International Association of Oil & Gas Producers

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S-732

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Supplementary Specification to UL 845 Low Voltage Motor Control Centers

Public Review Draft

JIP33
JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
0.1	September 2020	Issued for Public Review

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Acknowledgements

This IOGP Specification was prepared by a Joint Industry Programme 33 Standardization of Equipment Specifications for Procurement organized by IOGP with support by the World Economic Forum (WEF).

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Foreword

This specification was prepared under Joint Industry Programme 33 (JIP33) "Standardization of Equipment Specifications for Procurement" organized by the International Oil & Gas Producers Association (IOGP) with the support from the World Economic Forum (WEF). Companies from the IOGP membership participated in developing this specification to leverage and improve industry level standardization globally in the oil and gas sector. The work has developed a minimized set of supplementary requirements for procurement, with life cycle cost in mind, resulting in a common and jointly agreed specification, building on recognized industry and international standards.

Recent trends in oil and gas projects have demonstrated substantial budget and schedule overruns. The Oil and Gas Community within the World Economic Forum (WEF) has implemented a Capital Project Complexity (CPC) initiative which seeks to drive a structural reduction in upstream project costs with a focus on industry-wide, non-competitive collaboration and standardization. The CPC vision is to standardize specifications for global procurement for equipment and packages. JIP33 provides the oil and gas sector with the opportunity to move from internally to externally focused standardization initiatives and provide step change benefits in the sector's capital projects performance.

This specification has been developed in consultation with a broad user and supplier base to realize benefits from standardization and achieve significant project and schedule cost reductions.

The JIP33 work groups performed their activities in accordance with IOGP's Competition Law Guidelines (November 2014).

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Introduction

The purpose of this specification is to define a minimum common set of requirements for the procurement of low voltage motor control centers in accordance with UL 845, Fifth edition, published October 31, 2018, Motor Control Centers for application in the petroleum and natural gas industries.

This specification follows a common document structure comprising the four documents as shown below, which together with the purchase order define the overall technical specification for procurement.

JIP33 Specification for Procurement Documents
Supplementary Technical Specification

This specification is to be applied in conjunction with the supporting data sheet, quality and information requirements as follows:

IOGP S-732: Supplementary Specification to UL 845 Low Voltage Motor Control Centers

This specification defines the technical requirements for the supply of the equipment and is written as an overlay to UL 845, following the UL 845 clause structure. Clauses from UL 845 not amended by this specification apply as written to the extent applicable to the scope of supply.

Modifications to UL 845 defined in this specification are identified as *Add* (add to clause or add new clause), *Replace* (part of or entire clause) or *Delete*

IOGP S-732D: Data Sheet for Low Voltage Motor Control Centers (UL 845)

The data sheet defines application specific requirements, attributes and options specified by the purchaser for the supply of equipment to the technical specification. The data sheet may also include fields for supplier provided information attributes subject to purchaser's technical evaluation. Additional purchaser supplied documents may also be incorporated or referenced in the data sheet to define scope and technical requirements for enquiry and purchase of the equipment.

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IOGP S-732Q: Quality Requirements for Low Voltage Motor Control Centers (UL 845)

The QRS defines quality management system requirements and the proposed extent of purchaser conformity assessment activities for the scope of supply. Purchaser conformity assessment activities are defined through the selection of one of four generic conformity assessment system (CAS) levels on the basis of evaluation of the associated service and supply chain risks. The applicable CAS level is specified by the purchaser in the data sheet or in the purchase order.

IOGP S-732L: Information Requirements for Low Voltage Motor Control Centers (UL 845)

The IRS defines the information requirements, including contents, format, timing and purpose to be provided by the supplier. It may also define specific conditions which invoke information requirements.

The terminology used within this specification and the supporting data sheet, quality and information requirements follows that of the parent standard and is in accordance with ISO/IEC Directives, Part 2 as appropriate.

The data sheet and IRS are published as editable documents for the purchaser to specify application specific requirements. This supplementary specification and QRS are fixed documents.

The order of precedence (highest authority listed first) of the documents shall be:

a) regulatory requirements;

b) contract documentation (e.g. purchase order);

c) single line diagrams and project drawings;

d) purchaser defined requirements (data sheet, QRS, IRS);

e) this specification;

f) UL 845, Fifth edition, published October 31, 2018.

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1 Scope

1.1 Products covered

Add new clause

1.1.5

This specification defines minimum technical requirements for the purchase (including design features, fabrication quality, inspection, testing, shipment and documentation) of low voltage motor control center (LV MCC) equipment. This specification does not apply to motor control centers installed in hazardous (classified) areas.

2 Normative References

Add to clause

ABS MODU, *Publication Number 6 Part 4, Rules for Building and Classing Mobile Offshore Drilling Units - Machinery and Systems*

CBC, *California Building Standards Code*

IBC, *International Building Code*

IEC 62402, *Obsolescence management*

IEEE C37.20.7–2017, *Guide for Testing Metal-Enclosed Switchgear Rated Up to 52 kV for Internal Arcing Faults*

NEMA ICS 5, *Industrial Control and Systems: Control-Circuit and Pilot Devices*

46 CFR 111, *Title 46 – Shipping, Chapter I - Department of Coast Guard, Subchapter J - Electrical Engineering, Part 111 - Electrical Systems - General Requirements. (For US offshore only)*

4 Application information and components

Add new clause

4.3 Dependability of materials and parts

4.3.1

The motor control center and sub-components shall be designed for continuous operation at full load under the normal service conditions for at least 45 000 hours (five years).

4.3.2

During the first five-year operational period, the bus bars shall not need to be de-energized for maintenance or inspection.

4.3.3

Components within the motor control center that are not suitable for five years continuous operation shall by identified in the proposal and in the operation and maintenance manual.

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Add new clause

4.4 Technology readiness and obsolescence

4.4.1

The motor control center, excluding electronic components, shall have a design and post FAT supported lifetime of at least twenty years under the defined service conditions.

4.4.2

The manufacturer shall have an obsolescence management plan for all motor control center components.

NOTE: IEC 62402 is an example of an obsolescence management guide.

4.4.3

The use of motor control centers and sub-components with less than three years proven operational service shall be subject to approval by the Company responsible engineer.

5 Characteristics

5.1 General

Add new clause

5.1.3

LV MCCs and controllers shall be provided in accordance with the single line diagrams, standard motor control schematics and the low voltage motor control center data sheet.

Add new clause

5.1.4

The complete assembly and its components shall be suitable for the specified continuous rated load current and available fault current.

Add new clause

5.1.5

The MCC shall be listed and/or certified by a nationally recognized testing laboratory (NRTL) for the US or accredited certification organization (ACO) for Canada.

5.2 Voltage ratings

Add new clause

5.2.1

No control voltage other than 120 Vac or 24 Vdc shall be used.

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Add new clause

5.2.2

When 24 Vdc control is used, dual power supplies shall be provided including an alarm contact for each supply indicating if that supply has been turned off or has failed.

5.3 Current

5.3.2 Horizontal bus rating

Add new clause

5.3.2.1

The horizontal power bus and splice bars shall be fully rated with minimum ampacity as specified in the data sheet and as shown on project drawings.

Add new clause

5.3.2.2

The horizontal power bus bar, joint and connection plate shall be the same material and plating type as specified in the data sheet.

Add new clause

5.3.2.3

Bus connections from the incoming main section to the horizontal power bus shall have the same minimum ampacity as the horizontal bus.

Add new clause

5.3.2.4

When a neutral bus is specified, the rating shall be the same as the main bus rating.

5.3.3 Vertical bus

Add to clause

Vertical buses of each MCC section in the complete MCC line-up shall be sized the same.

5.4 Short-circuit

5.4.1 Standard short-circuit current ratings of motor control center units

Add new clause

5.4.1.4

The short-circuit rating of each unit shall be equal to or greater than the short-circuit current rating of the motor control center bus structure.

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5.4.4 Rating of bus structure

Add to clause

The minimum horizontal and vertical bus bracing in the MCC shall be equal to or greater than the maximum available fault current specified on the data sheets.

6 Markings and product information

6.1 Identification

Add to clause

A master nameplate shall be mounted on the MCC main incoming unit with the following:

a) company purchase order number;

b) company MCC designation (tag number);

c) company project name;

d) month and year of manufacture.

6.2 Product information

6.2.2

Add new list item

f) Each individual unit shall have a nameplate with the following information:

1) equipment tag number;

2) equipment name;

3) HP rating, kW rating, or full load amperes (FLA).

Add new clause

6.2.3

Arc resistant ratings of the motor control center section in accordance with IEEE C37.20.7:2017, 6.3 if indicated on data sheet.

6.3.36

Add to clause

When the disconnecting means uses an HMCP or MCB, the position indicator shall include the "TRIP" position.

Add new clause

6.3.63 Nameplate construction details

MCC and individual units shall be provided with engraved nameplates and field markings as required by the project nameplate schedule drawing or other associated documentation.

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6.3.63.1

A master MCC nameplate (refer to 6.1.1) with 2 in (50 mm) letters shall be located near the top of the MCC, above the main disconnect device in accordance with company nameplate schedule or other project documents.

6.3.63.2

Nameplates shall be mounted on the front of the cubicle with stainless steel screws.

6.3.63.3

Nameplates shall have black letters on a white background.

6.3.63.4

Unit nameplates shall be 1 in (W) by 2.5 in (L) minimum unless otherwise indicated on the project drawings.

6.3.63.5

Unit nameplate characters shall be at least $^{3}/_{16}$ in (4.8 mm) high unless indicated otherwise on project drawings.

Add new clause

6.3.64

Separate nameplates, suitably located, shall be provided to identify door mounted items such as meters, switches, indication lights and other devices.

Add new clause

6.3.65

Separate device markers, suitably located, shall be provided to identify components within each unit such as terminals, relays, switches and other devices.

Add new clause

6.3.66

Warning nameplates with distinguishing background color, suitably located, shall be provided to indicate the following:

a) warning or operational instructions as required;

b) external voltages if external sources are used within the unit.

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7 Normal service and transport conditions

Add new clause

7.3 Floating Marine Applications

7.3.1

If specified, MCC assemblies to be installed on floating offshore installations in United States Coast Guard (USCG) and American Bureau of Shipping (ABS) jurisdictions, shall comply with ABS MODU, Pub #6 Part 4 and 46 CFR 111.

USCG/ABS requirements include, but are not limited to:

a) nameplate on the door of each removable unit that identifies the rating of the short circuit protection device;

b) laminated wiring/schematic diagram on the inside of the door of each controlled removable unit (e.g. motor starter);

c) ground detection system in compliance with 46 CFR 111.05 27 for panel boards.

7.3.2

When MCC is specified to be used on a floating offshore facility, equipment shall be designed for continuous operation for the inclinations and motion criteria specified for operation.

8 Construction and performance requirements

8.1 General assembly

8.1.2 Enclosure - General

Add new clause

8.1.2.3

The MCC structure shall be a dead front, totally enclosed and freestanding assembly.

Add new clause

8.1.2.4

All hinged front doors shall close on gaskets installed around the edge of the door or the structure (NEMA Type 1 with gaskets).

Add new clause

8.1.2.5

The enclosure depth shall be 50 cm (20 in) due to normal wiring space requirements as detailed in the NEC unless otherwise specified.

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Add new clause

8.1.2.6

All equipment shall be mounted and wired from the front and arranged such that field connections can be readily made from the front.

Add new clause

8.1.2.7

Each MCC (or shipping section) shall be provided with removable eyes or removable angle irons for lifting.

Add new clause

8.1.2.8 Requirements for Arc-Resistant MCCs

8.1.2.8.1

For protection of personal and to improve electrical safety, arc resistant Type 2 enclosures shall be provided as specified in the datasheet.

8.1.2.8.2

Arc resistant assemblies shall be tested in accordance with the requirements of IEEE C37.20.7:2017, for not less than 0.1 second.

8.1.2.8.3

If a plenum is required, it shall run the full length of the MCC assembly and be fully rated to withstand the forces associated with an arc fault within the MCC assembly.

8.1.2.8.4

Minimum room dimension requirements and other guidelines (e.g. for plenum or arc duct) related to the performance of the arc resistant motor control center shall be provided.

8.1.2.8.5

MCC doors shall be secured with latches (tie down bolts are not allowed).

8.1.2.8.6

Special tools shall not be required to latch the front compartment door or engage the arc resistant function.

8.1.2.8.7

The methodology as defined in IEEE C37.20.7-2017 utilized to achieve the arc resistant certification of the MCC shall be provided.

8.1.2.8.8

When accessories (e.g. solid door) are required to maintain the arc resistant rating when a unit is removed, they shall be provided for each unit (physical size) in the quantity specified.

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Add new clause

8.1.2.9 MCC Seismic Requirements

When seismic requirements are specified, the MCC shall be designed to comply with the requirements of the IBC or the CBC including the specific details in the project drawings.

8.1.7.2

Replace clause with

A tool operated provision for deactivating the interlock for inspection purposes while the disconnecting device is closed shall be provided.

Add new clause

8.1.7.3

Plug-in units shall be equipped with a mechanical safety interlock that prevents connecting or disconnecting the unit to the vertical bus with the unit's disconnect handle in the "ON" position.

8.1.9

Replace sentence before list with

Doors required to be opened during normal operation shall have latches that are operated either by hand, quarter-turn screws using a flat-head screwdriver, or similar means.

Add to NOTE

Accessing vertical wireways is considered normal operation.

8.2 Construction requirements

8.2.2 Size, location, and covering or screening

Add new clause

8.2.2.10

If ventilation filters are required, all ventilation openings shall be covered on the inside with washable-type filters.

8.2.4 Hinged doors and covers

Add new clause

8.2.4.6

Vertical and horizontal wireways shall have separate access covers.

Add new clause

8.2.4.7

Vertical wireway covers shall be provided with hinges.

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Add new clause

8.2.4.8

If specified, enclosure and unit doors shall include NRTL or ACO approved viewer ports to allow infrared scanning of the equipment without opening the equipment doors or removing covers.

8.2.6 Protection against corrosion

Delete list item b)

Add new clause

8.2.6.1

Unpainted parts and hardware shall be plated for corrosion resistance or be made of stainless steel.

Add new clause

8.2.6.2

If the presence of corrosive gases is specified, the equipment shall be provided as detailed in 8.2.6.2 a) through c).

a) The equipment shall be protected against deterioration from corrosive gases by the use of compatible coatings and material selection.

b) Bare copper or silver or their alloys shall not be provided for current carrying parts when the presence of corrosive gases are identified.

c) Corrosion mitigation method shall be identified in the equipment specification.

8.2.8 Current-carrying parts

8.2.8.2

Replace first sentence with

Plated steel screws, nuts, and studs shall be used to secure pressure wire connectors and bus bars.

8.2.9 Bus bars

8.2.9.1

Replace clause with

Vertical and horizontal current carrying bus bars shall be tin plated copper or silver plated copper as specified.

Add new clause

8.2.9.5

Main and ground bus shall be pre-drilled for connection of future sections on each end without the need for additional bus supports or bracing.

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Add new clause

8.2.9.6 Removable cover plate(s)

8.2.9.6.1

Removable cover plates shall be provided for the main bus, ground bus and horizontal wireway.

8.2.9.6.2

Removable cover plates shall provide ample space for bus splice assemblies to be installed.

8.2.9.6.3

Removable cover plates shall be attached with bolts or screws.

Add new clause

8.2.9.7

Horizontal main bus bars shall be fully insulated (including shipping split joints) for the rated voltage of the motor control center using an insulated covering around each bus bar (e.g. insulated sleeving or epoxy coating) if specified.

Add new clause

8.2.9.8

Main and ground bus bars shall be free of splices within the shipping split.

Add new clause

8.2.9.9

The splice connections shall be front accessible for servicing with a torque wrench.

Add new clause

8.2.9.10

When a back-to-back MCC configuration is specified, the two separate MCC assemblies shall be connected through a wraparound end transition section having separate vertical power buses with same phasing sequence for the front and back assemblies.

Add new clause

8.2.9.11

Vertical bus bars in each MCC section shall be provided as either:

a) fully insulated for the rated voltage of the motor control center using an insulated covering around each bus bar (e.g. insulated sleeving or epoxy coating) except for locations where removable units make contact with the bus bars; or

b) isolated such that bus bars are enclosed individually or as a group by an insulated protective covering (e.g. a clam-shell).

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Add new clause

8.2.9.12

If an insulated main horizontal bus is specified, all bus bar joints shall be fully insulated for the rated voltage of the motor control center using either insulated protective boots or tape in accordance with 8.2.27.8.

8.2.10 Protection of service personnel

Add new clause

8.2.10.4

Vertical bus bars shall be protected against accidental contact by a touch safe bus bar enclosure or by automatic insulating shutters when the individual MCC draw out unit is removed from the structure.

Add new clause

8.2.10.5

If specified, the controllers/feeder units shall be provided with UL listed absence of voltage tester device in order to provide a means of verification of isolation without opening the unit door.

Add new clause

8.2.10.6

Line side conducting parts that remain energized when the unit disconnect is in the “OFF” position shall be covered with a barrier or otherwise protected from accidental contact.

8.2.11 Combination motor control unit

Add title to heading 8.2.11.8

8.2.11.8 Trip indication

Replace clause with

8.2.11.8.1

A unit containing a Type E combination motor controller shall have a visible means to indicate which function (overload or short-circuit) has operated with the unit door opened.

8.2.11.8.2

If specified, a unit containing a type E combination motor controller shall have a visible means to indicate that the overload has operated (tripped) with the unit door closed.

Add new clause

8.2.11.10

Motor starters shall be sized in accordance with the NEMA standard maximum horsepower ratings.

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Add new clause

8.2.11.11

The minimum acceptable motor starter size shall be NEMA size 1.

Add new clause

8.2.11.12

Dual and intermediate size motor starters such as 1¾ shall not be acceptable.

Add new clause

8.2.11.13

Sizes 1 and 2 motor starters shall have a minimum vertical space allowance of 305 mm (12 in).

Add new clause

8.2.11.14

If specified, circuit breakers shall be molded case, three pole, rated at the specified voltage of the MCC with adjustable magnetic trip only (MCP).

Add new clause

8.2.11.15

Breaker frame sizes and trip units shall be sized for starting premium efficiency motors.

Add new clause

8.2.11.16

If mechanical overload relays are specified, they shall be provided as detailed in 8.2.11.16 a) through c).

a) Mechanical overload relays shall be provided with ambient compensated overload elements.

b) Mechanical overload relays shall be designed to accept replaceable elements.

c) Mechanical overload relays shall be equipped with an externally operable manual reset function.

Add new clause

8.2.11.17

If adjustable solid-state overload relays are specified, they shall be provided as detailed in 8.2.11.17 a) through e).

a) Adjustable solid-state overload relays shall be three-pole.

b) Adjustable solid-state overload relays shall be current sensing.

c) Adjustable solid-state overload relays shall have a selectable overload trip of NEMA class 5 to 30.

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d) Adjustable solid-state overload relays shall be provided with an overload trip range that allows a setting of up to 125% of the motor full load current according to the NEC Table 430.250.

e) Adjustable solid-state overload relays shall be equipped with an externally operable manual reset function.

Add new clause

8.2.11.18

If microprocessor based digital multifunction motor protection relays are specified, they shall be provided with the following functions:

a) three-phase, adjustable overload protection;

b) adjustable overload trip of NEMA class 5 to 30 and pre-set to NEMA class 20;

c) protective functions to include thermal overload, underload, locked rotor, current imbalance, stall, phase loss, zero sequence ground fault;

d) programmable trip level, warning level, time delay, and inhibit window;

e) current monitoring functions to include phase current, average current, full load current, current imbalance percent, percent thermal capacity utilized and ground fault current;

f) on-board communications;

g) diagnostic information to include device status, warning status, time to reset, trip status, time to overload trip, and historical event recording;

h) four digital inputs and two digital outputs;

i) undervoltage ride-through and/or auto-restart functionality for the equipment as shown on the single line diagram;

j) LEDs for status indication.

Add new clause

8.2.11.19

Surge suppressors shall be installed across all control relay coils, except for electronic relays that include internal surge suppression.

Add new clause

8.2.11.20

Contactors provided in combination motor controllers shall be air-magnetic break for sizes 1 through 3 and vacuum break for size 4 and larger.

Add new clause

8.2.11.21

Motor control units with control power transformers shall be provided with primary and secondary overcurrent protection.

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Add new clause

8.2.11.22

If control power transformers are provided, the sizing shall include the load, motor space heaters (see Table 43).

Add new clause

8.2.11.23

If extra capacity control power transformers are specified, a minimum of an additional 50 VA shall be provided in addition to the requirement in 8.2.11.22.

Add new clause

8.2.11.24

If a control power source external to the MCC is specified, the MCC line-up shall be provided as detailed in 8.2.11.24 a) through d).

a) A single control power circuit shall be provided to each vertical section with units wired in parallel.

b) Separate control power fuses shall be provided for each unit.

c) The line side of the control power fuse (X1) and each grounded conductor (X2) in each unit shall be wired to pull apart terminal blocks.

d) An auxiliary contact that operates simultaneously with the unit disconnecting device shall open the control power circuit.

Add new clause

8.2.11.25

Each motor control unit shall be provided with a minimum of one seal-in contact (for three-wire control) plus one spare, normally open and normally closed contacts.

Add new clause

8.2.11.26

Unit interposing relays, auxiliary control devices, control wiring, and terminal block connection points shall be provided as shown on the project drawings.

Add new clause

8.2.11.27

Unit interposing relays supplied within the units shall be provided with retaining clips.

Add new clause

8.2.11.28

Provision shall be made for a hard-wired stop signal from the safeguarding system, wired directly into the motor contractor coil circuit as shown in the project drawings.

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Add new clause

8.2.11.29

Conductors between the line stab and the unit disconnect device of fixed units (bolt-in) and withdrawable units shall be full-rated based on the breaker frame size or disconnect maximum current rating without exceeding the allowable temperature rise of the conductor or components.

Add new clause

8.2.11.30

Plug-in unit stabs shall be plated copper equipped with a retractable stab assembly mechanism or other withdrawable unit designs allowing the primary voltage to be disconnected with the unit door closed.

Add new clause

8.2.11.31

If auto trip reset is specified, overloads that provide remote reset capability or reset after a specified period of time with a maximum number of resets shall be provided.

8.2.12 Unit mounting

Add to clause

Units of size 4 and larger shall be located in the lower half of the vertical section of the MCC with smaller units located in the upper half.

8.2.12.1

Feeder units providing circuit protection devices shall be thermal magnetic molded-case circuit breakers (MCCB) or fused switches, with fuses supplied and installed as indicated on project drawings.

8.2.12.2

The continuous current rating of feeder units shall be based on the maximum circuit breaker frame size or fused switch size rating suitable for the feeder unit.

8.2.12.3

If fused disconnect switches are specified, a “touch-safe” cover shall be provided that covers the fuse holders and fuses.

8.2.12.4

Ground fault detection and/or protection shall be provided where indicated on project drawings and data sheet.

8.2.12.5

Feeder units shall include a retractable power stab assembly mechanism or withdrawable unit design allowing the primary voltage to be disconnected with the unit door closed.

8.2.12.6

Unit load and control wiring shall be removable without de-energizing adjacent units.

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8.2.12.7

Units shall be provided with self-aligning plug-in unit stab construction to ensure positive electrical and mechanical contact to the bus under all load and rated fault conditions.

8.2.12.8

All vertical section 2X factor future spaces or larger shall be provided with guides for withdrawable units with supports and barriers to isolate units from each other.

8.2.12.9

Supports and barriers shall be designed to be removed or added in the field without special tools.

8.2.13 Internal wiring

8.2.13.1

Delete second sentence

Add new clause

8.2.13.1.1

The internal MCC wiring shall be soft or annealed copper wire with 600 V flame retardant insulation rated 90 °C (194 °F).

Add new clause

8.2.13.1.2

The internal MCC wiring shall be stranded in accordance with ASTM B8, Class D stranding for wires that cross hinged joints and Class C stranding or finer strand for all other wires.

Add new clause

8.2.13.1.3

The minimum size for control wiring internal to the motor control center shall be No.16 AWG.

Add new clause

8.2.13.1.4

Terminal blocks for termination of field run control conductors shall accept no less than 2 x No.14 AWG each.

8.2.13.4

Replace clause with

Internal wiring shall be installed in a single continuous piece from termination point to termination point, free of splices and taps.

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Add new clause

8.2.13.17

Circuit wiring shall be NEMA Class II, Type B.

Add new clause

8.2.13.18

Terminal strips located in individual units shall be provided with a minimum of 20% spare control terminal blocks and guarded, finger safe type.

Add new clause

8.2.13.19 Wire marking

8.2.13.19.1

Internal wiring shall be identified at both ends with machine printed 360° slip-on or heat-shrink wire markers.

8.2.13.19.2

Adhesive wrap around or clip-on type wire markers shall not be used for identification.

8.2.13.19.3

Wiring permanently marked every 18 in (45 cm) with a unique number is acceptable in lieu of wire markers.

Add new clause

8.2.13.20 Unit door wiring

Wiring connected to unit doors shall be provided as detailed in 8.2.13.20 a) through c).

8.2.13.20.1

Door wiring shall operate at 120 Vac (nominal) or less.

8.2.13.20.2

Wiring across hinged panels and doors shall be bundled with wraps to protect conductors against abrasion

8.2.13.20.3

Terminals shall be “touch-safe” or covered by an insulating barrier to provide protection from accidental contact.

Add new clause

8.2.13.21

No accessories such as terminal strips shall be installed in wireways unless integral to the MCC unit’s draw out design.

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Add new clause

8.2.13.22 Current transformers (CT) for incoming protection and metering

8.2.13.22.1

CT secondary circuit wiring shall be terminated with insulated, compression ring type lugs.

8.2.13.22.2

CT secondary circuit wiring shall be wired directly to short circuiting type terminal blocks.

8.2.13.22.3

CT circuit grounding shall have green insulation and be marked “CT Ground” at the terminal block and at the ground bus termination point.

8.2.13.22.4

One direct ground connection shall be made from the CT short circuiting terminal block to the ground bus without any intermediate terminations or splices.

8.2.15 Control circuit transformer protection

8.2.15.5

Delete clause

8.2.16 Field-wiring terminals

8.2.16.1

Replace first sentence with

Units shall be provided with pull-apart terminal blocks (one terminal for each conductor) to terminate field control wiring.

Add new clause

8.2.16.9

The MCC assembly shall be provided with insulating barriers between each phase at the incoming supply connection point (i.e. phase barriers if exposed bus, fuses or lugs are present).

Add new clause

8.2.16.10

The MCC assembly shall be provided with insulating barriers to protect the incoming supply (including line side of any overcurrent protective device) against accidental contact.

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Add new clause

8.2.16.11

The MCC assembly shall be arranged to allow the incoming supply conductors to be tested to prove absence of voltage without removal of barriers or guards (e.g. holes for test probes or permanently mounted automatic voltage tester).

Add new clause

8.2.16.12

Units shall be provided with a minimum of 20% spare terminals for external control wiring, provided it does not increase the size of the unit.

8.2.28 Wiring space

8.2.28.3 Clear wiring space

Add new clause

8.2.28.3.8 Vertical wireways

8.2.28.3.8.1

Vertical wireways shall be full-height, full-depth and isolated from all power buses.

8.2.28.3.8.2

Vertical wireways shall have a minimum width of 100 mm (4 in).

8.2.28.3.8.3

Vertical wireways shall have a fixed metal barrier (provided on the unit or part of the wireway) with openings for wire passage between the wireways and the unit.

Add new clause

8.2.28.3.9 Horizontal wireways

8.2.28.3.9.1

Horizontal wireways shall be isolated from all power buses.

8.2.28.3.9.2

Horizontal wireways shall be continuous across the top and bottom locations for each section.

8.2.28.3.9.3

Horizontal wireways shall have a minimum height of 6 in (150 mm).

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8.2.31 Transformer secondary grounding

8.2.31.1

Replace clause with

Control power transformers (CPT) shall have one secondary terminal grounded to the unit frame.

8.2.33 Ground bus

8.2.33.1 Horizontal ground bus

Replace clause with

8.2.33.1.1

Motor control centers shall include a tin-plated copper horizontal ground bus.

8.2.33.1.2

The horizontal ground bus shall be sized in accordance with Table 24 and Table 25 with a minimum rating of 300A.

8.2.33.1.3

The horizontal ground bus shall be uniform and continuous across the entire length of the MCC.

8.2.33.1.4

The horizontal ground bus shall be pre-drilled for outgoing equipment grounding conductors at each end section and equipped with NEMA 2-hole 4/0 AWG lugs.

8.2.33.1.5

The horizontal ground bus shall extend to the incoming line section, supplied with a suitable NEMA 2-hole, compression-type mechanical lugs.

8.2.33.1.6

The horizontal ground bus shall have provisions for future extension of the MCC.

Add new clause

8.2.33.7

Each individual MCC section shall include a tin-plated copper vertical ground bus with a minimum rating of 300 A.

Add new clause

8.2.33.8

Each MCC section vertical ground bus shall be mechanically connected to the horizontal ground bus, forming a complete internal grounding system.

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Add new clause

8.2.33.9

Withdrawable units shall connect to the vertical ground bus via a wiping-action slide connection to make a positive ground connection between fixed and withdrawable parts.

Add new clause

8.2.33.10

The withdrawable unit ground connection shall connect to the vertical ground bus before the line stabs are engaged and separate after the line stabs are disengaged.

Add new clause

8.2.34 Incoming Line Section

8.2.34.1

If specified, the MCC shall have a main incoming circuit breaker.

8.2.34.2

If specified, incoming circuit breakers shall have solid-state trip units.

8.2.34.3

If specified, the incoming breaker shall be provided with an arc reducing maintenance switch to reduce the arc flash incident energy levels when maintenance is performed on the MCC.

8.2.34.4

If specified, the incoming section shall be provided with a microprocessor based metering package that includes phase voltage, phase current, kVA, kW, power factor and communications capability.

8.2.34.5

If “main lugs only” (MLO) is specified, the incoming section shall be provided with crimp-type, NEMA 2-hole, compression lugs sized for the specified incoming cables.

8.2.34.6

If “main lugs only” (MLO) are specified, the incoming section shall be provided with bracing to withstand, without distortion, any torque imposed by the incoming line cables.

8.2.34.7

When cable bus or bus duct is specified for the incoming line section, the necessary components for the MCC to accept the cable bus or bus duct shall be provided.

8.2.34.8

When a main circuit breaker is specified, the requirements in 8.2.34.8 a) through c) shall apply.

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a) The main circuit breaker shall be accessible from the front of the unit with removable protective barriers or insulating guards on the line side terminations.

b) The main circuit breaker shall be operable from outside of the enclosure door.

c) The breaker position status shall indicate (closed, open, tripped) whether the enclosure door is closed or open.

Add new clause

8.2.35 Non-motor loads

8.2.35.1

Contractors provided for non-motor loads shall be sized/rated for the specific application (e.g. switching of capacitors, transformers, lighting) as indicated on the project drawings.

8.2.35.2

For lighting contactor, process heating, and similar applications, units shall be provided with spare auxiliary contacts (two normally open and two normally closed) wired to terminal blocks.

8.2.35.3

Lighting contactor units shall have a door mounted, hand-off-auto (HOA) switch and status light indicators with the capability of being remotely controlled from a photoelectric cell or other device as indicated on the project drawings.

Add new clause

8.2.36 Integral adjustable speed drives (ASD) and soft starters

8.2.36.1

Programmer/operator interface shall be door mounted.

8.2.36.2

The programmer/operator interface shall display speed, current, voltage, alarms and shutdowns.

8.2.36.3

ASD and soft starter terminals that interface with field wiring shall be wired to customer terminal blocks.

8.2.36.4

For applications that require a reduced voltage starter, solid-state soft starter type unit shall be provided.

8.2.36.5

ASD and soft starter units shall be provided with indicating lights for the status if indicated on the project drawings.

8.2.36.6

ASD and soft starter units shall include provisions facilities for isolation and bypass if indicated on the project drawings.

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Add new clause

8.2.37 Integral power distribution panels (panelboards)

8.2.37.1

When low voltage distribution panels are provided, they shall meet the requirements of UL 67.

8.2.37.2

Low voltage distribution panels shall be provided with thermal magnetic, bolt-on type branch circuit breakers equipped with a means to be locked out in the off position individually.

8.2.37.3

Low voltage distribution panels shall be provided with a circuit directory.

Add new clause

8.2.38 Integral distribution transformers

8.2.38.1

Transformers shall be of dry type with class H insulation with 80 °C (144 °F) rise.

8.2.38.2

Transformers shall be provided with a K4 minimum rating.

8.2.38.3

Transformers shall be provided with four 2.5% full capacity taps on the high voltage winding with two above and two below rated voltage.

8.2.38.4

Transformers shall have primary circuit protection using a feeder-tap unit within the MCC.

8.2.38.5

Transformers shall be provided with a thermal-magnetic molded case circuit breaker for secondary protection (e.g. in the panelboard or MCC).

8.2.38.6

If the transformer primary is fed from a feeder device located externally, a hazard identification label indicating an external power source is present shall be provided on the door of the transformer unit compartment.

Add new clause

8.2.39 MCC vertical section space heaters

8.2.39.1

If specified, space heaters shall be provided for moisture condensation control within each vertical section of the MCC as detailed in 8.2.39.1 a) through d).

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a) Space heaters shall be wired to an accessible terminal block provided for connection to an external power source.

b) Space heaters shall be guarded by an expanded metal cage around the heaters to prevent burns due to incidental contact.

c) Space heaters shall be operated at 120 Vac.

d) Space heaters shall be sized to provide a 5K temperature rise to prevent condensation.

8.2.39.2

If thermostat control is specified for space heaters, a control unit shall be provided as detailed in 8.2.39.2 a) through e).

a) The control unit supply disconnect shall have a circuit breaker that is lockable.

b) The control unit shall have a control circuit that includes a momentary push button that energizes the heaters (by bypassing the thermostat) to verify the proper operation of the heaters.

c) The control unit shall be provided with an ammeter.

d) The control unit ammeter shall be with appropriately sized scaled so that the failure of a single space heater element results in a discernible change in ammeter reading.

e) The normal operating ampacity of space heater circuit shall be inscribed on the ammeter nameplate.

8.2.39.3

When an external power source is required to operate the MCC section space heaters, caution or warning labels shall be provided on each vertical section.

Add new clause

8.2.40 MCC data communications

8.2.40.1

If MCC data communications are required, the devices intended to be monitored shall be compatible with the specific communication protocol (or combination of protocols).

8.2.40.2

Power for the MCC communication system shall utilize redundant power supplies in separate plug-in units.

8.2.40.3

The communication cabling trunk line shall be integrated into the MCC structure protected behind metal barriers.

8.2.40.4

A diagnostic interface accessible with the doors closed and covers in place shall be provided for each communication network.

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8.2.40.5

For non-Ethernet networks, connections made in wire ways shall be made using screw type connectors, as opposed to plug in type.

NOTE: If the communication network is Ethernet, a plug type connector is acceptable.

8.2.40.6

The number of ports shall be designed to service the number of unit devices in a vertical section including all future unit spaces.

8.2.40.7

The communication cabling in each vertical section shall be isolated from the power cabling by metal barriers

8.2.40.8

The communication cabling shall be rated for 600 Vac.

Add new clause

8.2.41 MCC control and indication - general requirements

8.2.41.1

If status indicator lights are specified, they shall be in accordance with 8.2.41.1 a) through d).

a) Status indicator lights shall be installed on the unit door.

b) Lights shall be provided to indicate running and stopped or running, stopped and tripped.

c) Lights colors shall be red (running), green (stopped) and amber (tripped).

d) Lights shall be LED type with 100 000 hour illumination life.

8.2.41.2

Push buttons, selector switches and other door mounted devices shall be heavy duty and oil tight.

8.2.41.3

Control relay output contacts or other auxiliary (interposing) control-circuit device contacts for field wiring to external equipment shall have a contact ampacity performance rating suitable for the intended switching application in accordance with NEMA ICS 5.

Add new clause

8.2.42 MCC condition based monitoring (CBM) requirements

8.2.42.1

If specified, continuous thermal monitoring shall be in accordance with 8.2.42.1 a) through e).

a) MCC assemblies shall be equipped with factory integrated continuous thermal monitoring technology.

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b) CBM thermal monitoring shall provide permanent hotspot detection sensors for main incoming section, such as main circuit breaker or lug, individual units, and other interconnections.

c) Continuous thermal monitoring shall include a fault relay dry contact output.

d) Continuous thermal monitoring shall provide local status and alarm indication.

e) Continuous thermal monitoring shall provide networking communication capabilities.

8.2.42.2

If specified, analytical software shall be provided for the specific CBM technology provided.

9 Motor control center tests

9.21 Factory tests

Add new clause

9.21.1

After completion of the MCC assembly and wiring of each unit, the MCC shall be functionally tested prior to shipping preparations.

Add new clause

9.21.2

When indicated on the data sheet, witnessing of functional testing or other system inspection testing shall be required.

Add new clause

9.21.3

Functional testing of the completed MCC shall include the following:

a. operation of unit contactor;

b. unit electrical and mechanical interlocks;

c. all control devices that are hard wired and/or communicating over a network to a system controller and, if applicable, local human machine interface (HMI);

d. protective relay and metering;

e. indicator lights;

f. unit draw out and mechanical insertions including operation of any retractable stabs and shutters;

g. vertical section space heaters and thermostat if applicable;

h. condition based monitoring system if applicable;

i. auxiliary equipment (e.g. interposing relay panel, mimic panel) provided as part of the system design.

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Tables

Add new table

Table 43 Rating for space heaters

(Clause 8.2.11.22)

Motor Horsepower	Space Heater Rating (W)
1/2 – 5	45
7.5 – 20	60
5 – 50	120
60 – 100	240
125 – 250	350

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Annex F (Normative)
Factory tests

In Annex F heading, replace "Informative" with

Normative

F.1 Factory tests

Delete "As an alternative, a potential 20% higher may be applied for 1 s." from clause.

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