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Supplementary Specification to UL 845 for Low Voltage Motor Control Centers

NOTE This version (S-732J) of the specification document provides the justification statements for each technical requirement, but is otherwise identical in content to S-732.

Revision history

VERSION	DATE	PURPOSE
1.1	July 2026	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 2020).

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Introduction

The purpose of the IOGP S-732 specification documents is to define a minimum common set of requirements for the procurement of low voltage motor control centers in accordance with UL 845, Sixth Edition, published February 2025, Motor Control Centers, for application in the petroleum and natural gas industries.

The IOGP S-732 specification documents follow a common structure (as shown below) comprising a specification, also known as a technical requirements specification (TRS), a procurement data sheet (PDS), an information requirements specification (IRS) and a quality requirements specification (QRS). These four specification documents, together with the purchase order, define the overall technical specification for procurement.



JIP33 Specification for Procurement Documents Supplementary Technical Requirements Specification (TRS)

This specification is to be applied in conjunction with the supporting PDS, IRS and QRS as follows.

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

This specification defines 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. Modifications to UL 845 defined in this specification are introduced by a description that includes the type of modification (i.e. Add, Replace or Delete) and the position of the modification within the clause.

NOTE Lists, notes, tables, figures, equations, examples and warnings are not counted as paragraphs.

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

The PDS defines application-specific requirements. The PDS is applied during the procurement cycle only and does not replace the equipment data sheet. The PDS may also include fields for supplier-provided information required as part of the purchaser's technical evaluation. Additional purchaser-supplied documents may also be incorporated or referenced in the PDS to define scope and technical requirements for enquiry and purchase of the equipment.

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

The IRS defines information requirements for the scope of supply. The IRS includes information content, format, timing and purpose to be provided by the supplier, and may also define specific conditions that invoke the information requirements.

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

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 PDS or in the purchase order.

The specification documents follow the editorial format of UL 845 and, where appropriate, the drafting principles and rules of ISO/IEC Directives Part 2.

The PDS and IRS are published as editable documents for the purchaser to specify application-specific requirements. The TRS and QRS are fixed documents.

The order of precedence of documents applicable to the supply of the equipment, with the highest authority listed first, shall be as follows:

- a) regulatory requirements;
- b) contract documentation (e.g. purchase order);
- c) purchaser-defined requirements (e.g. PDS, IRS and QRS);
- d) this specification;
- e) UL 845.

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 equipment. This specification does not apply to motor control centers installed in hazardous (classified) areas.

Justification

UL 845 is a safety and performance standard, and this clause identifies the scope and boundaries of this overlay.

2 Normative references

Add to section

The documents listed in Annex C are referred to in this specification, the PDS (IOGP S-732D) or the IRS (IOGP S-732L) in such a way that some or all of their content constitutes requirements of these specification documents.

3 Definitions

Add new definition

3.21 touch-safe – protected from inadvertent contact by a finger using covers, recessing of terminals or the size of openings.

NOTE Touch-safe and similar terms, such as finger safe, are widely used to describe products but are not defined by industry standards. Touch-safe is generally equivalent to IP 2X per ANSI/IEC 60529, but most products are not tested to a particular IP rating.

Add new definition

3.22 manufacturer – an organization manufacturing and/or supplying the equipment or services, and/or contractor on project.

NOTE May be referred to as "vendor", "seller" or "supplier".

4 Application information and components

Add new clause

4.3 Dependability of materials and parts

4.3.1

The motor control center, excluding electronic components, shall have a design life of and be supported for at least 25 years after delivery.

Justification

This requirement ensures long-term equipment support and proven component availability, reducing the risk of obsolete materials, unsupported designs and premature replacement during the expected service life.

4.3.2

The electronic components (e.g. protection and control devices) shall have a minimum design life of 14 years under usual (normal) service conditions.

Justification

This requirement ensures that electronic components have a design life and operate for two turnaround cycles that are typically seven years each.

4.3.3

The motor control center and sub-components shall not be required to be de-energized for at least 45 000 h (five years) at the continuous-current rating and under normal service conditions

Justification

This requirement ensures that the complete assembly does not need major maintenance or de-energization before the first scheduled turnaround.

Add new clause

4.4 Technology readiness and obsolescence

4.4.1

The motor control center, excluding electronic devices, shall be supported for a minimum of 25 years after delivery.

Justification

This requirement ensures that replacement components are available within the 25-year design life.

4.4.2

An obsolescence management plan shall be available from the manufacturer for all motor control center components excluding devices that are specified by the purchaser and not part of the manufacturer's standard offering.

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

Justification

This requirement ensures proactive management of component obsolescence, reducing the risk of unsupported or unavailable parts during the expected service life and supporting alignment with recognized obsolescence management guidance.

4.4.3

Proposals shall indicate whether the motor control center or any sub-component (individually denoted) has less than three years of proven operational service.

Justification

This requirement ensures transparency of operational service history, reducing the risk of selecting unproven components or designs that have not demonstrated sufficient reliability in comparable service.

5 Characteristics

5.1 General

Add new clause

5.1.3

Low voltage motor control centers and controllers shall be provided in accordance with the single line diagrams, standard motor control schematics and IOGP S-732D.

Justification

This requirement ensures that project-specific configuration, arrangement, wiring and component details are defined by the applicable drawings and schematics, reducing the risk of incomplete procurement requirements and incorrect equipment configuration.

Add new clause

5.1.4

The complete assembly and its components shall have a short-circuit rating meeting or exceeding the specified system available fault current and the system X/R ratio.

Justification

This requirement ensures adequate short-circuit withstand and interrupting performance for the specified site conditions, reducing the risk of equipment failure, fire and personnel hazard due to insufficient fault-current or X/R ratio capability.

Add new clause

5.1.5

The motor control center shall be listed or certified by a nationally recognized testing laboratory (NRTL) for the United States or an accredited certification organization (ACO) for Canada.

NOTE Applications for this equipment in other countries may have additional requirements for certification.

Justification

This requirement ensures independent certification against applicable safety and performance requirements, supporting acceptance by electrical inspectors and authorities having jurisdiction before the equipment is placed into service.

5.2 Voltage ratings

Add new clause

5.2.1

If 24 Vdc control is specified, dual power supplies shall be provided.

Justification

This requirement ensures low-voltage control power with redundancy, preventing loss of control, measurement and protection functions due to a single power supply failure.

Add new clause

5.2.2

If dc power supplies are provided, an alarm contact for each power supply shall be provided to indicate that the output voltage is outside of the acceptable range (i.e. the supply has been turned off or has failed).

Justification

This requirement ensures that power supply failures are detected promptly, reducing the risk of undetected loss of control, measurement and protection functionality during operation.

5.3 Current

5.3.2 Horizontal bus rating

Add new clause

5.3.2.1

The bus bar joint and connection plates shall be the same material and plating type as the main power bus.

Justification

This requirement prevents the use of incompatible bus bar materials or plating combinations, reducing the risk of increased operating temperature, reduced current-carrying capability and degraded joint reliability.

Add new clause

5.3.2.2

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

Justification

This requirement ensures adequate ampacity at the incoming bus connection, reducing the risk of overheating, nuisance tripping and reduced reliability of the main incoming circuit breaker.

5.3.3 Vertical bus

Add to clause

All vertical bus bars in each section shall be able to carry the current as specified.

Justification

This requirement ensures consistent vertical bus sizing across sections, reducing the risk of undersized sections and providing future flexibility.

5.4 Short-circuit

5.4.1 Short-circuit and short-time current withstand ratings of motor center units

Add new clause

5.4.1.5

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

Justification

This requirement ensures coordinated short-circuit withstand capability across connected units, reducing the risk of equipment malfunction, explosion, fire and personnel injury during fault conditions.

5.4.4 Rating of bus structure

Add new clause

5.4.4.3

The horizontal and vertical bus short-circuit rating in the motor control center shall be greater than or equal to the maximum available fault current specified in the data sheet.

Justification

This requirement ensures adequate bus short-circuit withstand capability for the specified fault duty, reducing the risk of bus bar deformation, explosion, fire and personnel injury during fault conditions.

6 Markings and product information

6.1 Identification

Add to clause

A master nameplate with the following information shall be mounted on the motor control center main incoming unit:

- a) purchase order number;
- b) motor control center designation (tag number);
- c) month and year of manufacture.

Justification

This requirement ensures clear assembly identification for installation, maintenance and manufacturer support, reducing the risk of misidentification during operation, troubleshooting and future modification activities.

6.2 Product information

6.2.2

Add new list item f)

- f) the following information on a nameplate on each individual unit:
- 1) equipment tag number;
 - 2) equipment name;
 - 3) HP rating, kW rating or full load amperes (FLA).

Justification

This requirement ensures clear unit identification and rating information for installation, operation, maintenance and manufacturer support, reducing the risk of misidentification and incorrect intervention.

Add new clause

6.2.3

If an arc-resistant motor control center is specified, an additional nameplate shall be provided to identify the arc resistant ratings of the motor control center in accordance with IEEE C37.20.7:2017, Clause 6.3.

Justification

This requirement ensures that arc-resistant ratings are clearly identified for applicable equipment, supporting correct operation and maintenance practices and reducing the risk of personnel exposure to arc-flash hazards.

6.3 Marking

6.3.11B

In first sentence, replace "may" with

shall

Justification

This replacement makes the requirement for marking mandatory.

In second sentence, delete "or the equivalent"

Justification

This deletion ensures standardization.

6.3.46

Add to clause

When the disconnecting means uses a magnetic-only trip motor circuit protector or a thermal-magnetic molded-case circuit breaker, the position indicator shall include the "TRIP" position.

Justification

This requirement ensures rapid identification of a tripped unit, reducing troubleshooting time and supporting safe response after a trip event.

6.3.64Replace clause with

A warning label shall be provided on the doors of compartments with an external voltage source.

NOTE This clause does not apply to circuits less than 50 V.

Justification

This requirement ensures clear warning of external voltage sources, reducing the risk of electric shock during operation, inspection and maintenance activities.

Add new clause**6.3.73 Nameplate details****6.3.73.1**

The motor control center and individual units shall be provided with engraved nameplates and field markings depicting the information within the project nameplate schedule or single line drawing.

Justification

This requirement ensures consistent equipment identification based on project documentation, reducing the risk of misidentification, incorrect operation, maintenance errors and personnel safety incidents.

6.3.73.2

Nameplates shall be of the engravable type with black letters on a white background.

Justification

This requirement ensures standardized and legible nameplate format, reducing the risk of misidentification, incorrect operation, maintenance errors and personnel safety incidents.

6.3.73.3

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

Justification

This requirement ensures durable and standardized nameplate attachment, reducing the risk of missing or loose identification labels and associated misidentification, maintenance errors and personnel safety incidents.

6.3.73.4

The lettering on the master motor control center nameplate (see Clause 6.1) shall be at least 50 mm (2 in) high.

Justification

This requirement ensures standardized and visible assembly identification, supporting correct installation, maintenance and manufacturer support while reducing the risk of misidentification.

6.3.73.5

The size of unit nameplates shall be at least 25.4 mm (1 in) wide by 63.5 mm (2.5 in) long.

Justification

This requirement ensures standardized and legible unit identification, reducing the risk of misidentification, incorrect operation, maintenance errors and personnel safety incidents.

6.3.73.6

Characters of unit nameplates shall be at least 4.8 mm (0.1875 in) high.

Justification

This requirement ensures standardized and legible unit markings, reducing the risk of misidentification, incorrect operation, maintenance errors and incomplete procurement definition.

Add new clause**6.3.74**

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

Justification

This requirement ensures clear identification of door-mounted devices, reducing the risk of incorrect operation, maintenance errors and personnel safety incidents during operation and troubleshooting activities.

Add new clause**6.3.75**

Separate device markers shall be provided to identify components (e.g. terminals, relays, switches and other devices) within each unit.

Justification

This requirement ensures clear identification of internal components, reducing the risk of repair errors, incorrect troubleshooting and personnel safety incidents during maintenance activities.

7 Normal service and transport conditionsAdd new clause**7.3 Floating marine applications**

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

NOTE Additional guidance and information for USCG and ABS requirements for motor control centers installed on floating facilities in US territorial waters can be found in API RP 14F and API RP 14FZ.

Justification

This requirement ensures that applicable marine and offshore jurisdictional requirements are addressed for floating installations, reducing the risk of non-compliance, approval delays and unsuitable equipment selection for outer continental shelf applications.

8 Construction and performance requirements

8.1 General assembly

8.1.2 Enclosure – General

Add new clause

8.1.2.3

The motor control center structure shall be a dead front, totally enclosed and freestanding assembly.

Justification

This requirement ensures a safe enclosure configuration for normal operation and maintenance, reducing the risk of electric shock, accidental contact with energized parts and other electrical hazards.

Add new clause

8.1.2.4

If NEMA Type 1 with gasket enclosure is provided, front doors and covers shall close on gaskets installed around the edge of the door, cover or structure.

Justification

This requirement ensures effective enclosure sealing, reducing the risk of moisture ingress, internal condensation, short-circuit events and associated equipment damage.

Add new clause

8.1.2.5

Equipment, wiring and field connection terminals shall be accessible from the front.

Justification

This requirement ensures safe and practical access for repair, troubleshooting, and field termination activities, reducing the risk of maintenance errors, extended outages and unsafe intervention.

Add new clause

8.1.2.6

Each motor control center shipping section shall be provided with removable eyes or removable angle irons for lifting.

Justification

This requirement ensures safe and standardized lifting provisions for handling, installation and removal activities, reducing the risk of equipment damage, unsafe lifting practices and installation delays.

Add new clause**8.1.2.7**

If seismic requirements are specified, the motor control center shall be designed in accordance with the requirements of ASCE/SEI 7-16.

Justification

This requirement ensures defined seismic withstand capability where applicable, reducing the risk of non-compliance, equipment damage and loss of function during a seismic event.

Add new clause**8.1.2.8 Arc-resistant motor control centers****8.1.2.8.1**

Arc-resistant assemblies shall be tested in accordance with IEEE C37.20.7-2017 for a duration of not less than 0.1 s, unless an optional short-time withstand rating is specified.

Justification

This requirement ensures verified arc-resistant performance for applicable assemblies, reducing the risk of personnel injury during operation and maintenance activities involving arc-fault hazards.

8.1.2.8.2

When an optional short-time withstand rating is specified, the arc-resistant assembly shall be tested for the specified duration or 0.5 s, whichever is less.

Justification

This requirement ensures verified arc-resistant performance for applicable assemblies, reducing the risk of personnel injury during operation and maintenance activities involving arc-fault hazards.

8.1.2.8.3

The manufacturer shall identify the methodology defined in IEEE C37.20.7 that is utilized to achieve the arc-resistant certification of the motor control center.

Justification

This requirement ensures the arc-resistant certification basis is clearly defined, supporting protective device coordination analysis and reducing the risk of personnel injury due to incorrect application of arc-fault mitigation methods.

8.1.2.8.4

Minimum requirements for clear space above or around and other guidelines (e.g. for plenum) related to the performance of the arc-resistant motor control center shall be provided.

Justification

This requirement ensures that installation constraints affecting arc-resistant performance are clearly defined, reducing the risk of improper installation, equipment damage, fire, explosion and personnel injury.

8.1.2.8.5

If a plenum is provided, it shall run the full length of the motor control center assembly.

Justification

This requirement ensures effective routing of arc products away from the equipment room where required, reducing the risk of personnel exposure, equipment damage, fire and explosion following an arcing event.

8.1.2.8.6

Motor control center doors shall be secured with latches (tie-down bolts are not allowed).

Justification

This requirement prevents reliance on multiple tie-down bolts to maintain door integrity, reducing the risk of incomplete reassembly after maintenance and personnel injury during an arcing event.

8.1.2.8.7

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

Justification

This requirement prevents dependence on special tools to restore the arc-resistant function, reducing the risk of incomplete reassembly after maintenance and personnel injury during an arcing event.

8.1.2.8.8

If accessories (e.g. a 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.

Justification

This requirement ensures that the arc-resistant rating can be maintained when a unit is removed, reducing the risk of personnel injury, equipment damage and loss of certified protection during maintenance or reconfiguration activities.

8.1.7 Door interlock**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.

Justification

This replacement ensures controlled interlock bypass for inspection and troubleshooting, reducing the risk of unsafe improvised methods while supporting maintenance needed to restore equipment to service.

8.1.9

Replace first sentence 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, and

Justification

This replacement prevents reliance on standard bolts for doors opened during normal operation, reducing the risk of incomplete reassembly, loss of arc-resistant integrity and personnel injury during an arcing event.

Add to NOTE

Accessing vertical wireways is considered normal operation.

Justification

This addition ensures that access to vertical wireways is treated as a normal operation activity.

8.2 Construction requirements

8.2.2 Size, location, and covering or screening

Add new clause

8.2.2.10

If ventilation filters are provided, ventilation openings shall be covered with externally accessible washable-type filters.

Justification

This requirement prevents filter media degradation from affecting internal equipment, reducing the risk of restricted ventilation, overtemperature conditions and fire.

8.2.4 Hinged doors and covers

Add new clause

8.2.4.6

Vertical and horizontal wireways shall have separate access covers.

Justification

This requirement ensures segregated access for wireway maintenance and troubleshooting, reducing the risk of personnel exposure to energized equipment compartments.

Add new clause

8.2.4.7

Vertical wireway covers shall be provided with hinges.

Justification

This requirement ensures practical and controlled access to vertical wireways, reducing the risk of improper cover handling, maintenance errors and personnel exposure to adjacent energized compartments.

Add new clause**8.2.4.8**

If specified, the enclosure and unit doors shall include NRTL- or ACO-approved thermal scanning inspection windows to allow for infrared scanning of the equipment without opening the equipment doors or removing covers.

Justification

This requirement ensures safe infrared inspection access without opening doors or removing covers, reducing the risk of personnel exposure to energized compartments during thermal scanning activities.

8.2.6 Protection against corrosion**Delete list item b)****Justification**

This deletion ensures that the parts in list item b) are covered by the corrosion protection requirement.

Add new clause**8.2.6.1**

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

Justification

This requirement ensures corrosion protection for exposed parts and hardware, reducing the risk of material degradation, loose connections, impaired operation and reduced equipment reliability in corrosive environments.

8.2.6.2

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

Justification

This requirement ensures corrosion protection for motor control centers and their components in corrosive environments that affect equipment reliability without appropriate protection.

8.2.6.3

Bare copper, bare silver, silver-plated copper and their alloys shall not be provided for current-carrying parts when the presence of corrosive gases is identified.

Justification

This requirement prevents the use of exposed conductive materials that are susceptible to corrosive gases, reducing the risk of surface degradation, increased resistance, overheating and equipment unreliability. Tin plating is preferred over silver in corrosive atmospheres because silver can react with H₂S or other corrosive gases.

8.2.8 Current-carrying parts**8.2.8.2**

In first sentence, replace "may" with

shall

Justification

This replacement makes the requirement mandatory rather than optional.

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.

Justification

This requirement ensures suitable bus bar material and surface protection, reducing the risk of corrosion, inadequate conductivity, overheating and reduced long-term reliability.

Add new clause

8.2.9.5

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

Justification

This requirement ensures that future expansion can be completed without field drilling or support modifications, reducing outage duration and preventing safety and reliability risks from metal shaving contamination.

Add new clause

8.2.9.6 Removable cover plates**8.2.9.6.1**

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

Justification

This requirement ensures practical access for installation, bus splice tightening, inspection and proactive maintenance activities, reducing the risk of difficult access, incomplete maintenance and extended outages.

8.2.9.6.2

Removable cover plates shall be attached with bolts or screws.

Justification

This requirement ensures secure and rigid cover attachment, supporting safe installation and inspection while reducing the risk of loose covers, compromised enclosure integrity and incomplete maintenance access.

Add new clause

8.2.9.7

If an insulated main horizontal bus is specified, each bus bar shall be fully insulated for the rated voltage of the motor control center using an insulated covering (e.g. insulated sleeving or epoxy coating).

Justification

This requirement ensures adequate insulation of energized bus bars, reducing the risk of accidental contact, short-circuit events, equipment outages and intrusion-related faults.

Add new clause

8.2.9.8

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

Justification

This requirement prevents unnecessary bus joints within a shipping section, reducing the risk of loose connections, hot spots, overheating and electrical fire.

Add new clause

8.2.9.9

Space shall be provided to allow for field installation and servicing of shipping split joint connections with a front accessible bus cover removed (i.e. assembly of joints and access with a torque wrench).

Justification

This requirement ensures adequate access or space for proper installation and servicing of shipping split joints, reducing the risk of improperly torqued connections, hot spots, overheating and electrical fire.

Add new clause

8.2.9.10

When a back-to-back motor control center configuration is specified, two separate motor control center assemblies shall be connected through a transition section that has separate vertical power buses with the same phasing sequence for the front and back assemblies.

Justification

This requirement prevents reliance on common bus arrangements in back-to-back configurations, reducing the risk of ampacity derating, increased fault damage, reduced reliability and incorrect phasing between assemblies.

Add new clause**8.2.9.11**

Vertical bus bars in each motor control center section shall be provided as either of the following:

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

Justification

This requirement ensures phase bus bar protection by insulation or isolation, reducing the likelihood of fault propagation, equipment damage and reduced reliability.

Add new clause**8.2.9.12**

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

Justification

This requirement ensures continuity of bus insulation at joints and shipping splits, reducing the risk of exposed energized areas, short-circuit events and incomplete protection after field assembly.

8.2.10 Protection of service personnelAdd new clause**8.2.10.4**

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

Justification

This requirement prevents incidental contact with energized vertical bus bars when a draw-out unit is removed, reducing the risk of electric shock or personnel injury during operation and maintenance activities.

Add new clause**8.2.10.5**

If specified, controllers and feeder units shall be provided with an absence of voltage tester device that is NRTL listed to UL 1436 in order to establish electrically safe work conditions and provide a means of verification of isolation without opening the unit door.

Justification

This requirement ensures that the absence of voltage can be verified 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 incidental contact.

Justification

This requirement prevents incidental contact with conducting parts that remain energized after isolation, reducing the risk of electric shock or personnel injury during operation and maintenance activities.

8.2.11 Combination motor control unitAdd new clause**8.2.11.10**

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

Justification

This requirement ensures standardized controller sizing based on NEMA horsepower ratings, reducing the risk of applying incompatible IEC contact ratings or selecting controllers that are not aligned with US customary motor control practices.

Add new clause**8.2.11.11**

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

Justification

This requirement ensures standardized minimum controller sizing, reducing spare parts variation and supporting consistent maintenance practices for small-load applications.

Add new clause**8.2.11.12**

Dual- and intermediate-size motor controllers (e.g. size 1 $\frac{3}{4}$) shall not be acceptable.

Justification

This requirement prevents the use of non-standard controller sizes, reducing spare part variation and supporting consistent selection, maintenance and alignment with NEMA-based motor control practices.

Add new clause**8.2.11.13**

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

Justification

This requirement ensures adequate space for controller components and accessories, reducing the risk of difficult maintenance, restricted access, overcrowded layouts and reduced maintainability over the equipment service life.

Add new clause**8.2.11.14**

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

Justification

This requirement ensures reliable primary connections and safer unit isolation, reducing the risk of poor contact, overheating, arc exposure and personnel injury during withdrawal or maintenance activities.

Add new clause**8.2.11.15**

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

Justification

This requirement ensures suitable breaker selection for premium efficiency motor starting characteristics, reducing the risk of nuisance tripping, failed starts and incorrect protection settings caused by higher inrush current.

Add new clause**8.2.11.16 Mechanical overload relays**

If mechanical overload relays are specified, they shall be provided in accordance with the requirements given in Clauses 8.2.11.16.1 through 8.2.11.16.3.

Justification

This ensures that additional requirements for mechanical overload relays are provided.

8.2.11.16.1

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

Justification

This requirement ensures reliable overload protection across the expected ambient temperature range, reducing the risk of nuisance trips, delayed trips and inadequate motor protection under extreme temperature conditions.

8.2.11.16.2

Mechanical overload relays shall be designed to accept replaceable elements.

Justification

This requirement ensures maintainable overload protection by allowing replacement of expendable elements, reducing repair cost, downtime, and requirements for spare parts when elements operate or motor characteristics change.

8.2.11.16.3

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

Justification

This requirement ensures that overload trips can be reset without opening the equipment door, reducing the need for electrical access, minimizing personnel exposure to energized compartments and supporting faster recovery from process-related motor overload conditions.

Add new clause**8.2.11.17 Adjustable solid-state overload relays**

If adjustable solid-state overload relays are specified, they shall be provided in accordance with the requirements given in Clauses 8.2.11.17.1 through 8.2.11.17.6.

Justification

This ensures that additional requirements for adjustable solid-state overload relays are provided.

8.2.11.17.1

Adjustable solid-state overload relays shall be three-pole type.

Justification

This requirement ensures that phase monitoring is provided on three phases, reducing the risk of undetected single-phasing, motor overheating and inadequate motor protection.

8.2.11.17.2

Adjustable solid-state overload relays shall be current sensing.

Justification

This requirement ensures accurate motor overload detection, reducing the risk of nuisance trips, missed overload conditions and motor protection unreliability.

8.2.11.17.3

Adjustable solid-state overload relays shall have a selectable overload trip of NEMA class 10 to 30.

Justification

This requirement ensures configurable overload protection for different motor starting characteristics, reducing the risk of incorrect trip selection, unnecessary spare parts variation and reduced interchangeability.

8.2.11.17.4

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.

Justification

This requirement ensures suitable overload setting capability for motors with service factors above 1.0, reducing the risk of nuisance trips, incorrect protection settings and plant unreliability.

8.2.11.17.5

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

Justification

This requirement ensures that overload trips can be reset without opening the equipment door, reducing the need for electrical access, minimizing personnel exposure to energized compartments and supporting faster recovery from process-related motor overload conditions.

8.2.11.17.6

If fused disconnect type is provided for the unit disconnect means, the adjustable solid-state overload relay shall be designed and configured to open the contactor on loss of a phase to prevent single phase operation of the motor.

Justification

This requirement ensures adequate motor protection when fusible disconnect devices are used, reducing the risk of undetected phase loss, single-phasing, motor overheating and equipment damage.

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;
- c) protective functions to include thermal overload, underload, locked rotor, current imbalance, stall, phase loss and 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;
- k) remote reset.

Justification

This requirement ensures adequate multifunction motor protection, monitoring, diagnostics, communication, and status indication, reducing the risk of undetected abnormal operating conditions, nuisance trips, motor damage, delayed troubleshooting and inconsistent relay configurations.

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.

Justification

This requirement ensures that control circuits are protected from voltage transients, reducing the risk of electronic component damage, relay failure, nuisance operation and costly equipment replacement.

Add new clause

8.2.11.20

Contactors provided in combination motor controllers shall be of the air-break magnetic type for sizes 1 through 4 and of the vacuum-break type for size 5 and larger.

Justification

This requirement ensures that the contactor technology is standardized in accordance with the motor controller size and expected switching duty, reducing the risk of contact erosion, reduced reliability and inconsistent starter selection.

Add new clause

8.2.11.21

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

Justification

This requirement ensures that faults in control power circuits are cleared effectively on both sides of the transformer, reducing fault duration, equipment damage and loss of control circuit reliability.

Add new clause

8.2.11.22

If control power transformers are provided, the sizing shall include the control circuit load and motor space heater loads as defined in Table 46.

Justification

This requirement ensures adequate control power transformer capacity for connected auxiliary loads, reducing the risk of undersizing, additional external power supplies, increased installation cost and inconsistent heater load allowances.

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 Clause 8.2.11.29.

Justification

This requirement ensures standardized spare control power capacity for additional motor control accessories, reducing the risk of transformer undersizing, inconsistent supplier selection and the need for separate auxiliary power supplies.

Add new clause**8.2.11.24**

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 contact.

Justification

This requirement ensures that standardized spare control contacts are available for typical control schemes and future modifications, reducing the risk of component replacement, rework, increased cost and inconsistent controller configurations.

Add new clause**8.2.11.25**

If a control power source external to the motor control center is specified, the motor control center line-up shall be provided in accordance with the requirements given in Clauses 8.2.11.25.1 through 8.2.11.25.4.

Justification

This requirement ensures that additional requirements for motor control center line-ups are provided.

8.2.11.25.1

A control power circuit shall be provided in each vertical section with all units wired in parallel.

Justification

This requirement ensures a standardized external control power distribution arrangement, reducing field wiring effort, installation cost, and the risk of inconsistent control circuit configurations.

8.2.11.25.2

Separate control power fuses shall be provided for each unit.

Justification

This requirement ensures unit-level control power fault isolation, reducing the risk of a single unit fault affecting other units and improving overall control system reliability.

8.2.11.25.3

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

Justification

This requirement ensures that control power wiring can be disconnected without unwiring field or internal circuits, reducing maintenance effort, removal time and lifecycle maintenance cost.

8.2.11.25.4

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

Justification

This requirement ensures that control power is isolated with the unit disconnecting device, reducing the risk of unexpected voltage remaining inside the controller and personnel exposure during maintenance or troubleshooting.

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.

Justification

This requirement ensures that a project-specific control methodology is implemented as defined in the project documentation, reducing the risk of incomplete supplier scope, incorrect control functionality and inconsistent unit wiring.

Add new clause**8.2.11.27**

Plug-in type interposing relays supplied within the units shall be provided with retaining clips.

Justification

This requirement prevents plug-in relays from loosening due to vibration, reducing the risk of intermittent control circuit operation, loss of functionality and reduced equipment reliability.

Add new clause**8.2.11.28**

If motor space heaters are specified, the combination motor controller shall be provided with a normally closed "M" contact wired in series with the control power source such that the motor space heater is energized when the contactor is open.

Justification

This requirement ensures automatic control of motor space heater energization when the motor is not running, reducing the risk of moisture accumulation, insulation degradation and reduced motor reliability.

Add new clause

8.2.11.29

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

Justification

This requirement prevents plug-in units from being inserted or withdrawn while energized, reducing the risk of unsafe load interruption, arc exposure, equipment damage and personnel injury.

Add new clause

8.2.11.30

If auto trip reset is specified, an overload relay shall include functionality to automatically reset after a specified period of time (e.g. automatic reset with a maximum number of resets or reset after thermal capacity is sufficient to allow a restart).

Justification

This requirement ensures that overload trips can be reset automatically where specified, reducing the need for manual intervention, improving recovery from temporary process-related overload conditions and supporting plant availability.

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 motor control center with smaller units located in the upper half.

Justification

This requirement ensures that heavier units are positioned for safer handling and improved equipment stability, reducing the risk of difficult lifting, unsafe maintenance and elevated centers of gravity.

Add new clause

8.2.12.1

Feeder units providing circuit protection devices shall be thermal MCCB or fused switches, with the fuses supplied and installed as indicated on project drawings.

Justification

This requirement ensures standardized feeder protection arrangements, reducing the risk of inconsistent device selection, incomplete supplier scope and misalignment with project-specific protection requirements.

Add new clause**8.2.12.2**

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.

Justification

This requirement ensures safer feeder unit isolation and withdrawal, reducing the risk of energized movement, arc exposure, poor stab contact, overheating and personnel injury during maintenance activities.

Add new clause**8.2.12.3**

If fused disconnect switches are specified, fuse holders shall be provided as touch-safe.

Justification

This requirement prevents incidental contact with energized fuse holder parts, reducing the risk of electric shock and personnel injury during operation and maintenance activities.

Add new clause**8.2.12.4**

Dual feeder-tap units with two MCCB feeders shall not be provided in a single 12-inch space factor unit.

NOTE The use of two separate 6-inch space factor units is acceptable.

Justification

This requirement prevents dual feeder arrangements in a single 12-inch space factor unit that increase exposure during troubleshooting, reducing the risk of electric shock, contact with live parts and personnel injury during maintenance activities.

Add new clause**8.2.12.5**

Unit control wiring and communication cabling shall be capable of being disconnected without de-energizing adjacent units.

Justification

This requirement ensures that unit wiring can be disconnected without affecting adjacent units, reducing the risk of unnecessary outages and supporting safe removal, maintenance and plant reliability.

Add new clause**8.2.12.6**

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

Justification

This requirement ensures positive stab alignment and contact integrity, reducing the risk of poor electrical connection, overheating, arcing, fire and equipment damage during normal load and fault conditions.

Add new clause**8.2.12.7**

A vertical section future space allowance of 305 mm (12 in) or larger shall be provided with the necessary hardware to allow for installation of a removable unit (e.g. guide, support or barrier) and to isolate units from each other.

Justification

This requirement ensures that future unit spaces are ready for safe and efficient equipment addition, reducing the risk of field modification, installation delays and inadequate segregation between units.

Add new clause**8.2.12.8**

Supports and barriers for draw-out and fixed removable units shall be designed to be removed or added in the field without special tools.

Justification

This requirement ensures that field modifications can be completed efficiently using standard tools, reducing installation time, maintenance complexity and delays when adding or removing units.

Add new clause**8.2.12.9**

Withdrawable units shall be equipped with a mechanical interlock that prevents drawing the device out in a single motion.

Justification

This requirement prevents uncontrolled withdrawal of the unit, reducing the risk of dropped equipment, personnel injury and equipment damage during removal activities.

8.2.13 Internal wiring**8.2.13.1**Delete second sentence**Justification**

This sentence has been replaced with detailed requirements in Clause 8.2.13.1.1 to 8.2.13.1.4.

Add new clause**8.2.13.1.1**

The internal motor control center wiring shall be soft or annealed copper wire with 600 V flame-retardant insulation rated not less than 90 °C.

Justification

This requirement ensures standardized internal wiring suitable for shared wireways and elevated temperature service, reducing the risk of insulation failure, inconsistent wiring practices, increased installation cost and reduced fire safety.

Add new clause**8.2.13.1.2**

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

Justification

This requirement ensures suitable conductor flexibility and durability for internal wiring, reducing the risk of wire fatigue, insulation damage and connection failure caused by repeated door or hinged-joint movement.

Add new clause**8.2.13.1.3**

The minimum size for control wiring internal to the motor control center shall be 1.3 mm² (No.16 AWG).

Justification

This requirement ensures standardized minimum control wiring size, reducing the risk of inconsistent supplier practices, inadequate mechanical robustness and increased maintenance complexity.

Add new clause**8.2.13.1.4**

Terminal blocks for termination of field run control conductors shall accept at minimum two conductors sized 2.1 mm² (No. 14 AWG) each.

Justification

This requirement ensures standardized field control termination capacity, reducing the risk of inconsistent terminal selection, installation constraints and field wiring modifications.

8.2.13.4Replace clause with

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

Justification

This replacement ensures continuous internal wiring integrity, reducing the risk of hidden connection failures, troubleshooting complexity, degraded performance and maintenance errors.

Add new clause**8.2.13.17**

Circuit wiring shall be NEMA Class II, Type B.

Justification

This requirement ensures standardized factory wiring for interlocking, inter-unit wiring, and remote interlocking functions, reducing field wiring scope, third-party installation variability, commissioning effort and lifecycle cost.

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 (provided it does not increase the size of the unit) and guarded, touch-safe type.

Justification

This requirement ensures standardized spare terminal capacity and touch-safe terminations, reducing the risk of field modification, limited future wiring flexibility, electric shock and inconsistent terminal strip configurations.

Add new clause**8.2.13.19 Wire marking****8.2.13.19.1**

Internal wiring shall be identified at both ends within 25.4 mm (1 in) of the termination, using one of the following:

- a) machine-printed 360° slip-on wire markers;
- b) heat-shrink wire markers;
- c) permanent stenciling per wire with a unique tag or wire number.

Justification

This requirement ensures standardized and durable wire identification near termination points, reducing the risk of wiring errors, troubleshooting delays, maintenance mistakes and reduced quality control.

8.2.13.19.2

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

Justification

This requirement prevents the use of wire markers that can detach or become unreadable over time, reducing the risk of troubleshooting delays, maintenance errors, rework and increased lifecycle cost.

Add new clause**8.2.13.20 Unit door wiring****8.2.13.20.1**

Wiring connected to unit doors shall operate at 120 Vac (nominal) or less.

Justification

This requirement ensures that door-mounted wiring uses a reduced control voltage, reducing the risk of electric shock to personnel during operation, inspection and maintenance activities.

8.2.13.20.2

Wiring across hinged panels and doors shall be bundled with wraps to protect conductors from damage caused by abrasion or pinching.

Justification

This requirement ensures that wiring across hinged panels and doors is mechanically protected, reducing the risk of conductor abrasion, pinching, insulation damage, short circuits and loss of control circuit reliability.

8.2.13.20.3

Terminals shall be touch-safe or covered by an insulating barrier to protect from incidental contact.

Justification

This requirement prevents incidental contact with energized terminals, reducing the risk of electric shock and personnel injury during operation, inspection and maintenance activities.

Add new clause**8.2.13.21**

Accessories (e.g. terminal strips) shall not be installed in wireways unless integral to the draw out design of the motor control center unit.

Justification

This requirement prevents non-integral accessories from obstructing wireways, reducing the risk of inconsistent layouts, difficult maintenance access, wiring damage and reduced installation quality.

Add new clause**8.2.13.22 Current transformers for incoming protection and metering****8.2.13.22.1**

Current transformer secondary circuit wiring shall be terminated with insulated, compression-ring-type lugs.

Justification

This requirement ensures secure and standardized current transformer secondary terminations, reducing the risk of loose connections, wiring faults, shock hazards and reduced circuit reliability caused by cable expansion and contraction.

8.2.13.22.2

Current transformer secondary circuit wiring shall be wired directly to short-circuiting-type terminal blocks.

Justification

This requirement prevents hazardous open-circuit conditions in current transformer secondary circuits, reducing the risk of high induced voltages, insulation failure, current transformer damage and personnel injury.

8.2.13.22.3

Current transformer circuit grounding shall have green insulation and be marked "CT GROUND" or with the grounding symbol (see IEC 60417, symbol 5019) at the terminal block and at the ground bus termination point.

Justification

This requirement ensures that current transformer grounding conductors are clearly and consistently identified, reducing the risk of wiring errors, delayed troubleshooting, shock hazards and incorrect maintenance intervention.

8.2.13.22.4

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

Justification

This requirement ensures a continuous and reliable current transformer grounding path, reducing the risk of connection failure, troubleshooting difficulty, shock hazards and costly equipment damage.

8.2.15 Control circuit transformer protection**8.2.15.5**

Delete Clause 8.2.15.5

Justification

This deletion ensures individual and separate overload protection for the control power transformer.

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.

Justification

This replacement ensures that field control wiring can be disconnected safely and efficiently during unit removal, reducing the risk of wiring damage, maintenance errors and extended outages.

Add new clause**8.2.16.9**

The motor control center 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).

Justification

This requirement ensures phase separation at incoming supply terminations, reducing the risk of incidental contact, phase-to-phase faults, electric shock and personnel injury during installation and maintenance activities.

Add new clause**8.2.16.10**

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

Justification

This requirement prevents incidental contact with energized incoming supply parts, reducing the risk of electric shock, arc exposure and personnel injury during installation, inspection or maintenance activities.

Add new clause**8.2.16.11**

The motor control center assembly shall be arranged to allow for incoming supply conductors to be tested for voltage without removal of insulation barriers or guards (e.g. holes for test probes).

Justification

This requirement ensures that voltage testing can be performed without removing protective barriers or guards, reducing the risk of electric shock, arc exposure and personnel injury during verification and maintenance activities.

8.2.29 Wiring space**8.2.29.3 Clear wiring space**Add new clause**8.2.29.3.8 Vertical wireways****8.2.29.3.8.1**

Vertical wireways shall be full-height, full-depth (space within the motor control center assembly occupied by units) and isolated from all power buses.

Justification

This requirement ensures that vertical wireways can be accessed without exposure to power buses, reducing the risk of electric shock, arc exposure and unnecessary access restrictions during routine operation and maintenance activities.

8.2.29.3.8.2

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

Justification

This requirement ensures adequate vertical wireway space for wiring access, reducing the risk of difficult maintenance, repair delays, wiring damage and restricted operational access.

8.2.29.3.8.3

Vertical wireways shall be isolated from the unit by a metal barrier except for openings necessary for wire passage between the wireway and the unit.

Justification

This requirement ensures rigid and grounded segregation between wireways and units, reducing the risk of wiring tools, conductors or foreign objects entering adjacent compartments and affecting safety or equipment reliability.

Add new clause**8.2.29.3.9 Horizontal wireways****8.2.29.3.9.1**

Horizontal wireways shall be isolated from all power buses using one or more barriers.

Justification

This requirement ensures segregation between horizontal wireways and power buses, reducing the risk of electric shock, arc exposure, wiring damage and personnel injury during installation and maintenance activities.

8.2.29.3.9.2

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

Justification

This requirement ensures continuous and standardized horizontal wireway routing, reducing the risk of additional taps, splices, joints, wiring complexity and reduced maintainability.

8.2.29.3.9.3

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

Justification

This requirement ensures adequate horizontal wireway space for wiring access, reducing the risk of difficult maintenance, repair delays, wiring damage and restricted operational access.

8.2.32 Transformer secondary grounding

8.2.32.1

Replace clause with

Control power transformers shall have one secondary terminal grounded.

Justification

This requirement ensures a defined reference to ground for the control power circuit, reducing the risk of unstable control voltage, fault detection issues and electric shock hazards.

8.2.34 Ground bus

8.2.34.1 Horizontal ground bus

Replace clause with

8.2.34.1.1

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

Justification

This requirement ensures a standardized corrosion-resistant grounding path, reducing the risk of oxidation, degraded conductivity, difficult maintenance and reduced grounding system reliability.

8.2.34.1.2

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

Justification

This requirement ensures adequate grounding capacity for applications, reducing the risk of insufficient fault-current capability, impaired fault clearing and reduced grounding system reliability.

8.2.34.1.3

The horizontal ground bus shall be uniform and continuous across the entire length of the motor control center with the exception of shipping splits.

Justification

This requirement ensures safety and standardization.

8.2.34.1.4

The horizontal ground bus shall be pre-drilled for outgoing equipment grounding conductors at each end section and equipped with NEMA 2-hole 107 mm² (4/0 AWG) lugs.

Justification

This requirement ensures standardized and ready-to-use grounding conductor termination points, reducing the risk of field drilling, metal shaving contamination, hole diameter errors and installation delays.

8.2.34.1.5

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

Justification

This requirement ensures a standardized and compatible grounding termination arrangement, reducing installation variability, field rework, connection errors and reduced grounding system reliability.

Add new clause**8.2.34.7**

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

Justification

This requirement ensures a standardized corrosion-resistant grounding path in each section, reducing the risk of oxidation, degraded conductivity, insufficient fault-current capability and reduced grounding system reliability.

Add new clause**8.2.34.8**

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

Justification

This requirement ensures a complete and standardized internal grounding system, reducing the risk of incomplete bonding, impaired fault clearing and reduced personnel safety in heavy industrial and oil and gas applications.

Add new clause**8.2.35 Incoming line section****8.2.35.1**

When a main circuit breaker is specified, the requirements given in Clauses 8.2.35.1.1 through 8.2.35.1.3 shall apply.

Justification

This requirement ensures that additional requirements for main circuit breakers are provided.

8.2.35.1.1

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.

Justification

This requirement ensures safe front access to the main circuit breaker, reducing the risk of incidental contact with energized line-side terminations, electric shock and personnel injury during inspection and maintenance activities.

8.2.35.1.2

The main circuit breaker shall be operable with the enclosure door closed.

Justification

This requirement ensures that the main circuit breaker can be operated under normal enclosed conditions, reducing the risk of personnel exposure to energized parts, arc hazards or unsafe operating practices.

8.2.35.1.3

The breaker position status (closed, open, tripped) shall be visible with the enclosure door closed or open.

Justification

This requirement ensures clear breaker status indication during operation, maintenance, and repair activities, reducing the risk of incorrect switching, delayed troubleshooting and unsafe intervention.

8.2.35.2

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

Justification

This requirement ensures standardized and compatible incoming cable terminations for MLO arrangements, reducing the risk of installation variability, loose connections, rework and reduced termination reliability.

8.2.35.3

If "main lugs only" (MLO) are specified, the incoming section shall be provided with supports for the incoming cables to prevent mechanical stress on the busbars.

Justification

This requirement ensures incoming cables are adequately supported, reducing the risk of mechanical stress on terminations, bus bar damage, loose connections and reduced long-term reliability.

8.2.35.4

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

Justification

This requirement ensures that vendor-specific incoming bus interface components are included with the equipment, reducing the risk of field installation issues, missing parts, rework and inconsistent connection arrangements.

8.2.35.5

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

Justification

This requirement ensures standardized incoming line monitoring and communication capability, reducing the risk of limited operational visibility, inconsistent metering functionality and reduced maintainability.

Add new clause

8.2.36 Non-motor loads

8.2.36.1

Contactors 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.

Justification

This requirement ensures that the application-specific contactor selection is defined by the project documentation, reducing the risk of incorrect ratings, unsuitable switching duty, equipment damage and reduced reliability.

8.2.36.2

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

Justification

This requirement ensures standardized spare auxiliary contacts for non-motor load applications, reducing the risk of field modification, additional wiring effort and limited flexibility for future control and monitoring functions.

8.2.36.3

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

Justification

This requirement ensures standardized local and remote lighting control functionality, reducing the risk of inconsistent operation, limited status visibility, difficult troubleshooting and reduced maintainability.

Add new clause

8.2.37 Integral adjustable speed drives and soft starters

8.2.37.1

Adjustable speed drives and soft starters shall be provided with a programmer or operator interface that is accessible with the door closed.

Justification

This requirement ensures safe and practical access to drive and soft starter settings without opening the unit door, reducing the risk of personnel exposure, unnecessary logout/tagout, extended troubleshooting time and increased maintenance cost.

8.2.37.2

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

Justification

This requirement ensures standardized local visibility of key operating and diagnostic information, reducing the risk of limited troubleshooting capability, inconsistent operator interfaces and delayed response to abnormal conditions.

8.2.37.3

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

Justification

This requirement ensures a standardized and accessible field wiring interface, reducing the risk of wiring errors, difficult terminations, extended installation time and maintenance issues caused by limited access to ASD or soft starter terminals.

8.2.37.4

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

Justification

This requirement ensures a standardized reduced-voltage starting method, reducing the risk of higher maintenance, increased equipment size and weight, and installation cost associated with older transformer-based starter designs.

8.2.37.5

If status indicator lights are specified for motor controller units, adjustable speed drives and soft starter units shall be provided with lights in accordance with Clause 8.2.41.1.

Justification

This requirement ensures local status indication is available without opening the unit door, reducing the risk of personnel exposure to energized parts, delayed status verification and unsafe troubleshooting practices.

8.2.37.6

Adjustable speed drives and soft starter units shall include facilities for isolation and bypass if indicated on the project drawings.

Justification

This requirement ensures that isolation and bypass capability is provided where required by the project design, reducing the risk of unsafe repair access, extended outages and inability to maintain power to the connected load during drive or soft starter maintenance.

Add new clause**8.2.38 Integral power distribution panels (panelboards)****8.2.38.1**

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

Justification

This requirement ensures distribution panels comply with a recognized safety standard, reducing the risk of unsuitable panelboard construction, safety non-compliance and approval issues.

8.2.38.2

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

Justification

This requirement ensures secure branch circuit breaker installation and lockable isolation capability, reducing the risk of breaker dislodgement from vibration, unintended energization and unsafe maintenance of connected loads.

8.2.38.3

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

Justification

This requirement ensures that connected loads are clearly identified, reducing the risk of incorrect switching, delayed troubleshooting and unsafe maintenance activities.

Add new clause**8.2.39 Integral distribution transformers****8.2.39.1**

Transformers shall be dry type with an insulation system temperature of 130 °C and a maximum allowable hot spot winding temperature rise of 90 °C.

Justification

This requirement ensures that transformer insulation is suitable for continuous full-load operation under high ambient and limited cooling conditions, reducing the risk of excessive hot-spot temperature, winding insulation failure and reduced transformer service life.

8.2.39.2

Transformers shall be provided with a K4 minimum rating.

Justification

This requirement ensures transformer capability for non-linear load applications, reducing the risk of harmonic-related overheating, insulation degradation and reduced transformer reliability.

8.2.39.3

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

Justification

This requirement ensures transformer voltage adjustment capability for variations in incoming supply, reducing the risk of unsuitable secondary voltage, reduced equipment performance and limited installation flexibility.

8.2.39.4

Transformers primary circuit protection shall be provided by a feeder-tap unit within the motor control center.

Justification

This requirement ensures integrated primary protection and isolation for transformers, reducing installation cost, external equipment requirements and safety risks during transformer maintenance or fault conditions.

8.2.39.5

Transformers shall be provided with a thermal-magnetic molded case circuit breaker in the panelboard for secondary protection.

Justification

This requirement ensures standardized secondary protection and isolation for transformers, reducing installation cost, external equipment requirements and safety risks during downstream fault or maintenance conditions.

Add new clause**8.2.40 Motor control center vertical section space heaters****8.2.40.1 Moisture condensation control**

If space heaters are specified, they shall provide moisture condensation control within each vertical section of the motor control center in accordance with the requirements given in Clauses 8.2.40.1.1 through 8.2.40.1.4.

Justification

This requirement ensures moisture condensation control within equipment sections, reducing the risk of arc flash events, component failure, corrosion and reduced equipment reliability.

8.2.40.1.1

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

Justification

This requirement ensures safe and accessible connection points for externally powered space heaters, reducing the risk of wiring errors, difficult maintenance and unsafe access to heater circuits.

8.2.40.1.2

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

Justification

This requirement prevents incidental contact with space heaters, reducing the risk of burns or personnel injury during operation, inspection and maintenance activities.

8.2.40.1.3

Space heaters shall be operated at 120 Vac.

Justification

This requirement ensures that space heaters operate at a reduced voltage, reducing the risk of electric shock, arc flash exposure and personnel injury during operation and maintenance activities.

8.2.40.1.4

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

Justification

This requirement ensures standardized heater capacity for condensation prevention, reducing the risk of moisture accumulation, corrosion, insulation degradation and reduced equipment reliability.

8.2.40.2

If thermostat control is specified for space heaters, a control unit shall be provided in accordance with the requirements given in Clauses 8.2.40.2.1 through 8.2.40.4.2.5.

Justification

This requirement ensures controlled space heater operation where specified, reducing unnecessary power consumption while maintaining condensation protection for applicable applications.

8.2.40.2.1

The control unit supply disconnect shall be a circuit breaker equipped with a means to lockout.

Justification

This requirement ensures lockable isolation for the control unit supply, reducing the risk of unintended energization, electric shock, or unsafe troubleshooting conditions.

8.2.40.2.2

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.

Justification

This requirement ensures that the space heater function can be verified safely without opening equipment doors, reducing the risk of personnel exposure, difficult troubleshooting and undetected heater failure.

8.2.40.2.3

The control unit shall be provided with an ammeter.

Justification

This requirement ensures that space heater performance can be assessed safely from the control unit, reducing the risk of personnel exposure, difficult troubleshooting and undetected heater degradation.

8.2.40.2.4

The control unit ammeter shall have an appropriately sized scaled such that the failure of a single space heater element results in a discernible change in ammeter reading.

Justification

This requirement ensures that space heater element failure can be detected from the ammeter reading, reducing the risk of undetected heater degradation, moisture accumulation and unnecessary exposure during troubleshooting.

8.2.40.2.5

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

Justification

This requirement ensures that the normal operating current is clearly available for maintenance personnel, reducing the risk of incorrect assessment, delayed troubleshooting and undetected space heater malfunction.

Add new clause**8.2.41 Motor control center data communications****8.2.41.1**

If motor control center data communications are required, devices intended to be monitored shall be compatible with the specified communication protocol or combination of protocols.

Justification

This requirement ensures compatible communication capability for monitored devices, reducing the risk of integration issues, limited condition monitoring, unnecessary door access and delayed troubleshooting.

8.2.41.2

Communication network cable connections made in wireways shall have a mechanical means (e.g. screw-type connectors, RJ-45 connectors) to prevent unintended separation.

Justification

This requirement prevents unintended communication cable disconnection, reducing the risk of lost device status, reduced operational visibility, delayed troubleshooting and loss of asset availability.

8.2.41.3

Communication cabling shall be rated for 600 Vac.

Justification

This requirement ensures that communication cabling has an insulation rating suitable for shared enclosures with power conductors, reducing the risk of regulatory non-compliance, insulation failure and unsafe multi-voltage wiring arrangements.

Add new clause**8.2.42 Motor control center indication and control****8.2.42.1****Add new clause**

If status indicator lights are specified, they shall be provided in accordance with the requirements given in Clauses 8.2.42.1.1 through 8.2.42.1.3.

Justification

This ensures that additional requirements for status indicator lights are provided.

8.2.42.1.1

Status indicator lights shall be installed on the unit door or be visible with the door closed.

Justification

This requirement ensures that status indication is visible without opening the unit door, reducing the risk of personnel exposure to energized parts, delayed status verification and unsafe troubleshooting practices.

8.2.42.1.2

Status indicator light colors shall be red (running), green (stopped) and amber (tripped).

Justification

This requirement ensures standardized status indication colors, reducing the risk of operator confusion, incorrect response, and delayed recognition of running, stopped and tripped conditions.

8.2.42.1.3

Status indicator lights shall be LED type with a minimum illumination life of 100 000 h.

Justification

This requirement ensures long-life, standardized visual indication, reducing the risk of premature lamp failure, increased maintenance and loss of reliable operating status visibility.

8.2.42.2

Push buttons, selector switches and other door-mounted devices shall be oil tight and have a heavy-duty rating as defined in NEMA ICS 5.

Justification

This requirement ensures standardized and robust door-mounted control devices, reducing the risk of premature device failure, unreliable operation and reduced safety in industrial service conditions.

8.2.42.3

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.

Justification

This requirement ensures that field interface contacts are suitably rated for the intended switching duty, reducing the risk of contact failure, unreliable control operation and unsafe external equipment control.

Add new clause

8.2.43 Motor control center condition-based monitoring

If continuous thermal monitoring is specified, it shall be provided in accordance with the requirements given in Clauses 8.2.43.1 through 8.2.43.4.

Justification

This requirement ensures that additional requirements for continuous thermal monitoring are provided.

8.2.43.1

Motor control center assemblies shall be equipped with factory integrated continuous thermal monitoring technology.

Justification

This requirement ensures that thermal monitoring is integrated during manufacture, reducing installation complexity, field modification, cost and safety risks associated with site-installed monitoring systems.

8.2.43.2

Thermal monitoring shall provide hotspot detection sensors for main incoming section (main circuit breaker or lug) and other areas of concern, such as individual units or shipping split connections.

Justification

This requirement ensures that thermal monitoring is applied to typical failure-prone locations, reducing the risk of undetected hot spots, loose terminations, overheating devices and thermal damage within the assembly.

8.2.43.3

The continuous thermal monitoring system shall include a fault relay dry contact output and communications (status and alarming).

Justification

This requirement ensures that essential thermal monitoring alarms are available for remote indication and system integration, reducing the risk of undetected abnormal temperatures, delayed response and limited alarming where facility networking is unavailable.

9 Motor control center tests

9.22 Factory tests

Add new clause

9.22.1

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

Justification

This requirement ensures completed assemblies and unit wiring are verified before shipment, reducing the risk of undetected wiring errors, functional defects, commissioning delays and site rework.

Add new clause

9.22.2

Functional testing of the completed motor control center 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) continuous thermal monitoring system, if applicable;
- i) auxiliary equipment (e.g. interposing relay panel, mimic panel) provided with the motor control center as part of the system design.

Justification

This requirement ensures a standardized minimum functional test scope before shipment, reducing the risk of undetected defects in unit operation, interlocks, controls, protection, communications, auxiliary systems and mechanical functions that are not fully covered by the parent standard.

TABLES

Add new Table 46

Table 46
Rating for motor space heaters

(Clause 8.2.11.22)

Motor horsepower	Space heater rating (W)
0.5 – 5	45
7.5 – 20	60
25 – 50	120
60 – 100	240
125 – 250	350

Justification

This table provides additional information for Clause 8.2.11.19.

In Annex C heading, add title

Annex C (Normative)

Normative references

Add items 31 to 38 to table

Item	United States	Canada	Mexico
31	46 CFR 111, Title 46 – Shipping, Chapter I - Department of Coast Guard, Subchapter J - Electrical Engineering, Part 111 - Electrical Systems - General Requirements	NA	NA
32	ABS MODU, Publication Number 6 Part 4, Rules for Building and Classing Mobile Offshore Drilling Units - Part 4 Machinery and Systems	NA	NA
33	ASCE/SEI 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures	ASCE/SEI 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures	ASCE/SEI 7-16, Minimum Design Loads and Associated Criteria for Buildings and Other Structures
34	IEC 61850 (all parts), Communication networks and systems for power utility automation	IEC 61850 (all parts), Communication networks and systems for power utility automation	IEC 61850 (all parts), Communication networks and systems for power utility automation
35	IEEE C37.20.7:2017, Guide for Testing Metal-Enclosed Switchgear Rated Up to 52 kV for Internal Arcing Faults	IEEE C37.20.7 - 2017, Guide for Testing Metal-Enclosed Switchgear Rated Up to 52 kV for Internal Arcing Faults	IEEE C37.20.7 - 2017, Guide for Testing Metal-Enclosed Switchgear Rated Up to 52 kV for Internal Arcing Faults
36	NEMA ICS 5, Industrial Control and Systems: Control-Circuit and Pilot Devices	NEMA ICS 5, Industrial Control and Systems: Control-Circuit and Pilot Devices	NEMA ICS 5, Industrial Control and Systems: Control-Circuit and Pilot Devices
37	UL 67, Panelboards	CSA C22.2 No. 29, Panelboards and Enclosed Panelboards	NMX-J-118-1-ANCE, Panelboards
38	UL 1436, Outlet Circuit Testers and Similar Indicating Devices	CSA-C22.2 No. 160, Voltage and Polarity Testers	UL 1436, Outlet Circuit Testers and Similar Indicating Devices

In Annex F heading, replace "Informative" with "Normative" and add title

Annex F (Normative)

Factory tests

F.1

Delete second paragraph ("As an alternative, ...")

Justification

Annex F is informative in UL 845 as opposed to normative as required for the procurement of a motor control center. AC withstand testing is required prior to shipping.

In Annex H heading, replace "Informative" with "Normative"

Annex H (Informative)

Application information

H.5 Service and storage conditions

H.5.2 Storage temperature

Replace last sentence with

If energizing assembly space heaters for temporary storage is specified, an easily accessible (temporary if required) connection point shall be provided for each shipping split.

Justification

This requirement ensures that temporary space heater connections are accessible during storage, reducing the risk of compromised packaging, inadequate preservation, moisture accumulation and equipment degradation before installation.

Add new clause

H.5.3

If energizing assembly space heaters for temporary storage is specified, the connection point shall be accessible without uncrating or unpacking the motor control center.

Justification

This requirement ensures that temporary space heater connections can be made without disturbing packaging, reducing the risk of compromised preservation, moisture accumulation, equipment degradation and storage-related damage before installation.

Add new clause

H.5.4

If energizing assembly space heaters for temporary storage is specified, the connection point shall be labelled as "TEMPORARY SPACE HEATER CONNECTION POINT" including the voltage and current requirements.

Justification

This requirement ensures that temporary space heater connection details are clearly identified, reducing the risk of incorrect connection, unsafe energization, inadequate preservation and storage-related equipment degradation.

Add Bibliography

Bibliography

The following documents are informatively cited in the text of this specification, the PDS (IOGP S-732D) or the IRS (IOGP S-732L).

API Specification Q1, *Quality Management System Requirements for Organizations Providing Products for the Petroleum and Natural Gas Industry*

API Specification Q2, *Quality Management System Requirements for Service Supply Organizations for the Petroleum and Natural Gas Industries*

API Recommended Practice 14F, *Recommended Practice for Design, Installation, and Maintenance of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Division 1, and Division 2 Locations*

API Recommended Practice 14FZ, *Recommended Practice for Design, Installation, and Maintenance of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1, and Zone 2 Locations*

IEC 62402, *Obsolescence management*

IEC 62439-3, *Industrial communication networks – High availability automation networks – Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR)*

ISO/IEC Directives, Part 2, *Principles and rules for the structure and drafting of ISO and IEC documents*

ISO 9001:2015, *Quality management systems — Requirements*

ISO 10005, *Quality management — Guidelines for quality plans*

NFPA 70E, *Standard for Electrical Safety in the Workplace*



New Draft

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