# SECTION 16480 - PROVISIONAL

## 600 VOLT CLASS MOTOR CONTROL CENTERS

***Provisional Specification Summary:***
*1.3.01 - Add section as shown below.*
*1.7 thru 1.9.02 - Add sections as shown below.*
*2.6 thru 2.12.02 - Add sections as shown below.*
*3.1.02 thru 3.1.03 - Add sections as shown below.*
*3.2 thru 3.8.02.06 - Add sections as shown below.*

1.3.01 Shop Drawings. Submit to the Contracting Officer, in accordance with Section 01080, shop drawings and product data, for the following:

Equipment outline drawings showing elevation and plan views, dimensions, weight, shipping splits and metering layouts. Indicate all options, special features, ratings and deviations from this Section.

Conduit entrance drawings.

Unit summary tables showing detailed equipment description and nameplate data for each compartment.

Product data sheets and catalog numbers for over-current protective devices, motor starters control relays, control stations, meters, pilot lights, etc. List all options, trip adjustments and accessories furnished specifically for this project.

Provide custom unit elementary drawings showing interwiring and interlocking between units and to remotely mounted devices. Show wire and terminal numbers. Indicate special identifications for electrical devices per the Drawings.

Instruction and renewal parts books.

Itemized list of spare parts furnished specifically for this project, including quantities, description and part numbers.

1.7 REFERENCE STANDARDS

1.7.01 Motor control centers shall be designed, built and tested in accordance with NEMA Standard ICS-2 and Underwriters Laboratories (UL) Standard No. UL-845. Equipment shall conform to ANSI C19.3 test standards and the requirements of the National Electric Code (NEC).

1.7.02 Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.8 QUALITY ASSURANCE. The motor control center shall be the product of a manufacturer who shall also be the manufacturer of all the circuit breakers, fused switches and motor starters included in the motor control center.

1.8.01 Motor control centers shall be designed, assembled and tested by the manufacturer of the motor control equipment included in the control center assembly.

1.8.02 Motor control centers shall receive Arc Flash Analysis Certification.

1.9 SPARE PARTS

1.9.01 Provide the following spare parts in the quantities specified:

1.9.01.01 One dozen each size of cover bolts, cage nuts and door fasteners.

1.9.01.02 Five (5) cans of aerosol touch-up paint.

1.9.01.03 100 percent replacement fuses, all types and sizes.

1.9.01.04 Ten percent, with a minimum of one of motor starter coils of each size used.

1.9.01.05 Twenty percent or minimum of two 2 replacement overload heaters of each size and range used.

1.9.02 Spare parts shall be boxed or packaged for long term storage. Identify each item with manufacturers name, description and part number on the exterior of the package.

2.6. STRUCTURAL.

2.6.01 Structures shall contain a horizontal wireway at the top, isolated from the horizontal bus and shall be readily accessible through a hinged cover. Adequate space for conduit and wiring to enter the top or bottom shall be provided without structural interference. Include fish-tape barriers.

2.6.02 Compartments for mounting control units shall be incrementally arranged such that not more than six (6) size 1 starters for front mounted only can be mounted within each vertical structure. Guide rails shall be provided.

2.6.03 A vertical wireway with minimum of 35 square inches of cross sectional area shall be adjacent to each vertical unit and shall be covered by a hinged door. Wireways shall contain steel rod cable supports.

2.6.04 All full voltage starter units through NEMA Size 5 shall be of the drawout type. Draw-out provisions shall include a positive guide rail system and stab shrouds to absolutely ensure alignment of stabs with the vertical bus. Draw-out units shall have a tin-plated stab assembly for connection to the vertical bus. No wiring to these stabs shall extend into the bus compartment.

2.6.05 Interior of all units shall be painted white for increased visibility. Units shall be equipped with side-mounted, positive latch pull-apart type control terminal blocks rated 600-volts. Knockouts shall be provided for the addition of future terminal blocks. In addition, a master terminal block, when Type C wiring is specified, shall be drawout and shall be located in the bottom wireway, readily accessible through a hinged cover. All control wire to be 14 gauge minimum.

2.6.06 All drawout units shall be secured by a spring-loaded quarter turn indicating type fastening device located at the top front of the unit. Each unit compartment shall be provided with an individual front door.

2.6.07 An operating mechanism shall be mounted on the primary disconnect of each starter unit. Separation between ON and OFF on selector switches should be 90 degree or more apart. It shall be mechanically interlocked with the unit door to prevent access unless the disconnect is in the OFF position. A defeater shall be provided to bypass this interlock. With the door open, an interlock shall be provided to prevent inadvertent closing of the disconnect. A second interlock shall be provided to prevent removal or re-insertion of the unit while in the ON position. Padlocking facilities shall be provided to positively lock the disconnect in the OFF position with from one (1) to three (3) padlocks with the door open or closed. In addition, means shall be provided to padlock the unit in a partially withdrawn position with the stabs free of the vertical bus.

2.7 BUS.

2.7.01 Each structure shall contain a main horizontal copper tin plated bus, with minimum capacity as shown on the drawings. The horizontal bus shall be rated at 50 degree C temperature rise over a 40 degree C ambient in compliance with UL standards. Vertical busses feeding unit compartments shall be copper and shall be securely bolted to the horizontal main bus. All joints shall be front accessible for ease of maintenance. The vertical bus shall have a minimum rating of 300 amperes for front mounted units and 600 amperes for back-to-back mounted units.

2.7.02 The vertical bus shall be completely isolated and insulated. It shall effectively isolate the vertical busses to prevent any fault generated gases to pass from one phase to another. The vertical bus shall include a shutter mechanism to provide complete isolation of the vertical bus when a unit is removed.

2.7.03 Busses shall be rated for continuous ratings indicated on Project Drawings and braced for 65,000amperes RMS symmetrical.

2.8 WIRING/TERMINATIONS. Wiring shall be NEMA Class I, Type B.

2.9 MOTOR CONTROLLERS. Combination starter units shall be full-voltage non-reversing, unless otherwise shown, and shall utilize motor circuit protectors (MCP).

2.9.01 Each combination unit shall be rated 65,000 AIC symmetrical at 480V. The MCP shall provide adjustable magnetic protection and be provided with pin insert to stop magnetic adjustment at 1300 percent motor nameplate full load current to comply with NEC requirements. All MCP combination starter units shall have a "tripped" position on the unit disconnect and a push-to-test button on the MCP. MCP shall include transient override feature for motor inrush current. MCP breakers shall be magnetic only type.

2.9.02 Motor starters shall be similar to Cutler-Hammer type ADVANTAGE, electrically operated, electrically held, three-pole assemblies with arc extinguishing characteristics and shall have silver-to-silver renewable contacts. They shall have provisions for a total of four (4) NO or four (4) NC auxiliary contacts. The overload protection shall consist of one (1) current sensor located in each phase monitored by the Microprocessor that yields a time current curve closely paralleling that of motor heating damage boundary, accurate to 2 percent. Running overload protection shall be DIP switch selectable for the specific motor full load amperes within the starter range. Provide DIP switch selectable overload trip class of 10, 20 and 30.

2.9.03 Motor starters shall monitor current in each phase to provide phase loss and phase unbalance protection, such that if the unbalance on any of two phases is greater than 30 percent of the DIP switch selected trip rating, a phase loss/unbalance trip occurs. Provide phase loss/unbalance protection that requires no time delay for reset.

2.9.04 Motor starters shall provide ground fault protection. Ground fault protection shall be set at 20 percent of maximum continuous ampere rating and have a start delay of 20 seconds, and a run delay of 1 second to prevent nuisance trip on starting. Microprocessor shall measure control circuit voltage and prevent closing of the coil on low-voltage (78 volts AC) and/or high-voltage (135 volts AC) conditions that are outside of the coil ratings.

2.9.05 Microprocessor shall apply voltage to the coil such that a guaranteed maximum of two (2) milliseconds of main contact bounce occurs on contactor closure.

2.9.06 Microprocessor shall continuously measure coil circuit voltage and current so as to maintain constant coil power at a level to maintain main contact closure and minimize coil power consumption.

2.9.07 Provide Control Modules to perform the indicated input/output control functions shown on the drawings. Module to incorporate faceplates having membrane type pushbuttons and LEDs. All pushbutton and LED functions to be furnished with clearly written identification. Modules to be provided with the ability to replace conventional start, stop, hand, auto, and control functions, and when utilized in starter applications, overload reset function. Modules to be provided with the ability to replace conventional indicating light status of run, off, selector switch pushbutton position, and when utilized in starter applications, overload alarm and overload trip.

2.9.08 Provide, where indicated on the drawings, a Metering Module capable of displaying control voltage, status and where utilized on starter applications, cause of trip, current at time of trip and current in each phase.

2.9.09 Provide an addressable communication card capable of transmitting all data over a compatible two-wire local area network to a central computer control center for storage and/or printout. The network shall be capable of transmitting data in Ethernet format. The Ethernet protocol must be via a device that is native to the MCC; multiple conversions will not be accepted. All necessary software and hardware must be also be submitted that provides real time diagnostics and MCC documentation via Ethernet. The network shall also be capable of transmitting data in RS232c format via a translator module.

ON-OFF reset control functions

Status (ON, OFF, TRIPPED, NO RESPONSE)

Current in each phase

Percent phase unbalance

Control voltage

Overload protection settings

Cause of trip

Trip current magnitude

2.9.10 Each starter shall be equipped with a fused control power transformer, two (2) indicating lights, HOA selector switch, and two (2) NO contacts, unless otherwise scheduled on the drawings. Device panel to have space to accommodate six (6) oil-tight pilot-control devices or indicating ammeters, voltmeters, or elapsed time meters.

2.10 OVERCURRENT DEVICES. Circuit breakers shall have individual feeder breakers with a minimum interrupting capacity of 65 kA symmetric at rated voltage or as scheduled on the drawings.

2.11 INCOMING FEEDER TERMINATIONS AND DEVICE. Incoming cable shall terminate within the control center on a main lug termination point. Main lug terminations shall have adequate dedicated space for the type and size of cable used and the lugs shall be standard mechanical screw with antiturn feature.

2.12 ENCLOSURES.

2.12.01 The type of enclosure shall be in accordance with NEMA standards for type 12 with gasketed doors. All enclosing sheet steel, wireways and unit doors shall be gasketed. MCC shall be Flash-Guard protected.

2.12.02 All MCCs shall have an IR window on front panel for taking thermography. The window should meet IEEE C.37.20.7 standard and made by Hawk IR.

3.1.02 Provide the services of a qualified factory-trained manufacturer's representative to assist the contractor in installation and start-up of the equipment specified under this section for a period of 3 working days. The manufacturer's representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.

3.1.03 The following minimum work shall be performed by the Contractor under the technical direction of the manufacturer's service representative:

Rig the MCC assembly into final location and install on level surface.

Check all removable cells and starter units for easy removal and insertion.

Perform insulation tests on each phase and verify low-resistance ground connection on ground bus.

Connect all power wiring and control wiring and verify basic operation of each starter from control power source.

Torque all bolted connections made in the field and verify all factory bolted connections.

Calibrate any solid-state metering or control relays for their intended purpose and make written notations of adjustments on record drawings. Perform startup of any solid-state starters and adjustable frequency drives.

The Contractor shall provide three (3) copies of the manufacturer's field startup report.

3.2 EXAMINATION. Installing Contractor to fully inspect shipments for damage and report damage to manufacturer and file claim upon shipper, if necessary. Overload relay heater ratings must be properly sized and coordinated for each motor starter unit.

3.2.01 Installing Contractor to verify NEC clearances as dictated on the contract drawings prior to installation. Verify UL labeling of the assembly prior to installation.

3.3 FACTORY TESTING. The motor control centers shall have been tested in a high-power laboratory to prove adequate mechanical and electrical capabilities.

3.3.01 All factory tests required by the latest ANSI, NEMA and UL standards shall be performed.

3.3.02 The manufacturer shall provide three (3) certified copies of factory test reports. Factory tests as outlined above shall be witnessed by the owner's representative. The manufacturer shall notify the owner two (2) weeks prior to the date the tests are to be performed.

3.3.03 The manufacturer shall include the cost of transportation and lodging for up to three (3) owner's representatives. The cost of meals and incidental expenses shall be the owner's responsibility.

3.4 INSTALLATION. Contractor to follow the installation instructions supplied by the manufacturer.

3.4.01 Control wiring shall be as shown on the contract drawings except as modified by the approval and submittal process. Interface all local and remote devices into the control wiring and operational systems for each load.

3.5 FIELD ADJUSTMENTS. Follow the manufacturer's instructions and the contract documents concerning any short-circuit device settings, heater selection, timing relays, or startup of components.

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3.6 FIELD TESTING. Follow the minimum requirements as stipulated in the NETA testing procedure for this type of motor control center assembly.

3.6.01 Generate a field report on tests performed, test values experienced, etc., and make available to owner upon request.

3.7 MANUFACTURER'S CERTIFICATION. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations. Equipment shall be inspected prior to the generation of any reports.

3.7.01 The Contractor shall provide three (3) copies of the manufacturer's representative's certification.

3.8 TRAINING. The Contractor shall provide a training session for up to 3 owner's representatives for 4 normal workdays at the jobsite or other office location chosen by the owner.

3.8.01 The training session shall be conducted by a manufacturer's qualified representative.

3.8.02 The training program shall consist of the following:

Review of the MCC one-line drawings and schedules

Review of the factory record shop drawings and placement of the various cells

Review of each type of starter cell, components within, control, and power wiring

Review contactor coil replacement and contact replacement procedures.

Discuss the maintenance timetable and procedures to be followed in an ongoing maintenance program.

Provide three-ring binders to participants complete with copies of as-built drawings and other course material covered.

End of Provisional Section