SECTION 16480

MOTOR CONTROL CENTER

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the General Requirements for Motor Control Centers (MCC) at ANC.

1.2 QUALITY ASSURANCE

A. Equipment shall be of the latest approved design as manufactured by Square D Company to match equipment provided in the C Concourse Phase 2 Building Completion Package. MCCs shall be in conformity with the requirements set forth by Underwriters' Laboratories publication UL-845, NEMA publication number ICS-2-322 and the National Electrical Code.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Shall be Square D Company Class 8998 Model 6 MCC.

B. Additions to existing MCCs shall be the same as the original manufacturer.

2.2 MATERIALS

A. Steel material shall comply with UL 845 and CSA requirements.

B. Each MCC shall consist of one or more vertical sections of heavy gauge steel bolted together to form a rigid, freestanding assembly. A removable 7 gauge structural steel lifting angle shall be mounted along the full width of the MCC lineup at the top. Removable 7 gauge bottom channel sills shall be mounted underneath front and rear of the vertical sections extending the full width of the lineup. Vertical sections made of welded side-frame assembly formed from a minimum of 12 gauge steel. Internal reinforcement structural parts shall be of 11 gauge steel to provide a strong, rigid assembly. The entire assembly shall be constructed and packaged to withstand all stresses included in transit and during installation.

2.3 FINISH

A. All steel parts (except plated parts) shall be provided with UL Listed and CSA certified acrylic/alkyd baked enamel paint finish. All painted parts shall undergo a multi-stage treatment process, followed by the finishing paint coat.

B. The standard paint finish shall be tested to UL 50 per ASTM B117 (5% ASTM salt spray) with no greater than 0.125 in (3 mm) loss of paint from a scribed line.

C. Paint color shall be #49 medium light gray per ANSI standard Z55.1-967 (60-70 gloss) on all surfaces, unless otherwise specified. Control station plates and escutcheon plates shall be painted a contrasting gray. All unit component mounting pans for combination starters shall be painted white for better visibility inside the unit.

2.4 STRUCTURES

A. Structures shall be totally enclosed, dead-front, freestanding assemblies. Structures shall be capable of being bolted together to form a single assembly.

B. The overall height of the MCC shall not exceed 90 in (2286 mm) (not including base channel). Base channels, of 1.5 in (38 mm) in height, shall be removable. The total width of one section shall be 20 in (508 mm). The depth of the MCC shall be 20 in (508mm).

C. Structures shall be NEMA 12 (industrial duty).

D. Each section shall have all the necessary hardware and bussing for modular plug-in units to be added and moved around. All unused space shall be covered by hinged blank doors and equipped to accept future units. Vertical bus openings shall be covered by manual bus shutters.

E. Each section shall include a top plate (single piece or two-piece). NEMA 12 units shall also include a bottom plate. Top and bottom plates shall be removable for ease in cutting conduit entry openings.

2.5 WIREWAYS

A. Structures shall contain a minimum 12 in (305 mm) high horizontal wireway at the top of each section and a minimum 6 in (152 mm) high horizontal wireway at the bottom of each section. These wireways shall run the full length of MCC to allow room for power and control cable to connect between units in different sections.

B. A full-depth vertical wireway shall be provided in each MCC section that accepts modular plug-in units. The vertical wireway shall connect with both the top and bottom horizontal wireway and shall be isolated from unit interiors by a full height barrier. The vertical wireway shall be 4 in (102 mm) wide minimum with a separate hinged door. There shall be a minimum of 4,000 in^3 (65,548 m^3) of cabling space available. Access to the wireways shall not require opening control unit doors. Structures that house a single, full section control unit are not required to have vertical wireways. Those control units shall open directly into the MCC horizontal wireways.

2.6 BARRIERS

A. All power bussing and splice connections shall be isolated from the unit compartments and the wireways. The horizontal bus shall be mounted onto a glass filled polyester support assembly that braces the bus against the forces generated during a short circuit. The horizontal bus shall be isolated from the top horizontal wireway by a two-piece grounded steel barrier. This barrier shall be removable to allow access to the bus and connections for maintenance.

B. The vertical bus shall be housed in a molded glass-filled polyester support that provides bus insulation and braces the bus against the forces generated during a short circuit. These supports shall have openings every 3 in (75 mm) for unit stab-on connections. Each opening shall be provided with a manual shutter to close off the stab opening. These shutters shall be attached to the structure so that when they are removed (to allow a stab connection) they are retained in the structure and are readily accessible for use should a plug-in unit be removed from the MCC.

C. Barriers shall be provided in the vertical structure and unit designs to prevent the contact of any energized bus or terminal by a fishtape inserted through the conduit or wireway areas.

2.7 BUSSING

A. All bussing and connectors shall be tin-plated copper.

B. The main horizontal bus shall be rated at 600 A continuous and shall extend the full length of the MCC. Bus ratings shall be based on 65° C maximum temperature rise in a 40° C ambient. Provisions shall be provided for splicing additional sections onto either end of the MCC.

C. The horizontal bus splice bars shall be pre-assembled into a captive bus stack. This bus stack shall be installed into the end of the MCC power bus to allow the installation of additional sections. The main bus splice shall utilize four bolts, two on each side of the bus split, for each phase. Additional bolts shall not be required when splicing higher amperage bus. The splice bolts shall secure to self clenching nuts installed in the bus assembly.

D. Each section that accepts plug-in units shall be provided with a vertical bus for distributing power from the main bus to the individual plug-in starter units. This bus shall be of the same material and plating as the main bus, and shall be rated at 300 A continuous. The vertical bus shall be connected directly to the horizontal bus stack without the use of risers or other intervening connectors. When a back-to-back unit arrangement is utilized, separate vertical bus shall be provided for both the front and rear units.

E. A tin-plated copper ground bus shall be provided that runs the entire length of the MCC. The ground bus shall be 0.25 in (6.0 mm) x 1.0 in (25 mm) and be rated for 300 amps. A compression lug shall be provided in the MCC for a 4/0-250 kcmil ground cable. The ground bus shall be provided with (6) 0.38 in (10 mm) holes for each vertical section to accept customer-supplied ground lugs for any loads requiring a ground conductor.

F. Each vertical section shall have a copper vertical ground bus that is connected to the horizontal ground bus. This vertical ground bus shall be installed so that the plug-in units engage the ground bus prior to engagement of the power stabs and shall disengage only after the power stabs are disconnected upon removal of the plug-in unit.

G. The power bus system shall be braced for a short circuit capacity of 42,000 rms amperes minimum.

2.8 WIRING:

A. The control center wiring shall be NEMA Class I, Type B.

B. As defined by NEMA Standard ICS-2-322, Class I control centers shall include no interconnections between control units.

C. Type B wiring shall include terminal blocks mounted on lift out brackets in the units.

2.9 UNIT CONSTRUCTION

A. Units with circuit breaker disconnects through 250 A frame, and fusible switch disconnects through 200 A, shall connect to the vertical bus through a spring reinforced stab-on connector. Units with larger disconnects shall be connected directly to the main horizontal bus with appropriately sized cable or riser bus. Stabs on all plug-in units shall be solidly bussed to the unit disconnect. Cabled stab assemblies are not permitted.

B. All conducting parts on the line side of the unit disconnect shall be shrouded by a suitable insulating material to prevent accidental contact with those parts.

C. Unit mounting shelves shall include hanger brackets to support the unit weight during installation and removal. All plug-on units shall use a twin-handle camming lever located at the top of the bucket to rack in and out the plug-on unit. The cam lever shall work in conjunction with the hanger brackets to ensure positive stab alignment.

D. A metal handle operator shall be provided on each disconnect. With the unit stabs engaged into the vertical phase bus and the unit door closed, the handle mechanism shall allow complete ON/OFF control of the unit disconnect with clear indication of the disconnects status. All circuit breaker operators shall include a separate TRIPPED position to clearly indicate a circuit breaker trip condition. It shall be possible to reset a tripped circuit breaker without opening the control unit door.

E. A mechanical interlock shall prevent the operator from opening the unit door when the disconnect is in the ON position. Another mechanical interlock shall prevent the operator from placing the disconnect in the ON position while the unit door is open. It shall be possible for authorized personnel to defeat these interlocks.

F. A non-defeatable interlock shall be provided between the handle operator and the cam lever to prevent installing or removing a plug-on unit unless the disconnect is in the OFF position.

G. The plug-in unit shall have a grounded stab-on connector which engages the vertical ground bus prior to, and releases after, the power bus stab-on connectors.

H. Provisions shall be provided for locking all disconnects in the OFF position with up to three padlocks.

I. Handle mechanisms shall be located on the left side to encourage operators to stand to the left of the unit being switched.

J. Unit construction shall combine with the vertical wireway isolation barrier to provide a fully compartmentalized design.

2.10 COMPAC Ô 6 UNIT CONSTRUCTION

A. Units with circuit breaker disconnects through 100 A frame, and fusible switch disconnects through 100 A, shall connect to the vertical through a spring-reinforced stab-on connector. Stabs on all plug-on units shall be cable connected to the unit disconnect. Compac™ 6 fusible units shall accept Class J fuses only and to be rated for 100,000 AIR (amperes interrupting rating) at 600 volts. Compac™ 6 units with breakers shall be rated for 65,000 AIR at 480 volts.

B. All conducting parts on the line side of the unit disconnect shall be shrouded by a suitable insulating material.

C. Unit mounting shelves shall include hanger brackets to support the unit weight during installation and removal. All Compac™ 6 plug-on units shall be installable without the assistance of a camming device so as to allow maximum accessibility with the unit installed.

D. A metal handle operator shall be provided on each disconnect. With the unit stabs engaged into the vertical phase bus and the unit door closed, the handle mechanism shall allow complete ON/OFF control of the unit disconnect with clear indication of the disconnects status. All circuit breaker operators shall include a separate TRIPPED position to clearly indicate a circuit breaker trip condition. It shall be possible to reset a tripped circuit breaker without opening the control unit door.

   1. A mechanical interlock shall prevent an operator from opening the unit door when the disconnect is in the ON position. Another mechanical interlock shall prevent an operator from placing the disconnect in the ON position while the door is open. It shall be possible for authorized personnel to defeat these interlocks.

   2. A non-defeatable interlock shall be provided between the handle operator and the structure to prevent installing or removing a plug-on unit unless the disconnect is in the OFF position. The plug-on unit shall have a grounded stab-on connector which engages the vertical ground bus prior to, and releases after, the power bus stab-on connectors.

E. Provisions shall be made for locking all disconnects in the OFF position with up to three padlocks.

F. Handle mechanisms shall be located on the bottom left side of the unit and operate horizontally to encourage operators to stand to the left of the unit being switched.

G. Unit construction shall combine with the vertical wireway isolation barrier to provide a fully-compartmentalized design.

H. Each vertical section shall hold up to a twelve Compac™ 6 units without placement restrictions in new or existing applications.

2.11 COMPONENTS

A. Combination Starters

1. Combination starters shall utilize a unit disconnect as specified in the previous article. Square D Company Type S magnetic starters shall be furnished in all combination starter units. All starters shall utilize NEMA rated contactors. Starters shall be provided with 3-pole, external manual reset, overload relay for solid state motor overload protection.

2. Control circuit transformers shall include internal primary protection 280 V to 480 V (separate primary fuse on 600 V) and one secondary fuse (in the non-ground secondary conductor). The transformer shall be sized to accommodate the contactor(s) and all connected control circuit loads. The transformer rating shall be fully visible from the front when the unit door is opened.

3. When a unit control circuit transformer is not provided, the disconnect shall include an electrical interlock for disconnection of externally powered control circuits.

4. Auxiliary control circuit interlocks shall be provided where indicated. Auxiliary interlocks shall be field convertible to normally open or normally closed operation.

5. NEMA Size 1-4 starters shall be mounted directly adjacent to the wireway so that power wiring (motor leads) shall connect directly to the starter terminals without the use of interposing terminals. Larger starters shall be arranged so that power wiring may exit through the bottom of the starter cubical without entering the vertical wireway.

B. Terminal Blocks

1. Terminal blocks shall be the pull-apart type 600 volt and rated at 25 amps. All current carrying parts shall be tin plated. Terminals shall be accessible from inside the unit when the unit door is opened. Terminal blocks shall be DIN rail mounted with the stationary portion of the block secured to the unit bottom plate. The stationary portion shall be used for factory connections, and shall remain attached to the unit when removed. The terminals used for field connections shall face forward so they can be wired without removing the unit or any of its components.

2. Type B wiring: all starter units shall be provided with unit control terminal blocks.

2.12 COMPONENTS FOR COMPAC$^{\hat{O}}$ 6 UNITS

A. Compac™ 6 Combination Starters

1. Compac™ 6 combination starters shall use a unit disconnect as specified in the previous article. NEMA rated units shall use Square D Company Type S magnetic starters and shall be furnished in all Compac™ 6 combination starter units. All starters shall use NEMA-rated contactors. Starter units shall be provided with a 3-pole, external manual reset, overload relay for solid state motor overload protection.

2. Control circuit transformers shall include internal primary protection 280 V to 480 V (separate primary fuse on 600 V), and one secondary fuse (in the non-ground secondary conductor.) The transformer shall be sized to accommodate the contactor(s) and all connected control circuit loads.

3. When a unit control circuit transformer is not provided, the disconnect shall include an electrical interlock for disconnection of externally powered control circuits.

4. Auxiliary control circuit interlocks shall be provided where indicated. For NEMA rated starters, auxiliary interlocks shall be field convertible to normally open or normally closed operation.

5. NEMA Size 1 starters shall be mounted directly adjacent to the wireway so that power wiring (motor leads) will connect directly to the starter terminals.

B. Terminal Blocks for Compac™ 6 Units

1. Starter units shall be provided with unit control terminal blocks.

2. Terminal blocks shall be pull-apart type, 250 V, and rated for 10 amperes. All current-carrying parts shall be tin-plated. Terminals shall be accessible from inside the unit when the unit door is opened. The stationary portion of the terminal block shall be used for factory connections and will remain attached to the unit when the portion used for field connections is removed. The terminals used for field connections shall be accessible so they can be wired without removing the unit or any of its components.

2.13 NAMEPLATES

A. Provide per Specification Section 16010 – Electrical General Provisions.

1. First line shall be MCC name.

2. Second line shall be voltage and phase.

3. Third line shall indicate if MCC is "NORMAL" (black background), or "STANDBY" (yellow background).

4. Fourth line shall indicate source of power “Panel designation – disconnect number”.

2.14 ADDITIONAL FEATURES:

A. Provide the following additional features and options

1. All required fuses and spares, and a spare fuse cabinet by each MCC.

2. 120 volt coil control voltage.

3. Red running pilot lights in cover of all starters.

4. H.O.A. switch in cover of all starters unless otherwise required.

5. Control transformer with fuse protection, for each starter, 480/120 volts, sized for the individual application.

2.15 QUALITY CONTROL

A. The entire MCC shall go through a quality inspection before shipment. This inspection will include physical inspection of the structure and electrical conductors; including bussing, and general wiring. The quality inspection shall include general electrical tests of the power circuit phasing, control circuit wiring, instrument transformers, meters, ground fault system, and device electrical operation. The quality inspection shall include AC dielectric tests of the power circuit and control circuits.

B. The MCC Markings/Labels shall include instructional type, Underwriters Laboratory (UL)/Canadian Standards Association (CSA), and inspector's stamps.

C. The manufacturer shall use integral quality control checks throughout the manufacturing process to ensure that the MCC meets operating specifications.

2.16 SHORT CIRCUIT CURRENT RATING

A. Each MCC, as a complete unit, shall have a minimum short circuit current rating (SCCR) equal to or greater than 30,000 A at 480 volts as required by the application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install items in accordance with manufacturer's instruction and applicable code requirements.

B. Provide fuses for all fused disconnect switches. Size fuses in accordance with nameplate requirements for each load served.

C. Provide overloads for all starters. Size overloads in accordance with nameplate requirements for each load served.

END OF SECTION