

Grouped Motor Controller Specification— Low Voltage (600 Volts)

Refining Department

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FOREWORD

The object of this publication is to provide a purchase specification to facilitate the manufacture and procurement of grouped full voltage motor controllers for the starting, control, and protection of squirrel cage induction motors for petroleum industry service. The specification is limited to motor controllers rated for 600V.

This specification requires the purchaser to specify certain details and features. Also, it is *recognized* that the purchaser may desire to modify, delete, or simplify sections of the specification. It is strongly recommended that such modifications be made by supplementing this specification rather than by rewriting or by incorporating sections thereof into another complete specification.

Suggested revisions are invited and should be submitted to the director of the Refining Department, American Petroleum Institute, 2101 L Street N.W., Washington, D.C. 20037.

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GROUPED MOTOR CONTROLLER SPECIFICATION—LOW VOLTAGE (600 VOLTS)

SECTION 1—GENERAL

•1.1 Scope

This specification (together with applicable data sheets and job specifications) covers the materials, design, and fabrication of grouped full voltage, indoor or outdoor, magnetic, combination motor controllers protected with fusible disconnect switch or molded case circuit breaker for the supply, control, and protection of squirrel cage induction motors used in petroleum industry service. Should conflicts exist, job specifications will govern.

•1.2 Referenced Publications

Applicable sections of the latest editions of the following standards and codes are part of this specification unless amended herein or by the data forms.

ANSI¹

- C19.3 *Industrial Control Apparatus—General*
- C19.4 *Industrial Control Apparatus—Enclosures*
- C19.5 *Industrial Control Apparatus—Switching or Controlling Devices*
- C19.6 *Industrial Control Apparatus—Control-Circuit Devices and Assemblies*
- C19.7 *Industrial Control Apparatus—Controllers and Controller Assemblies*
- C33.30 *Industrial Control Equipment for Use in Hazardous Locations*
- C1 *National Electrical Code*

NEMA²

- ICS-1970 *Industrial Controls and Systems*

IEEE³

- 288 *Guide for Induction Motor Protection*

NFPA⁴

- 496 *Purged and Pressurized Enclosures for Electrical Equipment*

NOTE: A bullet (•) in the margin indicates a decision may be required which may not be covered on the data sheets, Appendixes A, B, C, and D. Refer to Appendix E - Checklist.

Applicable state and local regulations and codes as noted in Appendix B or C.

1.3 Application

Motor controllers supplied as part of this specification shall meet the requirements of the designated area classification in which they are installed. Refer to Appendixes A through D (purchaser's data sheets) for details and specific requirements.

•1.4 Unusual Service Conditions

Motor controllers designated as suitable for indoor operation shall be furnished with enclosures designed for both continuous operation and long periods of inactivity in atmospheres that are made corrosive by (1) traces of chemicals that may be present in a petroleum processing plant and (2) environmental conditions existing at the plant site (such as high humidity, insects, rodents, and so forth). The purchaser shall specify chemicals involved and environmental conditions that prevail.

Enclosures designated as suitable for outdoor operation shall not require additional protective shelters or coatings and shall afford adequate protection against storms (rain, snow, or dust), salt-laden air, as well as the requirements of indoor operation mentioned above. The purchaser shall specify enclosure type required (that is, NEMA 3, 3R, or 3S).

1.5 Operating Experience

Where a new design or material that has not been proven in service for at least 2 years is offered, proposals shall indicate which parts of the controller are affected (such as new insulating materials, contact design change, and so forth) and the extent of experience with such parts.

¹American National Standards Institute, Inc., 1430 Broadway, New York, New York 10018.

²National Electrical Manufacturers Association, 2101 L Street, N.W., Washington, D.C. 20037.

³Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York 10017.

⁴National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts 02210.

1.6 Guarantee

Equipment shall be fully assembled and tested at the factory and guaranteed by the vendor against defective material, poor workmanship, design deficiencies, and failure from normal usage for a minimum of 1 year after being placed in specified service but not exceeding 18 months after date of shipment. The vendor shall repair or replace any defective controller parts or equipment and repair, as required, any controller damage resulting from poor workmanship or faulty design found within this time period, without expense to the purchaser.

1.7 Drawings and Data

1.7.1 The bidder shall furnish the following information with his quotation:

1. Data sheets: The specified number of copies of each of the purchaser's data sheets after the bidder has entered thereon the information to be supplied by him.
2. Outline drawings: The specified number of copies of complete outline dimensional drawings for each controller or lineup. The drawings shall show the principal dimensions of the unit, horsepower rating, type, and voltage rating.

1.7.2 In addition to the information to be furnished by the manufacturer as a bidder, the manufacturer shall furnish the specified number of copies of the following information for design, installation, maintenance, and record purposes. All drawings and data shall be identified with job number, purchaser's

name, purchaser's complete requisition number, and item number.

1.7.2.1 Preliminary

Within 3 weeks of receipt of a purchase order the manufacturer shall supply the specified number of copies of drawings covering dimensions, weight of the total assembly, and mounting arrangements. One-line, elementary, and/or wiring diagrams shall be included if specified. Dimensional drawings shall include all clearances required for door swings, equipment removal, and so forth.

These copies of the manufacturer's drawings shall be submitted for approval before fabrication is started. One copy bearing the purchaser's approval stamp and notations of any required corrections will be returned to the manufacturer.

1.7.2.2 Final

After approval of final drawings, the manufacturer shall supply the following data:

1. The specified number of copies or one reproducible copy of fully dimensioned detail drawings including total weight and mounting arrangements. One-line, elementary, schematic, and/or wiring diagrams shall be included when specified.
2. The specified number of copies of operating and maintenance instruction booklets.
3. The specified number of copies of the recommended spare parts list which includes price information.
4. The specified number of copies of the bill of materials of electrical components.

SECTION 2—CONSTRUCTION

2.1 General

2.1.1 An indication, either direct or by mechanical indicator, shall be provided to show the circuit breaker or disconnect switch position (that is, "On" or "Off").

2.1.2 If fuses are used for short-circuit protection, a load-break switch sized to interrupt locked rotor current shall be included in all such controllers or feeders to remote controllers. Spare fuse sets, suitably stored, shall be provided when specified.

2.1.3 All special tools required, nonstandard wrenches, sockets, and so forth to latch/unlatch, bolt/unbolt, and so forth, shall be provided with each assembly.

2.1.4 No operating device or instrument shall be over 78 inches (1980 millimeters) above the floor.

2.1.5 Motor data required for the selection of the controller and its components shall be supplied by the purchaser on the data forms.

2.1.6 The type of motor controller and enclosure (Table 1) shall be specified by the purchaser. In general, the enclosures should be as presented in Table 1. All arcing devices in power and control circuits in Division 2 locations must be housed in enclosures approved for Division 2, explosionproof or pressurized, hermetically sealed, intrinsically safe, or approved oil immersed. Sealing fittings shall be as required by the *National Electrical Code*. All arcing devices in power

Table 1—Types of Motor Controllers and Enclosures

<i>Location</i>	<i>Classification</i>	<i>Enclosure</i>	<i>Remarks</i>
Outdoor	Nonclassified	NEMA 3, 3R, 3S, or 4	Walk-in or non-walk-in weatherproof housing is built around the standard NEMA 1 equipment, or NEMA 4 mounted on switch racks.
	Class I Divisions 1 & 2	NEMA 3, 3R, or 3S pressurized	Refer to NFPA 496
	Class I Divisions 1 & 2	NEMA 7 or NEMA 8	Switchrack type construction, with enclosure weatherproofing
Indoor	Nonclassified	NEMA 1	General purpose
		NEMA 12	Dusttight with additional protection against contamination from oil.
	Class I Divisions 1 & 2	NEMA 12 pressurized	Refer to NFPA 496
	Class I Divisions 1 & 2	NEMA 7 or NEMA 8	Switchrack type construction

and control circuits in Division 1 locations shall be in approved explosionproof or oil-immersed enclosures with sealing fitting as required by the *National Electrical Code*.

2.2 Motor Control Centers

2.2.1 Control centers shall be rigid, free-standing, metal-enclosed structures. Structures shall consist of vertical sections which may be assembled into a group having a common power bus and forming an enclosure to which additional sections may readily be added. Each vertical section shall be subdivided into compartments containing the various control and protective devices.

2.2.2 Control centers shall have a ground bus horizontally mounted near the bottom of the structure extending throughout the length of the center. Connectors shall be provided on each end for No. 2/0 American Wire Gage (AWG) (67.4 square millimeters) copper grounding conductors.

2.2.3 Structure drilling, tapping, cutting, welding, and forming shall be designed and factory finished to permit field rearrangement of controller compartments into any possible combination by the use of simple fasteners such as bolts and screws. If bus plug-in con-

tact design utilizes special shapes or fittings connected permanently to the bus, they shall be provided at all locations needed by any rearrangement of all possible size compartments.

2.2.4 Isolation requirements between device, bus, and cable spaces shall be as follows:

1. Permit cables to be pulled safely into the center and extended to device compartments with the control center energized. Uninsulated live parts shall not be located in the cable pulling spaces. It is acceptable if guarded cable terminals are located in the cable pulling space, provided temporary isolation can be installed in one piece during cable pulling.
2. Prevent transmission of arcs and retard arc products which originate in device compartments from entering bus spaces or cable pulling spaces, or both.
3. Prevent transmission of arcs and retard migration of arc products between device compartments even when an intervening device assembly has been removed.
4. While the bus is energized, permit personnel to work safely within either an empty compartment or one from which the control assembly has been removed. Unless otherwise approved, this shall be accomplished by means of main bus isolation and full length vertical bus isolation having minimum-sized openings for the device plug-in contacts.

•**2.2.5** All phase, neutral, and ground buses shall be braced for a minimum of 22,000 amperes root mean square. If the specified bus momentary rating exceeds 22,000 amperes (symmetrical basis), a test report certifying satisfactory test results of a prototype shall be furnished.

•**2.2.6** If main bus neutral is specified without its current rating, the rating shall be 50 percent of the phase bus rating.

2.2.7 Control device assemblies shall have plug-in line connections or otherwise be arranged so the assembly can be removed without deenergizing the center. Fixed connections are acceptable only if size or weight of the assembly makes its removal as a unit impractical.

•**2.2.8** Power and control fuses shall be accessible for replacement without removing the control device assembly from the center or disconnecting cables. Spare control fuse sets, suitably stored, shall be provided when specified.

2.2.9 Engraved phenolic nameplates, showing black letters on white face, shall be provided and attached with stainless steel or brass screws to the door of each unit.

2.2.10 Circuit breakers and fused disconnect switches used to feed loads other than motor controllers may be twin-mounted in the same compartment provided there is a barrier between units and each has an individual door. If there is only a single door, it must be suitably interlocked with each circuit breaker or disconnect switch.

•**2.2.11** Unless otherwise specified, 120-volt power for space heaters shall be provided from the lighting panel in the motor control center.

•**2.2.12** Control centers shall be NEMA Class 1, Type A, B, or C as specified. Type definitions are as follows:

1. *Type A* - This basic type does not include unit terminal boards for control or power cables. Connections must be made directly to the component terminals.
2. *Type B* - Terminal boards are provided on motor controller units for all control wiring connections and for load power connections on motor controllers through NEMA Size 3. Load terminal blocks are not provided for feeder units.
3. *Type C* - This type includes master terminal boards for each section of a control center. It is located in the top or bottom terminal board compartment of the vertical sections and includes wiring between the con-

troller unit terminal boards (Type B) and the master terminal board.

•**2.2.13** The proper selection and arrangement of incoming feeder cables or bus duct and the connection to the control center main horizontal bus is essential to a good electrical layout and an economical installation. The following design requirements shall be specified by the purchaser:

1. Incoming feeder type (bus duct, cable in conduit, and so forth) and type of material used (copper or aluminum).
2. Entry location—top or bottom.
3. Size of incoming feeder.
4. Cable conductors per phase.
5. Incoming circuit breaker or fusible switch in control center.
6. Rear access or no rear access.
7. Mounting of controllers, both front and back or in front only.

•**2.2.14** Space shall be provided for incoming power, control, and ground conductors and conduits. The size and number of these conductors and conduits shall be specified by the purchaser. Provisions for terminating all incoming conductors shall be included.

2.2.15 A corrosion-resistant coating over a suitably prepared surface shall be applied to the inside and outside of the cubicle.

2.2.16 MECHANICAL DESIGN FEATURES

•**2.2.16.1 Indoor Installations**

The cubicle design shall be NEMA 1 (assumes an environmentally controlled installation location) or NEMA 12 *dusttight and driptight*. In either type enclosure, all ventilation openings shall be suitably filtered or screened with a specified corrosion-resistant material (such as, stainless steel hardware cloth or galvanized screen) arranged to prevent entrance of snakes, rodents, and so forth. All control devices shall be selected for proper operation in the designated atmosphere without further protection.

2.2.16.2 Outdoor Installation

a. The cubicle design shall be NEMA 3, 3R, 3S, or 4; walk-in or non-walk-in with outdoor weatherproof enclosure. The entire enclosure shall be supported on channels or other structural shapes that raise the structure a minimum of 3 inches (76 millimeters) above the foundation. The underside of the enclosure shall be protected by a liberal coat of mastic or other equally effective coating material to prevent rusting. Each vertical section shall have a one-piece, steel, overhanging,

sloping roof, plus all of the requirements of the indoor enclosure mentioned above. When sections are combined, roof joints shall be between sections and suitably sealed or covered to prevent the entrance of moisture. All outside doors shall have holding devices that maintain the door in the open position. All exterior hardware (handles, hinges, nuts, bolts, and so forth) shall be stainless steel.

- **b.** All walk-in and non-walk-in control centers shall be furnished with the following:
 1. Two 120-volt duplex grounding-type convenience outlets shall be provided, one located at each end of the line-up.
 2. Unless otherwise specified, 120-volt power for lighting and outlets shall be provided from lighting panel in motor control center.
 3. All exterior doors shall be gasketed for exclusion of dust and water.
 4. Doors on non-walk-in enclosures shall have provision for padlocks.

c. All walk-in control centers shall be furnished with the following additional features:

1. Accessway door at each end of the aisle shall have anti-panic hardware.
2. Accessway doors shall have a minimum width of 36 inches (915 millimeters).
3. Doors on walk-in enclosures shall have flush cylinder type locks.
4. Sufficient fluorescent lighting shall be provided for working within the enclosure accessway with doors closed.
5. Lights shall be controlled by three-way switches easily accessible inside each entrance door.

d. The corrosion-resistant coating, both inside and outside, of outdoor cubicles shall be rated as "corrosion-resistant" per NEMA ICS-1-110.58. Manufacturer's standard gray color is acceptable.

- **e.** Roof or wall-mounted ventilators, whether powered or gravity type, shall provide sufficient ventilation to prevent temperature inside from exceeding 122 degrees Fahrenheit (50 degrees Celsius) with an outside ambient temperature of 104 degrees Fahrenheit (40 degrees Celsius). Louvered air inlets with filters shall be provided on side walls of NEMA 3 enclosures constructed so as to eliminate the entry of driven rain (30 degree shielding).

f. Removable steel plates shall be provided in the bottom of motor control center units where conduits enter to make them rodent proof.

2.3 Switchrack Mounting

2.3.1 Motor controllers shall be the combination magnetic starter type. Each individual enclosure will contain a disconnecting device, short-circuit, and overload protection plus the appropriate number of contactors required to control an individual motor (one contactor for full-voltage nonreversing, two contactors for full-voltage reversing, and so forth).

- **2.3.2** The enclosures shall be NEMA 7 or 8 as specified, with enclosure weatherproofing if installed outdoors, when located in classified areas. Enclosures in unclassified areas shall be NEMA 4 unless otherwise specified on the data sheet. Corrosion-resistant enclosures and hardware shall be as specified.

2.3.3 Corrosion-resistant vents and drains shall be provided on all enclosures.

2.3.4 Engraved phenolic nameplates, showing black letters on white face, shall be provided and attached with screws to the exterior of each enclosure.

2.3.5 The combination starters are to be grouped together and mounted on switchracks. Vertical and horizontal clearances between enclosures shall be sufficient to permit installation and removal of all auxiliary devices such as breathers, drains, and so forth.

2.3.6 Switchracks shall be self-supporting and fabricated from standard structural shapes of adequate size and weight to assure a rigid structure. Racks shall either be #6061 aluminum alloy or steel that is hot dip galvanized after completion of welding and drilling. The racks shall be assembled with stainless steel hardware.

2.3.7 The bus portion of switchracks designated for nonclassified or Division 2 locations shall have bolted covers with handles—6 feet (1.83 meters) maximum length per section—and 3/8 inch (9.5 millimeters) weepholes in the bottom for drainage. Enclosures shall be either #5052 aluminum alloy or steel that is hot dip galvanized (see 2.3.6). The enclosures shall be assembled with stainless steel hardware. Nuts for cover bolts shall be captive. The bus portion of switchracks designated for Division 1 locations shall be enclosed in cast enclosures that are labeled for Division 1 locations. Any hubs, holes, and so forth added to these enclosures shall be done in such a manner as to retain the label.

- **2.3.8** Switchrack structure, bus enclosure, and all device enclosures shall be of the same material type (that is, all aluminum or cast iron and steel) unless otherwise specified.

•**2.3.9** Buses shall consist of bars, copper or aluminum as specified, 600 ampere minimum capacity, mounted on nonhygroscopic ceramic insulators. For locations subject to heavy insulator surface contamination, minimum length creepage dimensions should be specified. Buses shall be braced for 22,000 amperes minimum symmetrical short-circuit current otherwise specified on the data sheet. Buses shall be drilled for specified future connections.

2.3.10 Equipment shall be connected to bus enclosures using rigid conduit. Two-part, screw-type grounding hubs may be used at the bus enclosure only on units designated for unclassified or Division 2 locations. Sealing fittings at the starter enclosures shall be drain type.

•**2.3.11** When specified, space heaters shall be provided to reduce condensation in the bus enclosure. The heaters shall be rated 120 volts and served from equipment installed by manufacturer on the switchrack, unless otherwise specified.

2.3.12 Lugs shall be provided at each end of switchrack structural support for connection to No. 2/0 AWG (67.4 square millimeters) copper grounding conductors.

2.4 Electrical Design Features

2.4.1 CONTROLLERS

2.4.1.1 Motor controllers shall be 600-volt, three-pole magnetic across-the-line type. Controllers shall have a seal-in auxiliary contact for three-wire control.

2.4.1.2 Controllers in multispeed and reversing controllers shall have electrical or interference type mechanical interlocks to prevent line-to-line faults caused by one controller picking up before the other has dropped out. Interlocking shall be per NEMA ICS 2-110.03 and .04.

•**2.4.1.3** The contactor shall be suitably rated for the coordinated controller rating and shall be nonwelding under all normal conditions and operating overloads including locked rotor current. Controllers specified for special duty, such as jogging, shall also meet these criteria.

•**2.4.1.4** Control power transformers, if required, shall be provided in each controller.

2.4.1.5 Where control power transformers are specified, the secondary shall be grounded on one side and fused in the ungrounded leg.

2.4.1.6 Unless control power transformers are specified, contactor coils shall operate on line-to-line volts with control power derived from each individual controller.

2.4.2 CIRCUIT BREAKERS

2.4.2.1 Circuit breakers shall be molded case, air-break type. They shall be three-pole, 600-volt, rated continuously at 125 percent of motor full load current. Trip devices shall be trip free. Circuit breakers for motor loads shall be magnetic trip only, breakers for feeders and nonmotor loads shall be thermal-magnetic trips. Circuit breaker calibration shall be at 104 degrees Fahrenheit (40 degrees Celsius).

2.4.2.2 Each circuit breaker installed in a motor control center shall be manually operable by a trip-free handle on the front door. Each handle shall give visual indication of the "On" or "Off" position and shall be capable of being padlocked in the "Off" position. Each handle shall interlock the compartment door so that the door cannot be opened unless the breaker is open. Except for NEMA 7 enclosures, a door interlock bypass shall be provided to permit maintenance personnel to open the door with the breaker closed.

2.4.3 FUSED DISCONNECT SWITCH

2.4.3.1 The fused disconnect switch shall be 600-volt, AC, three-pole, horsepower rated.

2.4.3.2 The disconnect switch shall be capable of interrupting motor locked rotor current.

2.4.3.3 The switch shall be quick-make, quick-break, *visible-blade type combined with fusing facilities for current-limiting fuses.*

2.4.3.4 Each disconnect switch shall be operated by a handle accessible from the front of the enclosure. Each handle shall give visual indication of the "On" or "Off" position and shall be capable of being padlocked in the "Off" position. Each handle shall interlock the compartment door so that the door cannot be opened unless the handle is in the "Off" position. Except for NEMA 7 enclosures, a door interlock bypass shall be provided to permit maintenance personnel to open the door with the switch closed.

•**2.4.3.5** Spare fuse sets, suitably stored, shall be provided when specified.

2.4.4 SPACE HEATERS

•**2.4.4.1** All outdoor control centers shall be provided with space heaters in each vertical section. In-

door control centers shall have space heaters when specified.

2.4.4.2 A space heater control shall be furnished for each piece of equipment and shall consist of the following:

1. A thermostat shall be used to control the heater so that the equipment interior temperature is maintained at 7 degrees Fahrenheit to 10 degrees Fahrenheit (a Δt variation of 3 degrees Celsius to 5 degrees Celsius) above the outdoor air temperature.

2. The thermostat shall be cut off by one or more automatic devices set for a maximum equipment interior temperature of 95 degrees Fahrenheit (35 degrees

Celsius). The devices shall reset at 90 degrees Fahrenheit (32.22 degrees Celsius). Devices shall be located in enough typically loaded sections to prevent overheating.

2.4.4.3 For outdoor equipment, the space heater system shall be completely wired and shall include manual disconnect.

•2.4.4.4 Space heater sheath temperature for all outdoor equipment shall be limited to the temperature specified on the data sheets.

SECTION 3—PROTECTION

3.1

Control equipment shall have protective devices which adequately protect the motor for overload, locked rotor, and short-circuit conditions. Devices shall have time-current characteristics which permit the motor to accelerate the driven machine to full-load speed under normal operating conditions.

•3.2

Thermal overload relays shall be trip free and either lockout, manual reset, or automatic reset as specified. There shall be three thermal overload relays, one per phase.

•3.3

Undervoltage protection shall be supplied through a seal-in auxiliary contact on the main contactor, unless otherwise specified.

•3.4

Additional relaying, if required, will be shown on the appropriate one-line diagrams included with the data sheets. Some optional relaying might be ground fault, differential, and single phase protection.

SECTION 4—ACCESSORIES

4.1

A nameplate shall be attached to each controller and shall indicate manufacturer's catalog designation, maximum horsepower rating at a specified voltage, maximum continuous amperes, and control circuit voltage.

4.2

Separate nameplates, suitably located, shall indicate the following:

1. Warning or operational instructions as required.
2. Identity of all relays, meters, and so forth (Class 1 motor control centers).
- 3. Purchasers assigned motor or equipment number and identification when specified.

•4.3

Control devices and pilot lights, cover mounted as specified.

SECTION 5—TESTS AND PERFORMANCE

5.1

Manufacturers supplying controllers to this specification shall have subjected identical units to the interrupting, short-time current capacity and dielectric voltage tests specified by NEMA.

5.2

After completion of the assembly and wiring of each controller, all of the electrical and mechanical interlocks, control devices, protective relays, indicator

lights, meters, and optional equipment provided shall be thoroughly tested to the extent required to guarantee a completely workable controller assembly prior to shipping.

5.3

When two or more controllers are designed with functions dependent on another, the functions of the supporting controllers must also be thoroughly tested prior to shipping after final assembly.

SECTION 6—SHIPPING

6.1

Equipment shall be shipped completely assembled, whenever possible. For large assemblies, the line-up may be divided into reasonable sections to facilitate handling during transportation and installation. All shipments shall contain a packing list which completely outlines the number of separate items that are ultimately to be shipped by the manufacturer in order to meet the requirements of these specifications. Any partial shipments shall be so indicated on the outline. Any items which are to be field assembled and packed in crates separate from major items shall contain packing lists that fully describe the contents of such crates.

•6.2

Equipment shall be identified with purchaser's and

vendor's order numbers and any other designations requested on the purchaser's shipping instructions. These shipping instructions shall also include any special protective shipping or storage packaging required for long-term storage prior to installation or energization.

6.3

Foreign material to be removed prior to energization shall be clearly identified by distinctive colors and legends. Temporary warning signs stating "REMOVE TEMPORARY MATERIALS BEFORE ENERGIZATION" shall be posted on the exterior near the main power disconnect.

APPENDIX A MOTOR DATA

Motor Control Center No. _____
or
Switchrack No. _____
Description _____
Date _____

[illegible]

INFORMATION TO BE SUPPLIED BY PURCHASER

Purchaser _____ Job Number _____
Destination _____ Item Number _____
Quotation Number _____ Requisition No. _____
Environmental Conditions _____
NEMA Class _____ Wiring Type _____
(1, 11) (A, B, C)
Master Terminal Block for Type C Located _____
(Top or Bottom)
NEMA Enclosure Type _____
(See Table 1)
Equipment Mtg. _____ Corrosion-resistant hardware _____
(Front Only, Back to Back) (Stainless, Galvanized, Cadmium Plated)
Finish _____ Oversized Hor. Wireway: Top _____ Bottom _____
(ASA No. 61 Gray is Std.)
Power Supply _____ Volts _____ Phase _____
_____ Wire _____ Hertz (cy.) _____
Bus Bars _____
(Aluminum, Copper)
Bus Amps: Main Hor. _____ Vertical _____ Braced for _____ SYM
(600 Amp Std.) (300 Amp Std.) (22,000 Amp Std.)
Ground Bus _____ Neutral Bus _____
Main: Circuit Breaker _____ Fusible Switch _____
(Rating) (Rating & Fuse Type)
Spare Fuse Sets Required _____
Control Voltage: 120V _____ 480V _____ Other _____
Maximum Surface Temperature of Space Heaters _____ °F _____ °C.
Space Heaters: Watts _____ Voltage _____ Phase _____
Wiring Requirements (See Appendix A for Wire Sizes)
Incoming Power ☐ Wire Size, Size, and Type _____ Conduit Size _____
☐ Bus Duct - Size and Type _____
Location _____

APPENDIX B (CONTINUED)

Outgoing Power - Wiring Method and Type _____
Conduit Size _____ Location _____
Outgoing control and/or alarm—Wiring Method and Type _____
Conduit Size _____ Location _____
Space Heater (Controller Enclosure) Power Source _____
Voltage _____ Thermostat _____
Grounding - Wiring Method and Type _____
Conduit Size _____ Location _____
Relaying - Overload Relays _____ Lock-out _____
Thermal (Standard) _____ Hand Reset _____
Ambient Compensated _____ Auto Reset _____
Time Delay Undervoltage Relay _____
Ground Fault Relay _____ Additional Relays _____
Space Heater Bus (For Motors) Power Source _____
Voltage _____ Heater _____ Watts _____
Special Control Local _____ Remote _____
Control fuse sets to be provided _____
Other _____

Drawings and Data (Required Numbers)

Data Sheets (Appendix D) _____
Outline Drawings _____ Preliminary Drawings _____
Final Drawings _____ Detailed Drawings _____
Operating and Maint. Books _____ Spare Part Books _____
Bill of Materials _____

Mandatory State and Local Regulations and Codes

Options (describe)

APPENDIX C TYPICAL DATA SHEET FOR LOW-VOLTAGE SWITCHRACKS

INFORMATION TO BE SUPPLIED BY PURCHASER

General Requirements

Purchaser _____ Job Number _____
Destination _____ Item Number _____
Quotation Number _____ Requisition No. _____
Environmental Conditions _____
Area Classification: Class _____ Group _____ Division _____ Unclassified _____
Enclosure: NEMA 7 _____ NEMA 8 _____ NEMA 4 _____ Other _____
Structure, Bus & Device Enclosure Matl. _____ Hardware _____
(Aluminum or Galvanized) (Stainless, Galvanized, etc.)
Bus Bars _____
(Aluminum or Copper)
Horiz. Amps _____ Braced _____ Ground bus _____ Neutral bus _____
(600 A Min.) (22,000 Std.)
Main: Circuit Breaker _____ Fusible Switch _____
(Rating) (Rating & Fuse Type)
Control Voltage: 120V _____ 480V _____ Other _____
Space Heater (Bus Enclosure) Power Source _____ Volts _____ Phase _____
Space Heater (Controller Enclosure) Power Source _____ Volts _____ Phase _____
Max. Surface Temp. Space Heaters _____ °F _____ °C.

Wiring Requirements (See Appendix A for wire sizes)

Incoming Power - Wire Size and Type _____
Conduit Size _____ Location _____
Outgoing Power - Wiring Method and Type _____
Conduit Size _____ Location _____
Outgoing Control and/or Alarm - Wiring Method and Type _____
Conduit Size _____ Location _____
Grounding - Wiring Method and Type _____
Conduit Size _____ Location _____
Control: Local _____ Remote _____ Other _____

APPENDIX C (CONTINUED)

Relaying - Overload Relays

Thermal - (Standard) _____ Lock-out _____

Ambient Compensated _____ Hand Reset _____
Auto Reset _____

Time Delay Undervoltage Relay _____

Ground Fault Relay _____ Additional Relays _____

Drawings and Data (Required Numbers)

Data Sheets (Appendix D) _____

Outline Drawings _____ Preliminary Drawings _____

Final Drawings _____ Detailed Drawings _____

Operating and Maint. Books _____ Spare Part Books _____

Bill of Materials _____

Mandatory State and Local Regulations and Codes

Options (Describe)

APPENDIX D
STANDARD DATA SHEET FOR SQUIRREL CAGE
INDUCTION MOTOR CONTROLLERS—LOW-VOLTAGE
(600 VOLTS AND BELOW) INFORMATION TO BE
SUPPLIED BY MANUFACTURER

Purchaser _____ Job Number _____

Destination _____ Item Number _____

Quotation Number _____ Requisition Number _____

Manufacturer _____ Mfg. Catalog Number _____

Delivery Schedule - Assembly _____ Weeks.

Outline Drawings _____ Preliminary Drawings _____

Final Drawings _____ Detailed Drawings _____

Operation and Maint. Books _____ Spare Parts Books _____

Bill of Materials _____

Price Complete _____

Transportation to Destination _____

Field Service Charge _____

Invoice Terms _____

EXCEPTIONS _____

Date: _____

APPENDIX E CHECKLIST

This appendix should be used to indicate specific requirements of the purchaser where the standard provides a choice or requires that a decision be made or additional information be provided. These items are indicated by a bullet (•) in this standard.

The checklist should be completed and considered as part of the specification. Also refer to Appendixes A through C which cover information which should be supplied to the manufacturer for proposal or order purposes. Where need for additional specification information is indicated, an addendum to the specification should be prepared.

Paragraph Reference	Item	Indicate Requirement	
		Yes	No
1.1	Does job specification supersede this specification?	_____	_____
1.2	Do any other specifications apply? If yes, specify.	_____	_____
1.4	Have environmental conditions been specified?	_____	_____
1.7	Have number of copies of drawings, data books, and so forth, been specified?	_____	_____
2.1.5	Are motor data sheets completed and included?	_____	_____
2.1.6	Have motor controller and enclosure requirements been included?	_____	_____
2.2.5 and 2.2.6	Has bus bracing requirement been specified?	_____	_____
2.2.8	Are spare control fuse sets required?	_____	_____
2.2.11 and 2.2.16.2b	Has source of 120V power been specified?	_____	_____
2.2.12	Is control center class and type specified?	_____	_____
2.2.13 and 2.2.14	Have incoming feeder details been specified?	_____	_____
2.2.16.1	Has corrosion-resistant material been selected?	_____	_____
2.2.16.2b	Is auxiliary 120V power required?	_____	_____
2.2.16.2e	Are roof or wall mounted ventilators required?	_____	_____
	Are the ventilators gravity or powered type?	_____	_____
2.3.2	Is the area classification given?	_____	_____
2.3.8	Is structure and enclosure material specified?	_____	_____
2.3.9	Are bus details specified?	_____	_____
2.3.11	Space heater required?	_____	_____
2.4.1.3	Are special duty contactors required?	_____	_____
2.4.1.4	Are control power transformers' required?	_____	_____
2.4.3.5	Are spare power fuse sets required?	_____	_____
2.4.4.1	Are space heaters required for indoor control centers?	_____	_____
2.4.4.4	Has space heater sheath temperature been specified?	_____	_____
3.2	Has overload relay type been specified?	_____	_____
3.3	Has undervoltage protection been specified?	_____	_____
3.4	Additional relay requirements specified?	_____	_____
4.2(3)	Are motor numbers included?	_____	_____
4.3	Are cover mounted control or pilot devices required?	_____	_____
6.2	Are shipping instructions specified?	_____	_____