SECTION 16346100
MEDIUM VOLTAGE MOTOR CONTROLLERS
LIMITAMP® 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. Medium Voltage Motor Controllers with Power Management

1.02 RELATED SECTIONS

1.03 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).

A. ANSI C19.3

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

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

D. NEMA ICS 1-109

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

F. NEMA ICS 324

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

H. UL 347, High Voltage Industrial Control Equipment

I. UL 508, Industrial Control Equipment

1.04 DEFINITIONS

1.05 SYSTEM DESCRIPTION

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

1.06 SUBMITTALS

A. Manufacturer shall provide [quantity] copies of following documents to owner 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 PROJECT RECORD DOCUMENTS

A. 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.

1.08 OPERATION AND MAINTENANCE DATA

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

1.09 QUALITY ASSURANCE (QUALIFICATIONS)

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

B. 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.

1.10 DELIVERY, STORAGE, AND HANDLING

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

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

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

D. 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.)

E. 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.>

1.11 PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

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

B. 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.

1.12 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.

1.13 EXTRA MATERIALS

A. Provide [{parts}{spares}] as indicated in drawings.

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

1.14 FIELD MEASUREMENTS

A. 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.

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 SYSTEMS

A. Furnish [quantity] GE Type Limitamp® motor controllers with Power Management (or approved equal) as indicated in drawings.

2.03 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.

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

B. Enclosures shall be NEMA Type [{1, general purpose}{1, gasketed}{2}{3R}{4}{12}].

C. Enclosures shall be 90 inches high, 22 to 48 inches wide, and 30 inches deep.

D. 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.

E. Arrange load terminations for cable connections as indicated.

F. Incoming cables shall enter enclosure at [{top}{bottom}]. Cables shall be separated from high and low voltage compartments by barriers unless in a dedicated incoming section.

G. Motor cables shall enter enclosure at [{top}{bottom}]. Cables shall be separated from high and low voltage compartments by barriers.

H. Controller(s) shall be in (Select 1 of the 4 options below and fill in type of enclosure):

<1. 1-high line-up of NEMA type ___ enclosure(s)> <{with 3-phase horizontal ac power bus rated} as indicated in drawings.>

<2. Free-standing 1-high individual NEMA type ___ > <{enclosure(s) with provisions for terminating} incoming cable.>

<3. 2-high construction with NEMA type ___ > <{enclosure(s) with 3-phase horizontal AC power bus} rated as indicated in drawings.>

<4. 3-high construction with NEMA type ___ > <{enclosure(s) with 3-phase horizontal AC power bus} rated as indicated in drawings.>

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

2.04 CONTROLS

A. General

1. For overload protection, furnish electronic overload relay with phase unbalance and selectable OL class (10, 20, 30)] with hand-reset, shall be included.

2. Control power at 120 volts shall be provided from a control power transformer in each controller. Transformer shall be protected by current-limiting fuses.

3. 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}].

4. 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.

5. Controls shall be [{stationary vacuum break}{drawout vacuum break}{drawout air break}].

6. 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}>.

7. Control for wound-rotor induction motors

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

b. For regulating duty, controller shall provide continuous speed regulation with [__] points of speed reduction with maximum reduction of [__] percent from full-load speed at [__] percent full load torque.

8. Control for Synchronous Motors

a. DC field control for synchronous motors shall consist of one GE CR192 starting and 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.

b. 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).

B. Limitamp® Vacuum Break Controllers (or approved equal)

1. Controllers shall be [{400 ampere, 4160 Volts}{400 ampere, 7200 volts}{800 ampere, 4160 volts}].

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

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

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

3. 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.

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

a. Inadvertent operation of isolation switch under load;

b. Opening high voltage compartment door when isolation switch is ON;

c. Closing isolation switch with high voltage compartment door open;

d. Operating contactor with isolation switch in intermediate position;

e. Closing line contactor with door open.

5. Controllers rated 400 amperes up to 7.2 KV and 800 amperes up to 5 KV shall be rated 60 KV Basic Impulse Level (BIL). Control power transformer and autotransformer may be rated 25 KV BIL.

<{6. Options:}

{a. solid state OL relay}

{b. anti-single-phase trip bar}

{c. mechanically latched contactors}

{d. electronic multifunction motor protection relay}>

C. Limitamp® Air Break Controls

1. Controllers shall be [{400 amperes, 4160 volts}{700 amperes, 7200 volts}{400 amperes, 7200 volts}].

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

b. Starter(s) shall use magnetic [{air break}{vacuum}] line contactor(s) rated as indicated in drawings.

2. Line contactors shall be draw-out type.

3. Controllers shall be isolated by externally operated draw out stabs with shutter mechanism. Isolating mechanism shall open control power transformer secondary before opening main circuit. Mechanical interlocks shall be provided to prevent:

a. Inadvertent operation of isolating mechanism under load;

b. Opening high voltage compartment door when contactor is engaged;

c. Racking in contactor with high voltage compartment door open;

d. Testing line contactor with door open, unless contactor stabs are disengaged.

<{4. Options:}

{a. solid state relay protection}

{b. anti-single-phase trip bar}

{c. mechanically latched contactors}

{d. digital motor protective relay} (refer to Article 2.06)>

2.05 MOTOR CONTROLLER COMPONENTS

Provide the specified motor controller types with the following components.

A. Squirrel-Cage Motor Starters

1. Components Full-Voltage Non-Reversing (FVNR) available in 1 High or 2 High construction

a. High-Voltage Compartment

1) 1 Set of [{clip}{bolt-in}] current-limiting fuses and supports

2) 1 Externally operated contactor isolating mechanism

3) 1 - 3-pole vacuum contactor

4) 1 Set mechanical interlocks to prevent: opening disconnect when contactor is ON; prevent opening door when disconnect is ON; closing contactor when disconnect is in intermediate position; prevent closing disconnect when high-voltage door is open.

5) 1 Control Power Transformer (CPT)

6) 3 Current Transformers

7) [__] Provisions for motor cable connections

b. Low Voltage Compartment

1) 1 - 3-pole, [{ambient-compensated thermal overload relay} {electronic overload relay with phase unbalance} and selectable OL class {electronic multifunction motor protection relay}]

2) 1 Normal / Test selector switch

3) 1 Control-circuit fuse

4) 1 Contactor Timing Module (CTM)

c. On Door

1) 1 START-STOP push-button, oil-tight, flush-mounted

2. Components Full-Voltage Reversing (FVR)

a. Same as FVNR with following additions:

1) Auxiliary Enclosure

a) 2 - 3-pole vacuum contactors for reversing

2) On Door

a) 1 FORWARD-REVERSE-STOP push-button, oil-tight, flush-mounted (replacing START-STOP) push-button)

3. Components Reduced-Voltage Non-Reversing Primary Reactor (RVNRPR)

a. Same as FVNR with following additions:

1) High Voltage Compartment

a) 1 - 3-pole vacuum contactor used as RUN contactor

2) Auxiliary Enclosure (1 High)

a) 1 Reduced-voltage starting reactor with taps for 50-, 65- and 80-percent line voltage (set at 65 percent tap)

3) Low Voltage Compartment

a) 1 Definite time transfer relay

4. Components Reduced-Voltage Non-Reversing Auto-Transformer Closed Transition (RVNRAT)

a. Same as FVNR with following additions

1) High Voltage Compartment

a) 1 - 3-pole vacuum contactor as a RUN contactor

2) Auxiliary Enclosure (1 High)

a) 1 - 3-pole vacuum contactor-neutral

b) 1 Starting autotransformer with taps for 50, 65 or 80 percent line voltage (set at 65 percent tap)

3) Low Voltage Compartment

a) 1 - Definite time transfer relay

B. Wound Rotor Motor Starters

1. Components FVNR

a. Same as Squirrel-Cage FVNR with following additions:

1) Secondary Enclosure

a) 1 Set of intermediate accelerating contactors

b) 1 Final accelerating contactor

c) 1 Set of definite-time accelerating relays

2) Resistor Enclosure

a) 1 Set of starting-duty resistors. NEMA Class 135

2. Components FVR

a. Same as Wound Rotor FVNR with following additions:

1) High Voltage Compartment

a) 1 - 3-pole vacuum contactor used for reversing

2) On Door

a) 1 FORWARD-REVERSE-STOP push-button, oil-tight, flush-mounted (replacing START-STOP) push-button).

C. Brush-Type Synchronous Motors Starters

1. Components FVNR

a. Same as Squirrel-Cage FVNR with following additions:

1) Low Voltage Compartment

a) 1 Field application and discharge contactor

2) On Door

a) 1 CR192 µSPM solid-state synchronizing device (or equal) for precision-angle field application, load-angle field removal and squirrel-cage protection with built-in digital power factor and line ammeter

b) 1 Line amps display-digital readout (CR192 module)

c) 1 Field amps display-digital readout (CR192 module)

3) On Top

a) 1 Field starting and discharge resistor

2. Components RVNR

a. Same as Squirrel Cage RVNR with addition of preceding Low Voltage components

D. Brushless Synchronous Motors Starters

1. Components FVNR

a. Same as Squirrel-Cage FVNR with following additions:

1) Low Voltage Compartment

a) 1) Brushless-exciter field supply (7 amps maximum)

b) 1 Variable autotransformer for exciter field supply

2) On Door

a) 1 CR192 µSPM solid-state synchronizing device (or equal) for precision time delay field application, load-angle field removal and squirrel-cage protection with built-in digital power factor and line ammeter

b) 1 Line amps display-digital readout (CR192 module)

c) 1 Field amps display-digital readout (CR192 module)

2. Components RVNR

a. Same as squirrel Cage RVNR with addition of preceding Low Voltage components

2.06 Digital Motor Protection Relays

A. Provide a digital motor protection relay. The relay shall be equal to the MULTILIN 269+ or the 469. The relay shall be provided with capability to communicate over a power management communications network. Relay settings, trips, alarms and metered values shall be able to be communicated to a host computer. The communications link within the motor controller lineup shall be via a shielded twisted pair. A terminal point shall be provided within the lineup to connect

the internal communications link to the external communications network.

2.07 INSTRUMENTS

A. Provide a Multi-Function electronic monitor as described in the following paragraphs.

1. General Description

a. 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.

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

c. The Monitor shall have a local event log.

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

2. The Monitor shall include the following components:

a. The front panel shall contain:

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

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

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

b. The monitor shall contain:

1). terminals for AC or DC control power;

2). ground connection;

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

4). On/Off switch.

3. Mounting

a. 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.

4. Software

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

b. 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.

5. Supported Devices

a. 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.)

6. Basic Operations

a. The Monitor shall have the following functional categories.

1). View: Monitor Configured Devices

2). Setup: Configure Devices and Change Options

3). Diagnostics: Troubleshooting

7. Modbus Monitor Specifications

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

b. Modbus Communications: [{One}{Two}] RS-485 ports

1). 1200, 2400, 4800, 9600, or 19200 baud (User configurable)

2). No Parity, eight data bits, one stop bit

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

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

2.08 ACCESSORIES

A. Limitamp® UL listed current limiting power fuses (or equal)

B. Hand-Off-Auto selector switch for automatic starting from pilot devices

C. Ilsco solderless connectors (or equal)

D. Furnish nameplates for each starter device as indicated in drawings. Use [{black letters on white background}{white letters on black background}].

2.09 TESTING

A. Limitamp® is tested in accordance with NEMA ICS 1-109 and ANSI C19.3 summarized in following list:

1. Production Inspections;

2. Mechanical Operation;

3. Function Operation:

a. Devices:

b. Sequence and Timing Circuits:

c. Polarity of Phase-Sensitive Circuits:

d. Grounding.

4. High Potential Insulation:

a. Control Wiring;

b. Power Cable Insulation and Isolation.

2.10 FINISH

A. The Limitamp 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

CONTRACTOR/INSTALLER SHALL PERFORM ALL THE FOLLOWING:

3.01 EXAMINATION

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

B. Check concrete pads for uniformity and level surface.

C. Verify that medium voltage motor controllers 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 INSTALLATION

Install per manufacturers instructions. Install required safety labels.

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

3.03 FIELD QUALITY CONTROL

A. Inspect installed medium voltage motor controllers 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] megohms. Refer to manufacturers 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 manufacturers instructions.

D. Test each key interlock system for proper functioning.

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

F List other controls as required.

3.04 ADJUSTING

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

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

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

3.05 CLEANING

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

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

END OF SECTION