and other contracts as required.
			2. To properly size control power transformers, obtain data on motor space heater and other accessories.
			3. Review installation procedures under this and other Sections and coordinate installation of items to be installed with or before motor controllers Work.
		2. Related Sections:

NTS: List below only sections covering products, construction, and equipment specifically identified in this section and specified in another section and directly referenced in this specification. Do not list administrative and procedural Division 01 sections.

* + - 1. Section 26 05 05, General Provisions for Electrical Systems.
			2. Section 26 05 53, Identification for Electrical Systems.
			3. Section 26 05 73, Electrical Power Distribution System Studies
			4. Section 26 09 13, Electrical Power Monitoring
			5. Section 26 24 19, Motor Control Centers
	1. REFERENCES

NTS: Retain applicable standards and add others as required.

* + 1. Standards referenced in this Section are:
			1. NEC Article 430, Motors, Motor Circuits, and Controllers.
			2. NEMA ICS 2, Controllers, Contactors and Overload Relays Rated 600 Volts.
			3. NEMA ICS 2‑110, General Standards for Manual and Magnetic Controllers.
			4. NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
			5. UL 508, Industrial Control Equipment
	1. definitions
		1. Definitions referenced in this Section are:
			1. CPT: Control power transformer.
			2. MCCB: Molded-case circuit breaker.
			3. MCP: Motor circuit protector.
			4. NC: Normally closed.
			5. OCPD: Overcurrent protective device.
			6. SCCR: Short-circuit current rating.
			7. SCPD: Short-circuit protective device.

NTS: Edit article “1.4” below to suit the Project. DO NOT DELETE (NOT USED) ITEMS.

* 1. SUBMITTALS
		1. Action Submittals: Submit the following:
			1. Product Data: For each type of product.

Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

Product Schedule: List the following for each enclosed controller:

Each installed controller type.

NRTL listing.

Factory-installed accessories.

Nameplate legends.

SCCR of integrated unit.

For each combination magnetic controller include features, characteristics, ratings, and factory setting of the SCPD and OCPD.

* + - 1. Shop Drawings
				1. Include plans, elevations, sections, and mounting details.
				2. indicate dimensions, weights, required clearances, and location and size of each field connection.
				3. Wire Termination Diagrams and Schedules:

Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance.

Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.

Differentiate between manufacturer-installed and field installed wiring.

* + - * 1. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
			1. Samples (NOT USED)
		1. Informational Submittals: Submit the following:
			1. Certificates (NOT USED)
			2. Delegated Design Submittal (NOT USED)
			3. Test and Evaluation Reports (NOT USED)
			4. Manufacturers’ Instructions (NOT USED)
			5. Source Quality Control Submittals (NOT USED)
			6. Field Quality Control Submittals
				1. Visual and Mechanical Inspection Report
				2. Electrical Test Report
				3. System Function Test Report
			7. Manufacturer Reports (NOT USED)
			8. Sustainable Design Submittals (NOT USED)
			9. Special Procedure Submittals (NOT USED)
			10. Qualifications Statements (NOT USED)
		2. Closeout Submittals.
			1. Maintenance Contracts (NOT USED)
			2. Operation and Maintenance Data
				1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:

Routine maintenance requirements for magnetic controllers and installed components.

Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.

Manufacturer's written instructions for setting field-adjustable overload relays.

Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

* + - 1. Bonds (NOT USED)
			2. Warranty Documentation
				1. Provide the warranty information as stated within the Contract Documents.
			3. Record Documentation
				1. Provide record documentation as stated within Contract Documents.
			4. Sustainable Design Closeout (NOT USED)
			5. Software (NOT USED)
		1. Maintenance Material Submittals.

NTS: Edit the required spare parts to suit the Project.

* + - 1. Spare Parts
				1. Fuses for Fused Switches: Equal to 10 percent of quantity installed of each size and type, but no fewer than three of each size and type.
				2. Control Power Fuses: Equal to 10 percent of quantity installed of each size and type, but no fewer than three of each size and type.
				3. Indicating Lights: Two of each type and color installed.
				4. Auxiliary Contacts: Furnish one spare for each size and type of magnetic controller installed.
				5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.
			2. Extra Stock Materials (NOT USED)
			3. Tools (NOT USED)
	1. QUALITY ASSURANCE
		1. Regulatory Requirements: Comply with the following:
			1. NEC Article 430, Motors, Motor Circuits, and Controllers.
			2. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.
		2. Testing Agency Qualifications: In addition to requirements specified in Section 26 01 26 independent testing agency shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or shall be full member company in InterNational Electrical Testing Association (NETA).
	2. DELIVERY, STORAGE, AND HANDLING
		1. Upon delivery, check materials and equipment for evidence of water that may have entered equipment during transit.
		2. Storage and Protection:
			1. Store motor controllers in a clean, dry location with controls for uniform temperature and humidity. Protect equipment with coverings and maintain environmental controls.
	3. COORDINATION
		1. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.
		2. Coordinate features, accessories, and functions of each motor controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.
		3. Coordinate communication with control circuits to which they connect.
1. - PRODUCTS
	1. MANUFACTURERS

NTS: Edit paragraph “A” to suit the Project.

* + 1. Manufacturers: Provide equipment by one of the following:
			1. Allen-Bradley (Rockwell Automation).
			2. Cutler-Hammer (Eaton).
			3. Siemens.
			4. Square D (Schneider Electric).
	1. MATERIALS

NTS: Edit paragraph “a”, below, to suit the Project.

* + 1. General: Motor controllers shall comply with NEMA ICS 2-110 and be provided as shown with the following ratings:
			1. Voltage: Voltage rating and number of wires shall be as shown or indicated on the Drawings.
			2. Wiring: NEMA Class II, Type B.
			3. Enclosure: Panel enclosures shall be required for area classifications specified in Section 26 05 05, General Provisions for Electrical Systems, unless otherwise indicated on on the Drawings.
			4. Interrupting Capacity Rating: Motor controller shall have an interrupting capacity rating of 65kAIC or as indicated on the Drawings. Devices shall be suitable for minimum rating indicated.
			5. NEMA 1 minimum motor starter size. Starter units completely draw out type in Sizes 1 and 2 and draw out type after disconnecting power leads only in Sizes 3 and 4.
			6. Overload Relays: Provide an overload relay for each motor controller. Overload relays shall be in accordance with the following:

NTS: Retain one version of paragraph “a”, below, and delete the other. The preference is for electronic overload relays. The first version is for thermal overload relays, and the second version is for electronic overload relays. Consider providing ground fault protection for motors 200-hp and larger, and for motors considered critical.

* + - * 1. Thermal Overload Relays: Relays shall be thermal, bimetallic type, direct or current sensing. Relays shall include ambient compensation and be equipped with separate heater elements sized for full-load amperes and service factor of actual motors furnished.
				2. Electronic Overload Relays: Relays shall be electronic type. Electronic relays shall be multi-function, adjustable, current sensing, type, and include overload, phase-unbalance, phase-loss, and equipment type ground fault in one package.
				3. Each overload relay shall be manual reset type and shall include provisions for resetting by an insulating button on front of starter unit door.
				4. Each overload relay shall include a normally-open auxiliary contact and a normally-closed auxiliary contact for remote alarm purposes.
				5. Size each overload relay for full-load amperes and service factor of actual motors installed.
			1. Individual control power transformers for all controllers, capacity as required for all control circuit devices, 100 VA minimum, Class A insulation, two primary fuses, 120-volt secondary, one secondary fuse, and the other secondary leg grounded.
			2. Motor horsepower shown are preliminary. Circuit breaker trips and starter overload heaters to be coordinated with the actual equipment installed.
			3. Auxiliary contacts, relays, timers as required for specified control functions and those shown on Drawings.
			4. Starter devices, including spare contacts, shall be wired to numbered terminal blocks.
			5. Control devices shall be 600-volt heavy duty, NEMA A600. Relays shall have convertible contacts.

NTS: Retain sections 2.2 thru 2.6 as required. Delete sections not required.

* 1. FRACTIONAL HORSEPOWER MANUAL CONTROLLERS
		1. "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
		2. Configuration: Non-reversing
		3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; Bimetallic.
		4. Mounting: Refer to Drawings for installation requirements.
		5. Pilot Light: Red.
	2. MANUAL MOTOR CONTROLLERS
		1. Low-Voltage Manual Motor Starters:

NTS: Edit paragraph “1.” to suit the Project.

* + - 1. Type: Toggle-operated, horsepower-rated, with thermal overload protection.
				1. Where shown or indicated on the Drawings, provide manual motor starters rated 600-volt, three-pole, 20-amp without overload protection for use as disconnects.
				2. Where shown or indicated on the Drawings, provide starters rated for 600-volt, three-pole; 240-volt, two-pole; or 120-volt, single-pole with amperage and horsepower rating as required for load to be controlled.
			2. Enclosure: As required for area classifications specified in Section 26 05 05, General Provisions for Electrical Systems.
			3. Identification: Identify controllers in accordance with Section 26 05 53, Identification for Electrical Systems. Identify per the equipment controlled.
			4. Controller shall comply with NEMA ICS 2‑110 and UL 508.
	1. COMBINATION MAGNETIC MOTOR CONTROLLERS
		1. Description: NEMA ICS 2, Class A, full voltage, non-reversing, across-the-line, unless otherwise indicated.
		2. Control Circuit: 120 V; obtained from integral control power transformer, unless otherwise indicated. Include control power transformer with adequate capacity to operate connected pilot, indicating and control devices, plus 100% spare capacity.

NTS: Edit paragraph “C.” to suit the Project.

* + 1. Combination Controller: Factory-assembled combination controller and disconnect switch with or without overcurrent protection as indicated.
			1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses indicated. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by Nationally Recognized Testing Laboratory.
			2. Circuit-Breaker Disconnect: NEMA AB 1, motor-circuit protector with field-adjustable short-circuit trip coordinated with motor locked-rotor amperes.

NTS: Edit paragraph “D.” to suit the Project.

* + 1. Overload Relay:
			1. Electronic solid state type with inverse-time-current characteristic, phase loss and phase unbalance protection.
			2. Provide NEMA Class 20 heaters or sensors in each phase matched to nameplate full load current of specific motor to which connected with appropriate adjustment for duty cycle.
			3. Enhanced Protection Overload Relay: Provide overload relays with NEMA Class 10 or better tripping characteristics for submersible equipment or where indicated. Select to protect motor against voltage unbalance and single phasing.
		2. When power factor correction capacitors are indicated provide termination lugs on line side of overload relays.
		3. Time Delay Restart Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection.
			1. Provide in starter enclosure for Size 2 and larger starters.
			2. Delay initial motor start.
			3. Delay motor restart due to starter dropout caused by undervoltage or starter coil circuit interruption for maintained control circuits.
			4. Adjustable on delay from 0.15 to 30.0 sec; set at 10.0 sec.
			5. Connect control relay in motor starter coil circuit.
			6. Coordinate control relay section with motor starter to cause motor starter to drop out at voltage slightly higher than dropout voltage of starter and have dropout time slightly faster than motor starter to ensure if motor starter drops out, relay will drop out.
	1. COMBINATION REDUCED-VOLTAGE SOFT START MOTOR CONTROLLERS
		1. Design, fabricate, and test combination reduced-voltage soft start motor controllers in accordance with NEMA ICS 2 and NEMA 250.

NTS: Edit paragraph “B”, below, to suit the project. Coordinate indication for power loss. Add auxiliary contact on circuit breaker, when required.

* + 1. General:
			1. Provide solid-state, step-less, current limiting, soft-start, motor controllers (RVSS) as shown or indicated on the Drawings.
			2. RVSS shall be three-phase type and shall include an overload relay and isolation contactor.
			3. Provide subsystems that will protect RVSS from damage due to over-current and over-voltage.
			4. Current Rating: 115 percent of motor nameplate rated current, continuous, minimum.
		2. Required Features:
			1. Adjustable current limit of not more than 250 percent of motor nameplate full-load current throughout entire motor acceleration period including first three cycles of voltage waveform from instant start signal is engaged.
			2. Adjustable voltage acceleration, from two to 30 seconds.
			3. Adjustable voltage deceleration, from two to 30 seconds.
			4. Phase loss detection.
			5. LED diagnostic indicators.
			6. Static over-current and over-voltage trip.
			7. Phase reversal, line or fuse loss, and under-voltage protection.
			8. Power unit over temperature protection.
			9. Motor inverse time overload protection.
			10. Input line transient over-voltage protection.
		3. Enclosure:
			1. Cooling fans, if required, shall incorporate anti-friction bearings and internal impedance type motor protection.
		4. If cooling fans are used, install in accordance with NEMA ICS 1-110 by motor control center manufacturer.
		5. On start-up, start driven equipment at zero current and allow driven equipment to accelerate to maximum speed without exceeding the set current limit.
		6. On normal shutdowns, ramp driven equipment down at set deceleration rate that is non-regenerative for motor prior to shutdown.
		7. On emergency shutdowns, remove power to motor.
		8. Diagnostic LEDs: Provide LEDs on unit front that indicate the following:
			1. Control power on.
			2. Motor power on.
			3. Motor starting.
			4. Motor fault.
			5. RVSS fault.
		9. Control Outputs:
			1. Control output shall be electrically isolated, dry, normally open SPDT contacts, rated 10 amps at 120 vac.
			2. Provide the following control outputs:
				1. i. Motor running.
				2. ii. Motor fault.
				3. iii. RVSS fault.
		10. Overload Relays: Provide an overload relay for each motor controller. Overload relays shall be in accordance with:

NTS: Retain one version of paragraph “1”, below, and delete the other. Use the first version for thermal overload relays, and use the second version for electronic overload relays. Consider providing ground fault protection for motors 200 hp and larger, and for motors considered to be critical.

* + - 1. Thermal Overload Relays: Relays shall be thermal, bimetallic type, direct or current sensing. Relays shall include ambient compensation and be equipped with separate heater elements sized for full load amperes and service factor of actual motors furnished.
			2. Electronic Overload Relays: Relays shall be electronic type, multi-function, adjustable, current sensing type, that include overload, phase-unbalance, phase-loss, and equipment type ground fault in one package.
			3. Each overload relay shall be manual-reset type and include provisions for resetting by an insulating button on front of starter unit door.
			4. Overload relay shall include normally-open auxiliary contact for remote alarm purposes.
			5. Size overload relay for full-load amperes and service factor of actual motors installed.
		1. Pushbuttons, selector switches, pilot lights, and other devices shall be as shown on the Drawings and in accordance with Section 26 24 19 Motor Control Centers.
		2. Provide nameplate identifying equipment controlled in accordance with Section 26 05 53, Identification for Electrical Systems.
	1. CONTROL ACCESSORIES
		1. Pilot devices shall be 30.5 mm, LED and oil tight.
		2. Pilot Lights: Push to test “Run” and “Stopped” pilot lights.
		3. Pilot Lights shall have lens colors as shown or indicated. Where no color is indicated, provide the following lens colors:

|  |  |
| --- | --- |
| **Color** | **Legend** |
| Red | Running, Open |
| Green | Stopped, Closed |
| Amber | Alarm |
| Blue | Power |
| White | Status |

* + 1. Local Off Remote Selector Switches: Where Indicated.
			1. Maintained position unless specified elsewhere.
			2. Contact Blocks:
				1. Double break silver contacts.
				2. Ac Ratings: 7,200 va make, 720 va break.
				3. Single pole, double throw or double pole, single throw.
				4. Up to six tandem blocks.
			3. Operators:
				1. Number of positions as specified elsewhere.
				2. Standard knob type unless specified elsewhere.
			4. Legend plates as required for type of operation or specified elsewhere.
	1. SOURCE QUALITY CONTROL

NTS: The factory tests specified in paragraph “A”, below, are standard, non-witnessed tests. When witness tests are required, edit this article to include such requirements. Coordinate witness testing with project requirements and edit paragraph “A” to suit the Project.

* + 1. Prior to shipping, perform factory tests on motor controllers. Tests shall include manufacturer’s standard tests and the following:
			1. Physical inspection and checking of components.
			2. Mechanical operation and device functionality tests.
			3. Primary, control, and secondary wiring hi-pot tests.
1. EXECUTION
	1. INSPECTION
		1. Examine conditions under which Work will be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.
	2. INSTALLATION
		1. General:
			1. Install equipment in accordance with the Contract Documents, Laws and Regulations, and manufacturer’s installation instructions.
			2. Install equipment so that sufficient access and working space is provided for ready and safe operation and maintenance.
			3. Securely fasten equipment to walls or other surfaces on which equipment is mounted. Provide suitable 1/4-inch spacers so that enclosure is not installed directly against walls. Provide supports to rigidly support equipment reasonably close to motor where no wall or surface capable of supporting equipment exists.

+ + END OF SECTION + +