SECTION 16480100
LOW VOLTAGE MOTOR CONTROL CENTERS - 8000 LINE
WITH POWER MANAGEMENT

PART 1 GENERAL

A. The requirements of the Contract, Division 1, and Division 16 apply to work in this Section.

1.01 SECTION INCLUDES

A. Low Voltage Motor Control Center with Power Management

1.02 RELATED SECTIONS

1.03 REFERENCES

The motor control centers and protection devices in this specification are designed and manufactured according to latest revision of the following standards (unless otherwise noted).

A. ANSI/NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum)

B. ANSI/NFPA 70, National Electrical Code

C. CSA C22.2 No. 0, General Requirements of Canadian Electrical Code, Part II

D. CSA C22.2 No. 14, Industrial Control Equipment

E. MIL SPEC TT-C-490, Rev. D, Cleaning Methods for Ferrous Surfaces and Pretreatment for Organic Coatings

F. NEMA ICS 1, Industrial Control and Systems: General Requirements

G. NEMA ICS 2, Industrial Control and Systems: Controllers, Contactors and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC

H. NEMA ICS 6, Industrial Control and Systems: Enclosures

I. NEMA ST 20, Dry Type Transformers for General Applications

J. UL 508, Industrial Control Equipment (only for devices included in specification)

K. UL 845, Motor Control Centers

1.04 DEFINITIONS

1.05 SYSTEM DESCRIPTION

A. Vertical sections and individual units shall be [UL] [CSA] labeled where possible.

B. Wiring shall be NEMA Class [{I}{II}], Type [{A}{B-D, B-T}{C}]. <{With Type C wiring, master terminal blocks }shall be located in larger horizontal wireway at {top }{bottom }{of vertical section.}> Combination starter units shall be wired out to split-type terminal blocks for easy removal without disturbing either factory - or field - installed wiring.

C. Motor control center splits shall be assembled and packaged to withstand all shipping stresses.

1.06 SUBMITTALS

A. Manufacturer shall provide [quantity] copies of following documents for review and evaluation in accordance with general requirements of Division 1 and Division 16:

1. Product Data on specified product;

2. Shop Drawings on specified product;

1.07 OPERATION AND MAINTENANCE DATA

A. Manufacturer shall provide [quantity] copies of installation, operation and maintenance procedures to owner in accordance with general requirements of Division 1 and Division 16.

1.08 QUALITY ASSURANCE (QUALIFICATIONS)

A. Manufacturer shall have specialized in the manufacture and assembly of low voltage motor control centers for [40] years.

B. Low voltage motor control centers shall be listed and/or classified by Underwriters Laboratories in accordance with standards listed in Article 1.03 of this specification.

C. Installer has specialized in installing low voltage motor control centers with [minimum _ years documented experience].

D. Motor control center shall be inspected before shipment including structure, electrical conductors, bussing, general wiring, and devices.

1.09 REGULATORY REQUIREMENTS

1.10 DELIVERY, STORAGE, AND HANDLING

A. The manufacturer shall separate Motor Control Center into shipping splits of up to 3 vertical sections. Ship splits vertically for easier handling at job site. Each shipping split shall include a removable lifting angle, or lifting tabs, for positioning equipment at job site.

B. Contractor shall store, protect, and handle motor control centers in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.

C. The manufacturer shall deliver each motor control center split on individual shipping skids wrapped for protection.

D. Contractor shall inspect and report concealed damage to carrier within specified time.

E. Contractor shall store in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. (Heat enclosures to prevent condensation.)

F. Contractor shall handle in accordance with NEMA [___] and manufacturer's written instructions to avoid damaging equipment, installed devices, and finish. <Lift only by installed lifting eyes.>

1.11 WARRANTY

A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1

year from date of installation or 18 months from date of purchase, whichever occurs first.

1.12 FIELD MEASUREMENTS

A. Contractor shall make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in National Electrical Code.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. General Electric Company products have been used as the basis for design. Other manufacturers' products of equivalent quality, dimensions and operating features may be acceptable, at the Engineer's discretion, if they comply with all requirements specified or indicated in these Contract documents.

2.02 MANUFACTURED ASSEMBLIES

A. Furnish General Electric 8000-Line Motor Control Centers with Power Management (or approved equal) as indicated in drawings.

2.03 COMPONENTS

Refer to Drawings for: actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; and other required details.

A. Structure

1. Motor control center shall be rated as indicated in drawings.

2. Structures shall be totally enclosed, dead-front, free standing assemblies.

3. Indoor enclosure(s) shall be NEMA [{Type 1, gasketed}{Type 2, drip proof, indoor}{Type 12, industrial, dust tight, drip proof, indoor}]. Outdoor enclosure(s) shall be NEMA 3R [{non-walk-in}{non-walk-in, back-to back}{walk-in}{common-aisle walk-through}]. 1 space heater per vertical section shall be available for indoor and outdoor enclosures. Heaters require thermostatic control.

4. Motor control center shall consist of the required number of vertical section(s) of heavy gauge steel bolted together forming a rigid unit assembly. Removable lifting angles or tabs shall be mounted on top of motor control center sections. Removable bottom channel sills shall be mounted front and rear of vertical section and shall extend full width of lineup.

5. Motor control center sections shall be nominally 90 inches high and in multiples of 20 inch widths, with [{24}{30}] inch widths as required for oversized starters and relay panels. Depth shall be (select in accordance with description below):

[{a. Front-mounted units, only, 13 inch} deep sections;

{b. Front-mounted units, only, 20 or 22 inch} deep sections;

{c. Units mounted back to back in 20 or 22 inch} deep sections.

{d. Front-mounted units, only, 20 or 22 inch} deep sections with separate vertical bus in rear for future back to back unit mounting.] <{Front mounted units with separate vertical bus} shall have {42 kAIC}{65 kAIC} bracing.>

6. Phase relationship of stab-in units for rear mounting shall be same as for front-mounted units. No phase rotation shall be permitted.

7. All section parts shall be accessible from front for maintenance and rearrangement.

8. Each 20 inch section shall have all necessary hardware and bussing for modular plug-in units to be added at any point in section. Unused space shall be covered by hinged blank doors and equipped to accept future units.

9. Each section shall have top plate and two piece bottom plate. Each plate shall be removable to cut conduit entry openings.

10. Each device compartment shall have an individual flange formed pan type door with quick release, quarter turn latches. Door shall be mounted on unit so that an individual unit may be installed or removed without disturbing adjacent units or removing any hardware.

B. Horizontal Pullbox

1. Vertical sections shall contain [12] inch high horizontal wireway at [{top}{bottom}] of all sections for incoming lines and wiring between sections. A [6] inch high horizontal wireway shall be located at [{bottom}{top}] of all sections.

C. Vertical Wiring Trough

1. A separate removable vertical wire trough door shall be furnished adjacent to each plug-in device. Wire trough permits field control wiring to be isolated in trough area rather than drawn through cutouts into device.

2. Cable tie supports shall be furnished in vertical wire trough to hold cable and wiring in place. Each individual device compartment shall have a side barrier to permit pulling wire from wire trough areas without disturbing adjacent device compartments.

D. Incoming Power / Main Protective Devices

1. The MCC shall be connected to the supply source by: (Select one of the following)

[{a. Cables}] <number and quantity per phase, location>

[{b. 3 Phase Bus duct}] <ampere size> <{3 wire }{4 wire }>

[{c. Transition section}] <location>

2. The Main device shall be [{main lugs}{3 pole main breaker}]. The device shall be rated as follows.

<a. Lugs :_____ amperes.>

<b. Breaker: >< ____ amperes; ____ amperes interrupting.>

<{c. The main circuit breaker shall be} molded or insulated case circuit breaker with a digital electronic trip. The digital trip unit shall be as specified in Article 2.03.H. The trip unit shall utilize true RMS sensing and a rating plug for determining the trip.>

E. Bus Systems

1. Main Horizontal Bus

a. Power shall be distributed by means of a continuous horizontal bus rated as indicated in drawings: [{600}{800}{1000}{1200}{1600}{2000}{2500}] amperes.

b. Main bus shall be [{aluminum, tin-plated}{copper, tin-plated}{copper, silver-plated}] as indicated in drawings, enclosed in isolated compartment at top of each vertical section.

c. Bus bars shall be edgewise mounted, one above the other, and supported on white polyester reinforced insulators.

d. Main bus shall be isolated from wire troughs, starters, and other areas by insulated barriers. All bus and splice bar connections shall be accessible by sliding open the barrier panels or removing stationary barriers.

e. Main bus splicing between shipping splits shall be accomplished from the front without any structural disassembly. Bus ratings 1200 amperes and larger may require removal of barriers to gain access to main bus connections.

f. Bus bars shall be fully rated as indicated in drawings. Bus bars shall be arranged for future extension.

2. Vertical Bus

a. Vertical bus shall be rated as indicated in drawings. Bus shall be [{tin-plated}{silver-plated}] copper, 300 amperes minimum, or as indicated in drawings: [{300}{450}{600}] amperes.

b. Vertical bus shall be enclosed in flame-retardant white polyester glass sandwich to insulate bars front and rear and isolate individual vertical bus bars phase to phase. Small openings in bus sandwich shall permit unit stabs to plug into vertical bus bars, rather than onto them. Bottom of vertical bus sandwich shall be barriered to prevent entrance of foreign objects.

c. Vertical bus shall be connected directly to horizontal bus without using risers or other connectors unless directly connected to the load side of the incoming disconnect or terminal board assembly.

d. Devices with circuit breakers up to [225] ampere trips and fusible switches up to [200] amperes shall connect to vertical bus by spring reinforced stab-in connectors. Higher rated devices shall be bolted to main or vertical riser bus.

e. Bus bars shall be fully rated as indicated in drawings.

3. Power busses shall be braced to withstand short circuit currents as indicated in drawings: [{42}{65}{100}] kAIC.

4. Ground Bus (when specified) shall be [{aluminum}{copper}] and extend full width at bottom of motor control lineup. Ground bus will be drilled and lugs shall be furnished as specified in drawings. Ground bus shall be sized per drawings.

5. Neutral bus (when used) shall be [{half}{full}] rated. Neutral bus shall be continuous throughout the control center. Lugs shall be of appropriate capacity. Bottom plates shall be furnished when neutral bus specified.

<{6. Optional Construction Features}

{a. Shutter mechanism to completely isolate} vertical bus, including stab area opening, when plug-in device is withdrawn.

{b. Vertical 150 ampere rated (load) ground bus} to provide {studs}{terminals} { next to power terminal locations for motor ground} connections.

{c. Vertical Unit Ground Bus mounted to vertical} bus steel support assembly to engage device vertical ground bus stab on each plug-in unit before power stabs engage vertical bus and disengage only after power stabs are disconnected when removing plug-in unit.

{d. Power Off Lock - Out Feature to prohibit access} to unit racking screw with unit disconnect in closed or ON position. Device cannot be removed or installed. Access to racking screw is permitted with unit disconnect OFF.>

F. Main Disconnect Devices

1. Main disconnects shall be [{circuit breaker}{fusible switch}] type.

2. Circuit breakers shall be thermal magnetic.

3. Comply with all [utility] requirements for service entrances and associated metering.

4. Main breakers shall be [{conventional thermal magnetic}{current limiting and High IC, thermal magnetic}{Tri-Break®, integrally fused}{Spectra™}{Power Break® MicroVersaTrip®}{AKR MicroVersaTrip®}] (or equal).

5. Fusible main disconnects shall be [{QMR}{QMW}{HPC}] switches (or equal).

G. Feeder Units

1. Feeder units shown on the one-line shall be circuit breaker type.

2. Feeder breakers above 225 amp trip rating shall be molded case with digital electronic trip. The digital trip shall be the same as that specified for the main breaker. The digital trip unit shall be equal to that specified in Article 2.03.H.

3. Feeder breakers with trips less than that specified above shall be molded case with digital overload and short circuit protection. The trip unit shall incorporate true RMS sensing. The feeder breakers shall utilize a rating plug for determining the trip and for ease of changing the trip.

H. Feeder Breaker Digital Trip

1. Each circuit breaker shall be equipped with a digital electronic trip unit. The trip unit shall provide protection from overloads, short circuits< and ground faults>. The protective trip unit shall consist of a solid-state, microprocessor-based programmer; tripping means; current sensors; power supply and other devices as required for proper operation.

2. As a minimum, the trip unit shall have the following functions and features:

a. The housing shall be a metallic enclosure to protect against magnetic interference, dust and other contaminants.

b. The protective system shall have reliable programmable controls with repetitive accuracy and precise unit settings.

c. All current settings shall employ true RMS technology for detecting overloads, short circuit conditions< and ground fault conditions>.

d. A high contrast liquid crystal display (LCD) unit shall display settings, trip targets, and the specified metering displays.

e. The trip unit shall contain a multi-button keypad to provide local setup and readout of all trip settings on the LCD.

f. The trip unit shall contain a UL Listed interchangeable rating plug. It shall not be necessary to remove the trip unit to change the rating plug.

g. An integral test jack for connection to a battery source shall be provided.

h. A mechanism for sealing the rating plug and the trip unit.

i. The trip unit shall be dual rated for application at both 50 and 60 Hz. Noise immunity shall meet the requirements of IEEE C37.90.

j. The trip unit shall have an integral, resettable trip counter to record the number of long time, short time, instantaneous and <ground fault > trips.

k. The trip unit shall display trip targets for long time, short time,< ground fault,> undervoltage release and shunt actuated trips.

<{l. The ground fault function} shall contain a memory circuit to integrate low-level arcing fault currents with time, to sum the intermittent ground fault spikes.>

3. The trip unit shall include the following metering functions, which shall be shown on the LCD:

a. Current, RMS, each phase;

b. Current as above, plus:

1) Voltage, RMS, line-to-line, or line-to-neutral;

2) Energy, KWH, total;

3) Demand KWH, over an adjustable time period of 5 to 60 minutes;

4) Peak demand, KW, user resettable;

5) Real power, KW, line-to-line, line-to neutral;

6) Total (apparent) power, KVA, line-to-line, line-to-neutral;

4. The trip unit shall include communication capability as follows:

a. Dedicated secondary terminals on the trip unit shall provide a port for communication with and access to a remote computer via the breaker manufacturers standard communication network and protocol.

b. All metering, setpoint, protective trip counts and other data shall be retrievable by the remote computer.

<{5. The following protective relay functions} are optional for the trip unit. It shall be possible, by user programming, to disable any combination of the protective functions.

a. Undervoltage, adjustable pickup, 50 to 90 percent; adjustable delay, 1 to 15 seconds.

b. Overvoltage, adjustable pickup, 110 to 150 percent; adjustable delay, 1 to 15 seconds.

c. Voltage unbalance, adjustable pickup, 10 to 50 percent; adjustable delay, 1 to 15 seconds.

d. Current unbalance, adjustable pickup, 10 to 50 percent; adjustable delay, 1 to 15 seconds.

e. Reverse power, selectable direction, adjustable pickup, 10 KW to 990 KW; adjustable delay, 1 to 15 seconds.>

I. Combination Motor Starters Devices

1. Combination motor controller units shall be of the molded case circuit breaker type.

2. Circuit breaker disconnects for combination motor starters shall be digital magnetic, only.

3. Combination starters, circuit breakers and fusible switches, shall be rated as indicated in drawings.

4. Combination starter types shall be <{FVNR}{, }{FVR}{, }{RVNR}{, }{2S1W}{, }{2S2W}{, }{Part Winding}{, }{Y-Delta}>.

5. Circuit breaker combination starters size 5 and size 6 shall be provided with a circuit breaker disconnect with a digital electronic trip unit. The digital trip unit shall utilize true RMS sensing and a rating plug. Means shall be provided for communication to the power management communication network. The trip unit for these circuit breakers shall be the

same as that specified in Article 2.03.H.

6. Plug-in combination starter and feeder units shall use a positive guidance mechanical installation system to ensure positive stabbing of unit wedge shaped stab assembly into vertical riser bars. Power cables shall be connected to wedge stabs with maintenance free crimp connectors.

7. Unit operating handle shall be vertical lift, close coupled to unit disconnect for positive indication of disconnect position with unit door open or closed. Handle shall be mechanically interlocked with door closed so that interlock must be defeated to open door with device energized, or to energize device with door open. Handle shall be able to be padlocked in OFF position with up to 3 padlocks with door opened or closed. Handle shall have drilling pattern to add padlock in ON position. Circuit breaker handles shall indicate TRIPPED position in addition to ON, OFF and RESET.

8. Unit shall be able to be padlocked in LOCKOUT position for maintenance.

9. When in LOCKOUT position, power stabs shall be disengaged from vertical bus bars so no power can enter unit.

10. Combination starters with Type B or C wiring shall have drawout split-type control terminal blocks mounted on right-hand side. Control terminal boards are to be manually separable type. Combination starter units Sizes 1 to 4 up to 48 inches high shall be removable from section without removing control leads from terminal blocks.

11. Combination motor controller units shall have (Select 1, 2, or 3, below):

[{a. Individual control power transformers} with one secondary lead furnished with a control fuse and the other secondary lead grounded. Control power transformer primary fuses are required.

{b. Line voltage control circuits} on all circuit breakers and fusible switch combination starters larger than Size 2 shall be provided with NEMA Class J current-limiting fuses mounted in both legs of unit control circuit.

{c. Separate source control power. } A control power fuse shall be provided and the other secondary lead will be grounded in unit. Unit disconnect shall be equipped with a normally open contact to isolate control circuit from power source with controller disconnect open.]

12. NEMA Size 1 to 4 starters shall have control terminal board next to the vertical wireways. Motor leads shall connect directly to starter terminals. Larger starters shall be arranged so that motor leads exit through starter cubicle bottom.

13. Combination starter unitsshall have auxiliary devices (select from list below):

[{a. Auxiliary starter interlocks:}] <(number) N/O, (number) N/C>

[{b. Door-mounted pilot device:}] <(Specify type)>

[{c. Control/timing relays:}] <(Specify quantity)>

[{d. Other accessories:}] <(Specify type)>

[{14. Electronic Overload Relay}

a. Solid State Overload Relay to replace standard bimetalic type for Size 1 through Size 6 motor starters.

b. The solid state overload shall contain the following features:

1) Class 10, 20, 30 (selectable) with adjustable phase loss / unbalance (sensitivity 20 to 50 percent):

2) ambient insensitive within the stated operating temperature range of minus 20 to plus 70 degrees C;

3) built-in thermal memory to prevent hot motor restarts;

4) manual reset (standard) and remote reset (optional) 24 Vdc or 120 Vac;

5) manual trip;

6) visual trip indication;

7) self powered at 50 percent of minimum current range;

8) standard isolated 1 NO and 1 NC auxiliary contact;

9) built-in line / load straps;

10) DIN rail mountable, fits with existing 300 Line Starters.

{15. Electronic Control Module}

1. Circuit breaker combination starters shall be provided with a microprocessor based add - on module to a SpectraTM circuit breaker disconnect. This module shall provide contactor control plus overload functions and communication capability to Size 1 through Size 6 starters.

2. Module shall have true digital RMS sensing, user selectable motor protection Class (10, 20, 30), current unbalance/loss protection (On / Off) and ground fault (On / Off) with optional zero sequence sensor.

3. The ECM shall be compatible with communication networks running PMCS software. Communication capabilities shall include: remote metering of individual phase current, remote monitoring of protection settings and motor status, trip notification (for overload, ground fault, or phase unbalance / loss conditions).]

J. Other Available Drives and Controls

1. Series Six Plus, Series 90 - 30 or 90 - 70 Programmable Logic Control Mounting, and Genius® I/O System mounting in separate sections.

2. Solid State (reduced voltage) starters [{with isolation contactor}{with bypass contactor}] as described in SECTION 16483000.

3. Adjustable Speed AC Drives <{AC300™}{, }{AF300B}{, }{AF300C}{,} {AF300E$}>

<{K. Miscellaneous Branch Devices}

1. Other units to include in motor control center. (List as required):>

<a. Lighting and power transformers>

<b. Lighting and distribution panelboards:> <Type: ____> <Number of circuits: __,> <Trip amperes per circuit: __ >

<c. Metering panels and instrument transformers:> <Specify _____>

<d. Operating panels: Specify _____>

<e. Power factor correction capacitors:> <Specify : _____ KVAR>

2.04 OPTIONAL EQUIPMENT

A. Automatic Transfer Switches (ASCO 940) (or equal).

B. Incoming line reactors, 3, to limit short circuit current to motor control center.

C. Transitions from motor control center to other equipment:

1. Transitions to <{AV - Line switchboards}{, }{GE transformers}{, }{AKD-8 switchgear}>

D. Overcurrent protection for motor control centers must be provided.

E. Dry type transformers GE <{QB}{, }{QMS}{, }{QL}{, }{open core and coil}>

F. Ground fault protection as shown on drawings for main and feeder breakers. <{Type TSGR ground break protective relaying} for mains{, }{Type MC ground fault relaying for feeders}> (or equal).

G. Key interlocks [{Superior Lock Corporation}{Kirk}] installed on specified circuit breakers and fusible switches.

2.05 ACCESSORIES

A. Furnish nameplates for each unit as indicated in drawings. Use [{black letters on white background}{white letters on black background}].

2.06. INSTRUMENTATION

<{A. Provide a multi-function electronic monitor} as described in the following paragraphs.>

[{1. Multi-function electronic monitor}

a. General Description

1) The Modbus® Monitor shall be a microprocessor based device that shall allow for local interface with the power management system devices as well as other Modbus communicating devices connected to the Modbus monitor devices. The Monitor shall read metering and status information collected by power management devices connected to the segment.

2) The Monitor shall serve as the central location for reading data from remote devices on the RS-485 networks connected to it.

3) The Monitor shall have a local event log.

4) The Monitor shall be able to communicate over the RS - 485 segment at a speed of 1200 to 19,200 baud.

b. The Monitor shall include the following components:

1) The front panel shall contain:

a) a 10.75 inch, diagonal, VGA electroluminescent display.

b) a membrane keyboard shall be located below the display screen.

c) an RS-232 port in the lower right hand corner to to connect a PC to configure the Monitor.

2) The monitor shall contain:

a) terminals for AC or DC control power;

b) ground connection;]

[{c) one}{c) two}] [{five terminal RS-485 connectors;}

d) On/Off switch.

c. Mounting

1) The Monitor shall mount in a] [{ switchgear}{switchboard}{low voltage motor control center}{Hoffman enclosure}] [{ cutout, with a minimum} of 0.25 inch clearance behind and below it for proper cooling.

d. Software

1) The Modbus® Monitor must be compatible with the GE Power Management Control System (PMCS) and host software.

2) The Modbus Monitor Configuration Tool software, (furnished with the Monitor) shall be used to configure devices to furnish data to the Monitor. The Configuration Tool shall be compatible with Windows 3.1 or later.

e. Supported Devices

1) The Monitor shall support any generic register-based device using the Modbus RTU protocol on an RS-485 network, hybrid devices that combine features of tightly integrated devices with the flexible custom configuration used for generic devices, and the GE PMCS 6.0 devices. (See Extended Section 16941003.)

f. Basic Operations

1) The Monitor shall have the following functional categories.

a) View: Monitor Configured Devices

b) Setup: Configure Devices and Change Options

c) Diagnostics: Troubleshooting

g. Modbus Monitor Specifications

1) Control Power:][{100-240 VAC, 50-60 Hz}{125-250 VDC}][{, 30 W, minimum

2) Modbus Communications:][{One}{Two}][{ RS-485 ports}

a) 1200, 2400, 4800, 9600, or 19200 baud (User configurable)

b) No Parity, eight data bits, one stop bit

3) Mating Connector: Precision Connector Designs (PCD), ELFT03260 or equivalent (supplied with Monitor)

4) RS-485 Modbus interconnection terminals will accommodate #24 to 12 AWG copper wire.]

<B. Provide a repeater as specified.>

C. The communications link within the MCC shall be by a shielded twisted pair. Communications external to the MCC shall be MODBUS RTU. The communications medium external to the MCC shall be provided by the contractor.

2.07 TESTING

A. Electrical tests before shipment shall include:

1. Power circuit phasing

2. Control circuit wiring

3. Instrument transformers

4. Meters

5. Device electrical operation

6. AC Dielectric tests (per NEMA ICS 1-109-21) of:

a. Power circuits

b. Control circuits

2.08 FINISH

A. The Motor Control Center steel parts shall be cleaned and sprayed in controlled cleaning solutions by a 7-stage spray washer. The operation shall produce an iron phosphate coating of a minimum of 150 milligrams per square foot to meet MIL Specification TT-C-490. The primed metal parts shall be electrostatically coated with powder paint consisting of 670-011 ANSI-61 Acrylic Paint (Light Gray) with a gloss of 60 plus or minus 5 and thickness of 2.5 mils. The paint finish shall withstand a minimum of 1000 hours salt spray test.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine installation area to assure there is enough clearance to install motor control center.

B. Check concrete pads for uniformity and level surface.

C. Verify that motor control centers are ready to install.

D. Verify field measurements are as [{shown on Drawings}{instructed by manufacturer}].

E. Verify that required utilities are available, in proper location and ready for use.

F. Beginning of installation means installer accepts conditions.

3.02 LOCATION

A. Motor control centers shall have a minimum of 3 feet free space in front of assembly. Motor control centers should have 3 feet free space behind assemblies with back-to-back construction per NEC. Free space is needed to remove and install units. A [{1 inch space}{6 inch space for damp locations}] should be provided between back of front-of-board motor control centers and a wall.

B. Surface under motor control center will be non-combustible unless bottom plates are installed in each vertical section.

3.03 INSTALLATION
Additional provisions and editing may be required for this part.

A. Install per manufacturer's instructions.

B. Install required safety labels.

3.04 FIELD QUALITY CONTROL

A. Inspect installed motor control center(s) for anchoring, alignment, grounding and physical damage.

B. Megger and record phase to phase and phase to ground insulation resistance of each bus section. Megger for [1] minute for each measurement at minimum voltage of [1000] VDC. Measured Insulation resistance shall be at least [1] megohm(s). Refer to manufacturer's instructions for proper testing procedures.

C. Check tightness of all accessible mechanical and electrical connections< with calibrated torque wrench>. Minimum acceptable values are specified in manufacturer's instructions.

D. Test each key interlock system for proper functioning.

E. Operate test push button to check ground fault system(s).

3.05 ADJUSTING

A. Adjust all <{circuit breakers}{, }{switches}{, }{access doors}{, }{operating handles}> for free <{mechanical}{ and / or }{electrical}> operation as described in manufacturer's instructions.

B. Adjust circuit breaker trip and time delay settings to values [{specified}{determined}] by Architect Engineer.

C. Return "odd" Kirk keys to Engineer before energizing equipment.

3.06 CLEANING

A. Clean interiors of motor control centers to remove construction debris, dirt, shipping materials.

B. Repaint scratched or marred exterior surfaces to match original finish.

END OF SECTION