# GENERAL

## SECTION INCLUDES

### Arc Resistant 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

### ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems

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

### NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies

### NEMA ICS 3 Part 2NEMA ICS 324

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

### IEEE C37.20.7-2017 – Guide for testing metal enclosed switchgear rated up to 38kV for internal arcing faults

### IEEE 693-2018 – Recommended Practice for Seismic Design of substations

### ICC-ES AC156 – Acceptance criteria for seismic qualification by shake-table testing of nonstructural components and systems

### ASC7-05 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.

### 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.

* + 1. 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;

* + 1. 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.

### Arc Resistance Medium Voltage Controllers must meet the latest seismic testing according to the applicable 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.

## REGULATORY REQUIREMENTS N/A

## MOCK-UOS (FIELD SAMPLES) N/A

## 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.

## SEQUENCING AND SCHEDULING

## 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.

## MAINTENANCE SERVICE N/A

## 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 Limitamp® AR 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, gasketed- Arc Resistant Type 2B.

### Basic Enclosures shall be 90 inches high, 22 to 48 inches wide, and 42” inches deep.

### For Arc Resistant feature, the duct/plenum is adding 24” extra inches for a total height of 114”.

### 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; cable entrance compartment; and arc duct or plenum for arc venting.

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

### An incoming line section shall be provided for the connection of the incoming power cables. The cables shall enter at the [{top}{bottom}]. This section may be used for the mounting of potential transformers, current transformers, and other devices that might be required.

### Motor cables shall exit the enclosure at the [{top}][{ and }][{bottom}]. Cables shall be separated from low voltage compartments by barriers.

### Controller(s) shall be in a [{1}{2}] - high line-up of NEMA type 1 gasketed Arc Resistant Type 2B enclosure(s) with 3-phase horizontal ac power bus rated as indicated in drawings.

### 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]

## CONTROLLER

### 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.

#### Controllers shall be stationary or draw-out mounted with vacuum break contactors.

NOTE TO SPECIFIER: SYNCHRONOUS MOTOR CONTROLLER NOT AVAILABLE.

#### Motor starter type shall be: [Full Voltage Non-Reversing (FVNR)].

### Limitamp® AR Vacuum Break Controls (or approved equal) shall have the following features:

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

#### Controllers shall use three pole vacuum contactor(s) rated as indicated in drawings.

#### Power bus shall be braced for 80 KA RMS asymmetrical or 50 KA RMS symmetrical. Power bus shall be copper, fully rated and arranged for future extension.

#### Contactor(s) shall be [{stationary}{draw-out}]. The contactor coil shall be removable without removing contactor from its mounts. Vacuum interrupter wear checks shall not require removal of the contactor. The contactor fuses shall be capable of being removed without any disassembly of the contactor. No special tools shall be required to remove the fuses. The contactor shall be capable of one million load operations and two million mechanical operations.

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

##### Inadvertent operation of isolation switches 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 are rated for 400 and 800 Amperes and up to 7.2kV, 60 KV Basic Impulse Level (BIL). Control power transformer, reactors and autotransformer shall be rated 25 KV BIL standard.

### Options

#### {a. Latched contactors shall be provided where indicated on the drawings.}

#### {b. Indicating lights: }{red}{green}

#### {c. 3 - KVA control power transformer}><2kVA><750VA standard>.

## [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%3A%5CUsers%5CUSKEWOO22%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CINetCache%5CUSKEWOO22%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CUsers%5CUSRISCH13%5CAppData%5CRoaming%5CLocal%20Settings%5CTemporary%20Internet%20Files%5CContent.Outlook%5Cpqm_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 IEEE C37.20.7-2017, NEMA ICS 1-109, ANSI C19.3 and other applicable standards as listed in 1.03 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).

### 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