

SECTION 16346000
MEDIUM VOLTAGE MOTOR CONTROLLERS
LIMITAMP®

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

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

C. NEMA ICS 1 - General Standards for Industrial Control Systems

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

E. NEMA ICS 324

F. UL 347, High Voltage 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 10 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 10 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)

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A. Manufacturer shall have specialized in the manufacture and assembly of medium voltage motor controllers for 10 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 REGULATORY REQUIREMENTS N/A

1.11 MOCK-UPS (FIELD SAMPLES) N/A

1.12 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 50.1 and manufacturer's written instructions to avoid damaging equipment, installed devices, and finish. Lift only by installed lifting eyes.

1.13 PROJECT CONDITIONS (SITE ENVIRONMENTAL CONDITIONS)

A. 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.

1.14 SEQUENCING AND SCHEDULING

1.15 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.

1.16 MAINTENANCE SERVICE N/A

1.17 EXTRA MATERIALS

1.18 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

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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 [the required quantity] GE Type Limitamp® motor controllers (or previously 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, gasketed.

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

D. For personnel safety, enclosure(s) shall have:

1. low-voltage control compartment with separate door;
2. high voltage compartment with separate interlocked door;
3. ac bus compartment with protective barriers;
4. cable entrance compartment.

E. Load terminations shall be arranged for cable connections as indicated.

F. 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.

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

H. Controller(s) shall be in a [1]{2} - high line-up of NEMA type 1 gasketed 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. Bus bars shall be copper.

2.04 CONTROLLERS

A. General

1. For overload protection, one digital multifunction motor protection relay shall be provided for each starter. Provide three phase current transformers and one ground sensor current to provide input to the relay.

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2. Control power at 120 volts shall be provided from a control power transformer in each controller. The transformer shall be protected by current-limiting fuses.
3. Controls shall provide undervoltage release when maintained contact switch is used. Provide a [{"start-stop push-button"} {"H-O-A switch"}] mounted on the controller door.
4. Each controller 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. Controllers shall be stationary or drawout mounted with vacuum break contactors.
6. Motor starter types shall be as shown on the drawings and shall be of the following types:
 - a. Full Voltage Non-Reversing (FVNR).
 - b. Reduced Voltage Non-Reversing - Autotransformer (RVNR-AT)
 - c. Reduced Voltage Non-Reversing - Primary Reactor (RVNR-PR)
 - d. Wound Rotor Non-Reversing
 - e. Synchronous Non-Reversing
 - f. Full Voltage Reversing

B. Limitamp® Vacuum Break Controls (or approved equal), Full Voltage Non-Reversing (FVNR) motor controllers shall have the following features:

1. Controller(s) shall be fused type with current-limiting power fuses that provide an interrupting rating as indicated in drawings.
2. Controllers shall use three pole vacuum contactor(s) rated as indicated in drawings.
3. 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.
4. Contactor(s) shall be [{"stationary"} {"drawout"}]. 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.
5. 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:
 - 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.
6. Controllers rated 400 amperes up to 7.2 KV and 800 amperes up to 5 KV shall be rated

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60 KV Basic Impulse Level (BIL). Control power transformer and autotransformer shall be rated 25 KV BIL.

7. In addition to the FVNR starter requirements, full voltage reversing controllers shall be provided with:

- a. 2 - three pole vacuum contactors for reversing.
- b. 1 - forward-reverse-stop push button.

8. In addition to the FVNR starter requirements, reduced voltage non-reversing primary reactor starters shall be provided with:

- a. 1 - three pole contactor used as a run contactor.
- b. 1 - auxiliary enclosure for the starting reactor with 50, 65, and 80 percent taps.
- c. 1 - definite time transfer relay.

9. In addition to the FVNR starter requirements, reduced voltage non-reversing autotransformer closed transition starters shall be provided with:

- a. 1 - three pole contactor used as a run contactor
- b. 1 - auxiliary enclosure with a three pole vacuum neutral contactor and one autotransformer with 50, 65, and 80 percent taps.
- c. 1 - definite time transfer relay.

10. In addition to the FVNR starter requirements, non-reversing wound rotor starters shall be provided with:

- a. 1 - secondary enclosure containing one set of intermediate accelerating contactors, one final accelerating contactor, and one set of definite time accelerating relays.
- b. 1 - resistor enclosure with one set of starting duty resistors, NEMA class 135.

11. In addition to the FVNR starter requirements, brush-type synchronous motor starters shall be provided with:

- a. 1 - field application and discharge contactor
- b. 1 - digital electronic synchronizing device for field application, load-angle field removal and squirrel-cage protection with built-in digital power factor and line amps and field amps readout
- c. 1 - field starting and discharge resistor.

12. In addition to the FVNR starter requirements, brushless synchronous motor starters shall be provided with:

- a. 1 - brushless exciter field supply (7 amps maximum)
- b. 1 - variable autotransformer for exciter field supply
- c. 1 - digital electronic synchronizing device for field application, load-angle field removal and squirrel-cage protection with built-in digital power factor and line amps and field amps readout

<{13. Options:}

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

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

{c. 3 - KVA control power transformer}>

2.07 INSTRUMENTS

A. Provide the following instruments where indicated on the drawings:

1. Ammeter
2. Voltmeter
3. Elapsed-Time Meter
4. Power Factor Meter
5. Varmeter
6. Wattmeter
7. Watt-hour Meter
8. Demand Register for Watt-hour Meter
9. Transducers
10. Test Blocks
11. Operation Counter
12. GE Electronic Power Meter (EPM 3710), (or equal)
14. GE MDP200 Digital Overcurrent Relay
15. Potential Transformers
16. Current Transformers

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.

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;

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- 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.
- 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

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physical damage.

B. Megger and record phase to phase and phase to ground insulation resistance of each bus section. Megger for [___] minutes for each measurement at minimum voltage of 1000 VDC. Measured insulation resistance shall be at least 1000 megohms. 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).

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 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