# GENERAL

## SECTION INCLUDES

### Medium Voltage Motor Controllers

## RELATED SECTIONS

## REFERENCES

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

### ANSI C19.3, Industrial Control Apparatus

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

### NEMA ICS 1, Industrial Control and Systems: General Requirements

### NEMA ICS 1-109

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

### NEMA ICS 324

### NEMA ICS 6, Industrial Control and Systems: Enclosures UL 347 7th edition, Medium-Voltage AC Contactors, Controllers, and Control Centers

### UL 508, Standard for Safety for Industrial Control Equipment

## DEFINITIONS

## SYSTEM DESCRIPTION

### Controllers shall be for medium voltage motor and feeder applications specified in this document.

B. The MCC shall be rated at [2300] [2400] [3300] [3600] [4000] [4160] [4200] [4800] [6000] [6300] [6600] [6900] [7200] volts, three phase, [3] wire, [60] [50] Hertz power system having a short circuit availability of 50 kiloamperes RMS symmetrical.

## SUBMITTALS

### Manufacturer shall provide [quantity] copies of following documents to owner for review and evaluation in accordance with general requirements of Division [1] [01] and Division [16] [26]:

#### Product Data on specified product;

#### Shop Drawings on specified product;

## PROJECT RECORD DOCUMENTS

### Contractor to maintain an up-to-date set of Contract documents. Note any and all revisions and deviations that are made during the course of the project.

## OPERATION AND MAINTENANCE DATA

### Manufacturer shall provide [quantity] copies of installation, operation and maintenance procedures to purchaser in accordance with general requirements of Division [1] [01] and Division [16] [26].

## QUALITY ASSURANCE (QUALIFICATIONS)

### Manufacturer shall have specialized in the manufacture and assembly of medium voltage motor controllers for [50] years.

### Medium voltage motor controllers shall be listed and/or classified by Underwriters Laboratories in accordance with standards listed in Article 1.03 of this specification.

### Equipment shall be qualified for use in seismic areas as follows:

#### High seismic loading as defined in IEEE Std 693-2018, with 2.5 amplification factor.

#### IBC-2018 & CBC-2019, Ss = 2.76g, Sds = 1.84g, Ip = 1.5, for z/h equal to 1 and Ss = 4.41g, Sds = 2.94g, Ip = 1.5, for z/h equal to 0 in accordance with ICC-ES-AC156.

#### Seismic compliance shall be qualified only through shake table testing. Compliance by calculation is not acceptable.

## DELIVERY, STORAGE, AND HANDLING

### The installer shall store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.

### Deliver each shipping split mounted on shipping skids and wrapped for protection.

### Installer shall inspect and report concealed damage to carrier within specified time.

### Installer shall store motor controller 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.)

### Installer shall handle motor controller in accordance with NEMA [ \_\_\_ ] and manufacturer's written instructions to avoid damaging equipment, installed devices, and finish. Lift only by installed lifting eyes.

## PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

### The Contractor shall follow (standards) service conditions before, during and after motor controller installation.

### Medium voltage motor controllers shall operate up to 3300 feet (1000 meters) without de-rating.

### Medium voltage motor controllers shall be located in well-ventilated areas, free from excess humidity, dust and dirt and away from hazardous materials. Ambient temperature of area will be between zero and plus 40 degrees C. Indoor locations shall be protected to prevent moisture from entering enclosure.

## WARRANTY

### 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.

## EXTRA MATERIALS

### Provide [parts] [spares] as indicated in drawings.

### Provide [2] of each size and rating of fuses.

## FIELD MEASUREMENTS

### The Installer 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.

# PRODUCTS

## MANUFACTURER

### ABB 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.

## SYSTEMS

### Furnish [quantity] ABB Type Limitamp® motor controllers (or approved equal) as indicated in drawings.

## EQUIPMENT

### 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.

### Controllers shall be NEMA Class E2 high-voltage with ratings as indicated in drawings.

### Enclosures shall be NEMA Type [1, general purpose] [1A, gasketed] [2, Driptight] [3R, Weather-resistant] [12, Dusttight].

### Enclosures shall be 90 inches high, 22 to 48 inches wide, and 30 inches deep for bus ratings to 2000A, at 3000A depth shall be 42”.

### For personnel safety, enclosure(s) shall have: low-voltage control compartment with separate door; high voltage compartment with separate interlocked door; ac bus compartment with protective barriers; and cable entrance compartment.

### Arrange load terminations for cable connections as indicated.

### Incoming cables shall enter enclosure at [top] [bottom][as indicated on the drawings or data sheets]. Cables shall be separated from high and low voltage compartments by barriers unless in a dedicated incoming section.

### Motor cables shall enter enclosure at [top] [bottom][as indicated on the drawings or data sheets]. Cables shall be separated from high and low voltage compartments by barriers.

### Enclosure

#### Enclosure shall be [NEMA 1 general purpose][NEMA 1A gasketed] [NEMA 2, Driptight] [NEMA 3R Weather-resistant non-walkin] [NEMA 3R Weather-resistant enclosed aisle walkin] [NEMA 12, Dusttight]

#### [Provide pad lockable features for doors][provide door stops]

#### [Provide compartment space heaters][ control voltage to space heaters shall be [115AC][230AC]][Space heaters shall be controlled by [thermostat][humidistat][ Heater circuit shall be monitored by ammeter][space heaters shall be provided with covers]

### Bus bars shall be full sized and rated as indicated in drawings. Bus shall be arranged for future extension.

#### Bus shall be [bare copper][tin plated copper][silver plated copper]

#### Bus shall be [non-insulated][insulated with boots on splice plates]

#### Ground bus shall be [bare copper][tin plated copper][silver plated copper][is not required]

## CONTROLS

### General

#### For overload protection, furnish electronic overload relay with phase unbalance and selectable OL class (10, 20, 30)] with hand-reset, shall be included.[Furnish solid state multi-function overload relay as specified hereinafter]

#### Control power at 115 or 230 volts shall be provided from a control power transformer in each controller. Transformer shall be protected by current-limiting fuses.

#### Controls shall provide [instantaneous undervoltage protection] when momentary contact push-button is used [undervoltage release] when maintained contact switch is used]. [Push-button] [Switch] shall be [mounted on door] [remotely located].

#### Each control shall be protected against single-phasing due to blown fuses and shall have blown fuse indication. Blown fuse indicator shall be mounted on controller door.

NOTE TO SPECIFIER: 2S2W AVAILABLE AS NON-UL LABELED AND 2S1W AVAILABLE AS NON-UL LABELED. WOUND ROTOR CONTROLLER SHALL BE START DUTY ONLY AND AVAIALBLE AS NON-UL LABELED.

#### Motor starter types shall be: [Full Voltage Non-Reversing (FVNR)] [, ] [Full Voltage Reversing (FVR)] [, ] [Reduced Voltage Non-Reversing Primary Reactor (RVNRPR)] [, ] [Reduced Voltage Non-Reversing Autotransformer closed transition (RVNRAT)] [, ] [Reduced Voltage Reversing Primary Reactor (RVRPR)] [, ] [Reduced Voltage Reversing Autotransformer closed transition (RVRAT)] [, ] [2S2W] [, ] [2S1W].[As indicated on drawings and data sheets].

#### Provide load break fusible switches type IC 1074 as indicated on the drawings or data sheets. Switches shall be [one high][two high][fused][non-fused] construction.

#### Control terminal blocks shall be [stationary][pull apart]. Provide spare terminal points.

#### Control wire size shall be minimum of [#14][#12].

#### Control wires shall be terminated with [stripped bare wire][non insulated ring terminals][insulated ring terminals][non insulated spade terminals][insulated spade terminals].

#### Control cable wire markers [are required][not required].

#### Indicating lights where required shall be [full voltage][LED][[LED push to test].

#### Push buttons where required shall be [non illuminated][illuminated].

#### Indicating lights where required shall be [full voltage][LED][[LED push to test].

#### Indicating lights where required shall be [full voltage][LED][[LED push to test].

### Control for wound-rotor induction motors

#### Secondary control shall use contactors. It shall provide automatic acceleration through [ \_\_\_ ] starting steps with uniform torque peaks using a NEMA Class [ \_\_\_ ] resistor.

### Control for Synchronous Motors

#### DC field control for synchronous motors shall consist of one Multilin 869 with integral SPM [or approved equal] with an integrated synchronous motor protection module (or equal) equipped with digital displays for power factor, field current and line current, one field starting and discharge resistor and one solid state field contactor. Operation shall be fully automatic.

#### If required, static field supplies shall be [tapped transformer with Static Field Contactor] [transformer and adjustable SCR type Variable Field] Contactor with manual potentiometer for field voltage adjustment [transformer and adjustable SCR type VFC with field] current regulation [transformer and adjustable SCR type VFC with power] factor regulation] (or equal).

### Vacuum Contactor Controllers

#### Controllers shall be [400 ampere, 4160 Volts] [400 ampere, 7200 volts] [800 ampere, 4160 volts] [800 ampere, 7200 volts].

#### Controller(s) shall be fused type with current-limiting power fuses that provide an interrupting rating that meet or exceed interrupting rating as indicated in drawings.

#### Starter(s) shall use vacuum contactor(s) rated as indicated in drawings.

#### Power bus shall be braced for 80 KA RMS asymmetrical or 50 KA RMS symmetrical.

#### Contactor(s) shall have [stationary] [drawout] connections. Coil shall be removable without removing contactor from its mounts. Vacuum interrupter wear checks shall not require removal of contactor.

#### Controller shall be isolated by a non-load-break quick-make quick-break isolation switch operated by an externally mounted handle. Optional grounding isolation switch in the open position shall be provided. Isolation switch shall open control power transformer secondary before opening main circuit. Mechanical interlocks shall be provided to prevent:

##### Inadvertent operation of isolation switch under load;

##### Opening high voltage compartment door when isolation switch is ON;

##### Closing isolation switch with high voltage compartment door open;

##### Operating contactor with isolation switch in intermediate position;

##### Closing line contactor with door open.

#### Controllers rated 400 and 800 amperes up to 7.2 KV shall be rated 60 KV Basic Impulse Level (BIL). Control power transformer and autotransformers may be rated 25 KV BIL standard.

### [Options:]

#### [solid state OL relay]

#### [anti-single-phase trip bar]

#### [mechanically latched contactors]

#### [Provide starter isolation switch viewing window]

#### [Mimic bus shall be provided] Mimic bus shall be [red][blue][white] and shall be [screw attached][adhesive attached]

## [ELECTRONIC MULTIFUNCTION POWER METER]

NOTE TO SPECIFIER: ADD APPROPRIATE METER SPECIFICATIONS HERE IF ELECTRONIC POWER METER IS DESIRED. A DIGITAL MOTOR PROTECTION RELAY CAN ALSO PROVIDE ADEQUATE POWER METERING CAPABILITY.

[PQM II Meter](file:///C:\Users\USKEWOO22\AppData\Local\Microsoft\Windows\INetCache\USKEWOO22\AppData\Local\Microsoft\Windows\Users\USRISCH13\AppData\Roaming\Local%20Settings\Temporary%20Internet%20Files\Content.Outlook\pqm_ii_specs.doc)

## DIGITAL MOTOR PROTECTION RELAYS

### A multi-function, 3-phase microprocessor-based ABB Relion relay or approved equal shall be used. ABB Relion [REM615] [REM620] series relays or approved equal shall be used for motor protection.

## INSTRUMENTS

### Provide instrumentation as indicated on drawings or listed below.

#### [Elapsed-Time Meter]

#### [Provide [current] [voltage] [watt] [var] [power factor] transducers. Transducer output shall be [0 –1mA] [4 – 20mA]]

#### [ABB FT-1 Test Blocks (or equal)]

#### [Operation Counter]

## ACCESSORIES

### UL listed current limiting power fuses

### [Hand-Off-Auto selector switch for automatic starting from pilot devices]

### [T&B solderless connectors (or equal)]

### [Furnish nameplates for each starter device as indicated in drawings. Use [black letters on white background] [white letters on black background].]Nameplates shall be [adhesive mounted][screw attached]

## TESTING

### Equipment shall be factory tested in accordance with NEMA ICS 1-109 and ANSI C19.3 summarized in following list:

#### Production Inspections;

#### Mechanical Operation;

#### Function Operation:

##### Devices:

##### Sequence and Timing Circuits:

##### Polarity of Phase-Sensitive Circuits:

#### Grounding.

#### High Potential Insulation:

#### Control Wiring;

#### Power Cable Insulation and Isolation.

## FINISH

### The motor controller 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 40-50 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). The paint finish shall withstand a minimum of 1000 hours salt spray test.

# EXECUTION

## EXAMINATION

### Examine installation area to assure there is enough clearance to install motor control centers.

### Check concrete pads for uniformity and level surface.

### Verify that medium voltage motor controllers are ready to install.

### Verify field measurements are as [shown on Drawings] [instructed by manufacturer].

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

### Beginning of installation means installer accepts conditions.

## INSTALLATION

### Install per manufacturers instructions. Install required safety labels.

### Contractor shall furnish and completely install all motor control centers as shown on drawings and described in these specifications and in NEC.

## FIELD QUALITY CONTROL

### Inspect installed medium voltage motor controllers for anchoring, alignment, grounding and physical damage.

### 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] megohms. Refer to manufacturers instructions for proper testing procedures.

### Check tightness of all accessible mechanical and electrical connections [with calibrated torque wrench]. Minimum acceptable values are specified in manufacturers instructions.

### Test each key interlock system for proper functioning.

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

### F List other controls as required.

## ADJUSTING

### Adjust all [switches] [, ] [access doors] [, ] [operating handles] for free [mechanical] [ and / or ] [electrical] operation as described in manufacturer's instructions.

### Adjust relay trip and time delay settings to values [specified] [determined] by Architect Engineer.

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

## CLEANING

### Clean interiors of motor controller sections to remove construction debris, dirt, and shipping materials.

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

### END OF SECTION