International Association of Oil & Gas Producers

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November 2026
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Supplementary Specification to UL 347 for Medium-Voltage AC Contactors, Controllers, and Control Centers

NOTE This version (S-742J) of the specification document provides the justification statements for each technical requirement, but is otherwise identical in content to S-742.

Public Review Draft

JIP33
JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
1.1	November 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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These Terms and Conditions shall be governed by and construed in accordance with the laws of England and Wales. Disputes arising here from shall be exclusively subject to the jurisdiction of the courts of England and Wales.

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-742 specification documents is to define a minimum common set of requirements for the procurement of medium-voltage AC contactors, controllers, and control centers in accordance with UL 347, seventh edition, published November 2020, revised February 2025, UL Standard for Safety for Medium-Voltage AC Contactors, Controllers, and Control Centers, for application in the petroleum and natural gas industries.

The IOGP S-742 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 Specification

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

IOGP S-742: Supplementary Specification to UL 347 for Medium-Voltage AC Contactors, Controllers, and Control Centers

This specification defines technical requirements for the supply of the equipment and is written as an overlay to UL 347, following the UL 347 clause structure. Clauses from UL 347 not amended by this specification apply as written. Modifications to UL 347 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-742D: Procurement Data Sheet for Medium-Voltage AC Contactors, Controllers, and 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-742L: Information Requirements for Medium-Voltage AC Contactors, Controllers, and 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-742Q: Quality Requirements for Medium-Voltage AC Contactors, Controllers, and 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 347 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 347.

1 General

1.1 Scope

In first sentence, add after "contractor-based controllers"

(NEMA Class E2 only)

Justification

Although UL 347 permits the use of E1 controllers, unfused controllers with low interrupting capacity (E1) have been associated with electrical incidents. Therefore, their use in these assemblies has been excluded for safety reasons.

Add to clause

This specification defines minimum technical requirements for the purchase (including design features, fabrication quality, inspection, testing, shipment and documentation) of MV MCC equipment.

Justification

This requirement clearly defines the scope and boundaries of the specification overlay, supporting consistent application of the supplementary requirements and alignment with the agreed framing approach.

1.2 Normative references, component standards, and general requirements

1.2.1 General

Add to clause

The documents listed in Annex A are referred to in this specification, the PDS (IOGP S-742D) or the IRS (IOGP S-742L) in such a way that some or all of their content constitutes requirements of these specification documents.

Add new clause

1.3 Dependability of materials and parts

1.3.1

The MV MCC (excluding protection and control devices) shall have a design life of at least 25 years at rated current and under normal service conditions.

Justification

This requirement ensures that the MV MCC is designed for long-term operation over the specified service life, reducing the risk of premature equipment replacement, reduced reliability and increased lifecycle cost.

1.3.2

The MV MCC shall be capable of operating continuously under normal service conditions for at least five years without requiring de-energization of the complete assembly or lineup.

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Justification

This requirement ensures continuous operation of the complete MV MCC lineup between scheduled turnarounds, reducing the risk of unplanned de-energization, premature major maintenance and disruption to plant operation.

1.3.3

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

Justification

This requirement ensures that the electronic components are designed for reliable operation over the specified service life, reducing the risk of premature component replacement, obsolescence and loss of protection and control functionality.

Add new clause

1.4 Technology readiness and obsolescence

1.4.1

The MV MCC, excluding electronic devices, shall be supported for at least 25 years after delivery.

Justification

This requirement ensures long-term manufacturer support and component availability over the specified service life, reducing the risk of obsolete and unsupported equipment and premature replacement.

1.4.2

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

Justification

This requirement ensures proactive management of component obsolescence throughout the expected service life, reducing the risk of unavailable or unsupported parts and supporting long-term maintainability of the MV MCC.

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

Justification

This note provides recognized guidance for obsolescence management, supporting consistent application of the requirement and alignment with established industry practice.

1.4.3

Proposals shall indicate whether the MV MCC or any sub-component (individually denoted) has less than three years of proven operational service excluding devices that are required by the purchaser and not part of the manufacturer's standard offering.

Justification

This requirement ensures transparency of operational service history, reducing the risk of selecting unproven equipment or components and allowing the purchaser to identify and assess items without sufficient proven service before contract award.

2 Normal and Special Service Conditions

2.2 Special service conditions

Add new clause

2.2.4

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

Justification

This requirement ensures that seismic design requirements are defined for MV MCCs installed in locations where seismic withstand capability is required by project, site or regulatory conditions, supporting consistent specification and standardization across applicable installations.

Add new clause

2.2.5

If service conditions with environmental contamination are specified, the equipment shall be provided as detailed in Clauses 2.2.5.1 and 2.2.5.2.

Justification

This requirement ensures that MV MCCs installed in environmentally contaminated or corrosive service conditions are provided with suitable corrosion protection, reducing the risk of degradation, loss of reliability and premature equipment failure.

2.2.5.1

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

Justification

This requirement ensures that the equipment is protected against deterioration caused by corrosive gases through suitable coating and material selection, maintaining equipment reliability and reducing the risk of corrosion-related failure in corrosive service conditions.

2.2.5.2

Silver-plated copper shall not be used for current-carrying parts when the presence of corrosive gases is identified.

Justification

This requirement prevents the use of silver-plated copper current-carrying parts in environments where corrosive gases, such as H_2S, can degrade the silver plating, reducing the risk of corrosion-related deterioration, poor electrical contact, overheating and loss of equipment reliability.

Add new clause

2.2.6

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

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

Justification

This requirement ensures that MV MCC assemblies intended for floating offshore installations comply with applicable USCG and ABS requirements where specified, addressing marine application requirements that are not covered by the UL 347 and supporting safe, consistent use in offshore oil and gas installations.

Replace Clause 3 title with

3 Terms, Definitions, and Abbreviated Terms

For the purposes of this document, the terms, definitions and acronyms given in UL 347 and this clause apply.

Add new clause 3.0 before clause 3.1

3.0 Abbreviated terms

ACO	accredited certification organization
CBM	condition-based monitoring
CT	current transformer
FLC	full load current
HMI	human machine interface
IED	intelligent electronic device
LED	light-emitting diode
LV	low voltage
MV	medium voltage
MCC	motor control center
NRTL	nationally recognized testing laboratory
VT	voltage transformer

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3.1 General terms

Add new term

3.1.225 **arc-resistant accessibility Type 2**: An equipment with arc-resistant designs or features at the freely accessible exterior (front, back and sides) of the equipment only.

Add new term

3.1.226 **arc-resistant accessibility Type 2B**: An equipment with arc-resistant designs or features at the freely accessible exterior (front, back and sides) of the equipment only, including the additional requirements of IEEE Std C37.20.7.

NOTE: The equipment is arc-resistant even with the instrument or control compartment doors open.

Add new term

3.1.227 **arc-resistant equipment**: An equipment designed to withstand the effects of an internal arcing fault, as indicated by successfully meeting the test requirements of IEEE Std C37.20.7.

Add new term

3.1.228 **internal arcing fault**: An unintentional discharge of electrical energy in air or insulating gas within the confines of a switchgear enclosure.

Add new term

3.1.229 **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 term

3.1.230 **manufacturer**: An organization manufacturing, assembling and/or supplying the equipment or services, and/or contractor on the project.

NOTE: Also referred to as "vendor", "seller" or "supplier".

3.4 Switching devices

Replace term 3.4.104 with

3.4.104 **grounding (earthing) switch**:

Replace "[Vacant]" with definition

A permanently installed mechanical three-pole open-air switching device used to connect the load side of a de-energized MV controller power circuit to ground (earth) for maintenance purposes.

NOTE: Vacuum or any other sealed-type switching devices are not suitable to be used as grounding switches.

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3.202 Index of definitions

A

Add after "arcing time (of a pole or a fuse)"

arc-resistant accessibility Type 2 3.1.225

arc-resistant accessibility Type 2B 3.1.226

arc-resistant equipment 3.1.227

G

Add after "grounding kit"

grounding (earthing) switch 3.4.104

I

Add after "interlock (interlocking device)"

internal arcing fault 3.1.228

M

Add after "making capacity (of a switching device)"

manufacturer 3.1.230

T

Add after "transient recovery voltage (TRV)"

touch-safe 3.1.229

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4 Controller and Control Center Ratings and Characteristics

4.4 Rated continuous current and temperature rise

Add new clause

4.4.202 Bus bar requirements

4.4.202.1

All extendable (main) bus and non-extendable (vertical) bus shall be plated with the same plating material (tin-plated or silver-plated).

Justification

This requirement prevents accelerated degradation at bus bar joints caused by contact between dissimilar plating materials, reducing the risk of increased resistance, overheating, and loss of electrical reliability.

4.4.202.2

All bolted power bus connections shall be secured with corrosion-resistant steel hardware, including bolts, locking washers, and nuts or pressed threaded inserts.

Justification

This requirement ensures that bolted power bus connections use corrosion-resistant steel hardware to maintain joint integrity, reduce the risk of corrosion-related loosening or increased resistance, and prevent hot spots that could affect equipment reliability.

4.4.202.3

Extendable 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 extendable buses are designed to support future section connections without field drilling or additional bus support modifications, reducing outage duration and preventing safety and reliability risks associated with metal shavings inside the equipment.

4.4.202.4

A removable cover shall be provided on each end of the assembly for access to the predrilled extendable bus bars.

Justification

This requirement ensures that predrilled extendable bus bars are accessible from either end of the assembly, enabling future section installation in the field without unnecessary disassembly or modification of the MV MCC.

4.4.202.5

Tapered bus design for the extendable (main) bus or non-extendable (vertical) bus shall not be used.

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Justification

This requirement prevents the use of tapered bus designs that could restrict future section additions or reduce the short-circuit capacity of the MV MCC assembly, supporting consistent expandability and maintaining the required electrical performance.

4.4.202.6

Extendable (main) and non-extendable (vertical) current-carrying bus bars shall be tin-plated copper or silver-plated copper as specified.

Justification

This requirement ensures that current-carrying bus bars are made from plated copper, providing suitable conductivity, joint reliability, and long-term performance for MV MCC applications where aluminium bus bars are not considered acceptable.

4.4.202.7

The fastening means for power bus splices or connections shall employ provisions to negate the effect of temperature cycling and bus material cold flow or creep.

Justification

This requirement prevents loss of contact pressure at power bus splices and connections caused by temperature cycling, cold flow or creep of bus materials, reducing the risk of increased resistance, hot spots, arc flash events and fire.

4.7 Rated duration of short-circuit (t_k)

4.7.2 Rated duration of short-circuit for extendable power bus

Add to clause

For close-coupled applications without a protective device or scheme between the MV switchgear main bus and the MV MCC extendable bus, the rated duration of short-circuit (t_k) for extendable power bus for the MV MCC assembly shall meet the short-time short-circuit duration of the MV switchgear main bus.

NOTE 1: The default value for the rated duration of short-circuit (t_k) for MV switchgear main bus is 2 seconds.

NOTE 2: MV MCCs close coupled to an MV switchgear whose sole purpose is to feed the MV MCC are excluded.

Justification

This requirement ensures that the rated short-circuit duration of the MV MCC extendable power bus is coordinated with the MV switchgear main bus in close-coupled applications where no protective device or scheme is provided between them, reducing the risk of equipment damage, fire, or explosion caused by insufficient short-circuit withstand capability.

4.8 Rated supply voltage of operating devices and of auxiliary and control circuits (U_a)

Add new clause

4.8.4

Contactors shall be capable of remaining closed during a system voltage sag or dip down to 65 % of the nominal voltage.

Justification

This requirement prevents nuisance tripping of contactors during temporary system voltage sags or dips, reducing the risk of unnecessary process interruption, equipment shutdown, and operational instability.

4.107 Coordination with medium-voltage fuses

Replace second paragraph with

The MV fuses shall be located on the supply side of the controller.

Justification

This replacement prevents increased electrical safety risk to personnel by ensuring that MV fuses are located on the supply side of the controller, providing appropriate current-limiting protection upstream of the controller and reducing exposure to fault energy during operation or maintenance.

The MV fuses shall have a short-circuit breaking capacity greater than the available current (symmetrical) under short-circuit conditions at their location.

Justification

This requirement ensures that MV fuses have sufficient short-circuit breaking capacity for the available symmetrical fault current at their installed location, reducing the risk of fuse failure, equipment damage, explosion, electrical fire, and personnel injury during downstream fault conditions.

4.201 Characteristics of Class E2 controllers

4.201.2

Add to clause

Power circuit fuses for motor protection shall be of the current-limiting type (Type R) designed for motor starting applications.

Justification

This requirement ensures that motor protection fuses are current-limiting Type R fuses suitable for motor starting applications, reducing available fault energy and the risk of arc flash, equipment damage, and unsafe fuse operation during motor starting and fault conditions.

5 Design and Construction

5.3 Provisions for protective grounding

5.3.203 Ground bus

Add to clause

5.3.203.1

The ground bus 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 the ground bus is designed to accommodate future section connections without field drilling or additional support modifications, reducing outage duration and preventing safety and reliability risks associated with metal shavings inside the equipment.

5.3.203.2

The ground bus shall be drilled at each end for a NEMA two-hole lug for field connections.

Justification

This requirement ensures that the ground bus is pre-drilled for NEMA two-hole lug field connections, supporting safe and standardized installation while avoiding field drilling, metal shaving contamination, and hole diameter control issues.

5.3.203.3

Removable cover plate(s) attached with bolts or screws shall be provided to allow connection of the ground bus to future sections.

Justification

This requirement ensures that the ground bus remains accessible for connection to future sections through removable bolted or screwed cover plates, supporting safe and efficient expansion of the MV MCC assembly without unnecessary disassembly or field modification.

5.3.203.4

Ground bus joints shall be through-bolted, i.e., hex nut, pressed threaded insert.

Justification

This requirement ensures that ground bus joints are through-bolted to provide reliable mechanical and electrical continuity, reducing the risk of loose connections, impaired fault-clearing capability, overheating, and fire.

5.3.203.5

The ground bus shall be 6.35 mm (1/4 in) by 50.8 mm (2 in) minimum in size.

Justification

This requirement ensures that the ground bus has sufficient minimum cross-section to provide a reliable mechanical connection and electrical fault-current path, supporting safe installation, consistent standardization, and effective fault clearing.

5.3.203.6

The ground bus shall be made of plated copper.

NOTE: Tin or silver plating is acceptable.

Justification

This requirement ensures that the ground bus is made of plated copper to prevent surface oxidation and maintain conductivity, reducing the need for field surface preparation and preventing conductive filings, particles, or dust from entering the assembly during future ground conductor connections.

5.3.203.7

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

Justification

This requirement ensures that the horizontal ground bus provides a uniform and continuous grounding path across the full length of the MCC, maintaining grounding system integrity and supporting effective fault-current continuity throughout the lineup.

5.3.203.8

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

Justification

This requirement ensures that the horizontal ground bus extends to the incoming line section and is provided with specified NEMA two-hole compression-type lugs, supporting compatible, robust termination of incoming ground conductors and reducing the risk of loosening, overheating, fire, or protection system misoperation caused by vibration or cable movement.

5.3.203.9

The ground bus shall include provisions to connect a portable safety grounding clamp device in each controller compartment.

Justification

This requirement ensures that each controller compartment provides a dedicated means to connect a portable safety grounding clamp, reducing the risk of personnel exposure to hazardous voltage from accidental contact with live or unintentionally energized parts during maintenance.

5.3.203.10

The ground bus shall be pre-drilled to accommodate the connection of the shield wire from the field cable termination in each controller compartment.

Justification

This requirement ensures that the ground bus is pre-drilled to accommodate shield wire connections from field cable terminations in each controller compartment, supporting safe and standardized installation while avoiding field drilling, metal shaving contamination, and hole diameter control issues.

5.3.203.11

The ground bus shall be supplied with NEMA two-hole lug copper compression-type lugs for field connections at each end.

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Justification

This requirement ensures that the ground bus is supplied with NEMA two-hole copper compression-type lugs at each end, supporting safe, standardized, and reliable field connections while avoiding field drilling, metal shaving contamination, and hole diameter control issues.

5.3.206 Grounding of instrument and control circuits

Add new clause

5.3.206.1

The CT short-circuiting terminal block shall be connected to the ground bus via one direct connection without intermediate terminations or splices.

Justification

This requirement ensures that the CT short-circuiting terminal block has a direct, uninterrupted connection to the ground bus, supporting standardized installation and reducing shock hazard during maintenance and troubleshooting activities.

Add new clause

5.3.206.2

The grounding wire insulation color for CT circuits shall be green or green with yellow stripe.

Justification

This requirement ensures that grounding wires for CT circuits are identified by a standardized insulation color, supporting clear recognition during installation, maintenance, and troubleshooting, and reducing the risk of wiring errors or shock hazard.

Add new clause

5.3.206.3

The grounding wires for CT circuits shall be marked "CT Ground" at the short-circuiting terminal block and at the ground bus termination point.

Justification

This requirement ensures that CT circuit grounding wires are clearly identified at both the short-circuiting terminal block and the ground bus termination point, supporting standardized wiring practices and reducing the risk of misidentification, wiring errors, or shock hazard during maintenance and troubleshooting.

Add new clause

5.3.209

Hinged doors and panels with powered devices shall be bonded to the enclosure with a flexible copper conductor connected between hinged doors or panels and the MV MCC ground bar or metallic structure.

Justification

This requirement prevents reliance on hinge or metal-to-metal contact as the bonding path for powered hinged doors and panels, reducing the risk of ineffective grounding and electric shock to personnel.

5.4 Auxiliary and control equipment

Add new clause

5.4.1

Plug-in type relays shall be provided with retaining clips.

Justification

This requirement prevents plug-in type relays from loosening due to ambient vibration, supporting secure relay retention and reducing the risk of loss of control circuit functionality or reduced equipment reliability.

5.10 Markings

5.10.203 Additional markings for control centers

Add new clause

5.10.203.1

The MV MCC shall be listed or certified by an NRTL for the United States or ACO for Canada.

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

Justification

This requirement ensures that the MV MCC is listed or certified by an applicable NRTL or ACO, providing independent confirmation that the equipment satisfies the relevant certification requirements and supporting acceptance by local electrical inspectors and authorities having jurisdiction.

Add new clause

5.10.203.2

An overall assembly nameplate shall be mounted on the MV MCC main incoming unit with the following information:

a) purchase order number;

b) MV MCC designation (tag number);

c) month and year of manufacture.

Justification

This requirement ensures that the MV MCC assembly is clearly identified by key project and manufacturing information, supporting correct installation, maintenance, future extensions or modifications, and effective manufacturer support throughout the equipment lifecycle.

Add new clause

5.10.203.3

MV MCC individual controller rear doors or covers shall be provided with externally mounted nameplates to identify the equipment tag number.

Justification

This requirement ensures that individual controller rear doors or covers are clearly identified with externally mounted equipment tag number nameplates, supporting correct equipment identification during installation, operation, and maintenance, and reducing the risk of personnel safety incidents caused by misidentification.

Add new clause

5.10.203.4

Each controller shall have a nameplate on the front door with the following information:

a) equipment tag number;

b) equipment name;

c) equipment HP rating, kW/kVA rating or FLC.

Justification

This requirement ensures that the controller is clearly identified with essential equipment and rating information, supporting correct installation, operation, maintenance, troubleshooting, and manufacturer support throughout the equipment lifecycle.

Add new clause

5.10.203.5

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

Justification

This requirement ensures that door-mounted devices are clearly identified by separate nameplates, supporting standardized equipment identification and reducing the risk of incorrect operation, maintenance errors and personnel safety incidents caused by misidentification.

Add new clause

5.10.203.6

Separate device markers/labels shall be provided to identify each component (e.g. terminals, relays, switches, wiring and other devices) within each unit in accordance with project drawings/diagrams.

Justification

This requirement ensures that individual components within each controller compartment are clearly identified by separate device markers, supporting standardized equipment identification and reducing the risk of maintenance errors, incorrect intervention and personnel safety incidents caused by misidentification.

Add new clause

5.10.203.7

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

Justification

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

Add new clause

5.10.203.8

Nameplates on the exterior of the controller compartment shall be mounted with stainless steel fasteners.

Justification

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

Add new clause

5.10.203.9

Controller compartment 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 controller compartment identification, reducing the risk of misidentification, incorrect operation, maintenance errors and personnel safety incidents.

Add new clause

5.10.203.10

Controller compartment nameplate characters shall be at least 4.8 mm (0.1875 in) high.

Justification

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

Add new clause

5.10.203.11

If a key-type interlock system is utilized, nameplates containing operational instructions shall be affixed on the front of the MV MCC near the point of operation.

Justification

This requirement ensures that clear operating instructions are readily available at the point of use, reducing the risk of improper key interlock operation, unsafe switching and personnel safety incidents.

Add new clause

5.10.203.12

Interior warning labels and device nameplates shall be located such that they are not obscured by wiring or other components.

Justification

This requirement ensures that warning labels and device nameplates remain clearly visible to maintenance personnel, reducing the risk of missed hazard information, device misidentification and maintenance errors.

5.11 Interlocks

5.11.201 Isolating means interlocks

In first sentence, add after "mechanical"

and electrical

Justification

This requirement ensures redundant mechanical and electrical interlocking of the isolating means, reducing the risk of operation under load, severe equipment damage, arc-related hazards and personnel injury.

Add to second sentence

for the mechanical interlock

Justification

This requirement ensures redundant mechanical and electrical interlocking of the isolating means, reducing the risk of operation under load, severe equipment damage, arc-related hazards and personnel injury.

5.12 Position indication

5.12.201 Isolating means – position indication

Replace first sentence of second paragraph with

The isolation gap or a mechanically operated indicator shall be visible without opening the MV compartment door of the controller (e.g., through a viewing pane).

Justification

This requirement ensures that the isolation status can be verified without opening the MV compartment door, reducing personnel exposure to energized MV components and the risk of injury during LOTO activities.

5.14 Spacings

5.14.201 General

Add to first paragraph

If the MV MCC is operating at a nominal voltage greater than 5 kV, the routing of controller internal unshielded power cabling shall include mitigations to prevent partial discharge between the phase conductors and ground.

Justification

This requirement ensures appropriate mitigation of partial discharge for unshielded power cabling above 5 kV, reducing the risk of insulation degradation, cable failure and ground faults caused by insufficient phase-to-phase or phase-to-ground separation.

NOTE: Mitigations may include ensuring a minimum air gap or the use of additional insulating materials.

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Justification

This note provides examples of partial discharge mitigation methods for unshielded power cabling above 5 kV, supporting consistent application of the requirement and reducing the risk of insulation degradation due to inadequate conductor separation or insulation.

5.102 Enclosures

5.102.202 General Requirements

Add new clause

5.102.202.1

MV MCC assembly shall consist of steel structures as detailed in Clauses 5.102.202.1.1 through 5.102.202.1.3.

Justification

This requirement ensures a defined and standardized steel enclosure construction for the MV MCC assembly, supporting safe operation and maintenance and reducing the risk of unsuitable or inconsistent enclosure design.

5.102.202.1.1

The MV MCC shall be metal-enclosed.

Justification

This requirement ensures a defined metal-enclosed construction for the MV MCC, supporting safe operation and maintenance and reducing the risk of personnel exposure to energized components.

5.102.202.1.2

The MV MCC shall be comprised of free-standing vertical sections.

Justification

This requirement ensures a defined and standardized free-standing assembly configuration for the MV MCC, supporting safe installation, operation, and maintenance while reducing the risk of unsuitable or inconsistent enclosure arrangements.

5.102.202.1.3

The MV MCC assembly shall be dead front to allow safe operation of the units.

Justification

This requirement ensures a dead-front MV MCC construction that supports safe operation and maintenance, reducing the risk of personnel exposure to energized components.

Add new clause

5.102.202.2

Each controller shall be in a separate compartment.

Justification

This requirement ensures segregation between individual controller compartments, reducing the risk of personnel exposure to energized MV circuits and supporting safer troubleshooting or maintenance while adjacent controllers remain in service.

Add new clause

5.102.202.3

Motor controllers shall have dedicated LV control compartments as detailed in Clauses 5.102.202.3.1 through 5.102.202.3.4.

Justification

This requirement ensures segregation of LV control components from MV circuits, reducing the risk of personnel exposure to energized MV components during operation, inspection or maintenance activities.

5.102.202.3.1

LV compartments shall have separate doors.

Justification

This requirement ensures physical separation of the LV control compartment from adjacent equipment compartments, reducing the risk of personnel exposure to energized components during operation or maintenance activities.

5.102.202.3.2

LV compartments shall be externally accessible.

Justification

This requirement ensures safe external access to LV control components, reducing the risk of personnel exposure to energized MV circuits during operation, inspection, or maintenance activities.

5.102.202.3.3

LV compartments shall not contain MV components.

Justification

This requirement ensures segregation of LV control components from MV equipment, reducing the risk of personnel exposure to energized MV components during operation or maintenance activities.

5.102.202.3.4

LV compartments shall contain all control and protection components.

Justification

This requirement ensures that control and protection components are located within the dedicated LV compartment, reducing the risk of personnel exposure to energized MV components during operation, inspection, or maintenance activities.

Public Review Draft

Add new clause

5.102.202.4

Enclosures shall allow for mounting pad level variation of +/-3.175 mm ($^1/_8$ in) within 900 mm (3 ft) without affecting alignment or operation of removable elements, doors or mechanical interlocks.

Justification

This requirement ensures that the MV MCC enclosure can accommodate typical mounting pad variations without impairing equipment alignment or operation, reducing the risk of door, removable element, or mechanical interlock malfunction.

Add new clause

5.102.202.5

Controllers shall be furnished at a maximum of two-high per vertical section.

Justification

This requirement ensures that controller arrangement limits the need for personnel to work at height during operation or maintenance activities, reducing the risk of falls and associated personnel injury.

Add new clause

5.102.202.6

Hinged doors that are located on the front of the assembly and exceed a height of 1 143 mm (45 in) or a width of 610 mm (24 in) shall be provided with door keepers or positioners.

Justification

This requirement ensures that large hinged doors remain secured in a controlled position during installation, inspection, or maintenance activities, reducing the risk of accidental door movement and personnel injury.

Add new clause

5.102.202.7

Two-high vertical sections shall be provided with barriers to separate wiring between the controllers as detailed in Clauses 5.102.202.7.1 and 5.102.202.7.2.

Justification

This requirement ensures segregation of wiring between controllers within the same vertical section, supporting maintenance or troubleshooting of one controller while the adjacent controller remains energized and reducing the risk of personnel exposure to energized circuits.

5.102.202.7.1

Each vertical section shall have dedicated and enclosed raceways for outgoing power cables.

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Justification

This requirement ensures segregation of outgoing power cables between controllers within the same vertical section, supporting maintenance or troubleshooting of one controller while the adjacent controller remains energized and reducing the risk of personnel exposure to energized circuits.

5.102.202.7.2

Two-high vertical sections shall have separate raceways or compartmentalization for load and field control cables for each controller.

Justification

This requirement ensures segregation of load and field control cables between controllers within the same vertical section, supporting maintenance or troubleshooting of one controller while the adjacent controller remains energized and reducing the risk of personnel exposure to energized circuits.

Add new clause

5.102.202.8

If specified, cable terminations for the incoming section shall be provided as detailed in Clauses 5.102.202.8.1 through 5.102.202.8.5.

Justification

This requirement ensures that the incoming cable termination arrangement is clearly defined where applicable, reducing the risk of inconsistent feeder interfaces, installation issues, or incomplete supplier scope.

5.102.202.8.1

Cable terminations shall be provided with supports for the incoming cables to prevent mechanical stress on the busbars.

Justification

This requirement ensures adequate support of incoming MV cables and their terminations, reducing the risk of mechanical stress, termination failure, arc-flash events, or associated equipment damage.

5.102.202.8.2

Cable terminations shall be provided with NEMA two-hole pattern at the cable termination point.

Justification

This requirement ensures a robust and standardized incoming cable termination arrangement, reducing the risk of loose electrical connections caused by vibration or cable movement, electrical fire, or protection system misoperation.

5.102.202.8.3

Cable terminations shall be provided with space to accommodate shielded cable terminations and formed insulating boots.

Justification

This requirement ensures sufficient space for proper installation of shielded cable terminations and insulating boots, reducing the risk of excessive electrical stress, termination failure, arc-flash events, or short circuits.

5.102.202.8.4

Cable terminations shall be provided with a grounding ball stud and a reusable, removable insulating cover on each phase busbar and the ground bus.

Justification

This requirement ensures provision of a safe and short-circuit-rated grounding facility for maintenance activities, reducing the risk of accidental contact with energized parts and personnel injury.

5.102.202.8.5

Grounding ball studs shall meet the requirements of ASTM F855.

Justification

This requirement ensures that grounding provisions have adequate short-circuit withstand capability during fault conditions, reducing the risk of grounding equipment failure and personnel exposure during maintenance activities.

NOTE: The selection guidance provided in ASTM F855 accounts for fault current level, duration, and dc offset.

Justification

This note provides guidance for selecting grounding equipment based on the applicable fault current magnitude, duration, and dc offset, supporting correct application of the ASTM F855 requirements.

Add new clause

5.102.202.9

If bus duct or cable bus is specified for the incoming connection, the components required for the MV MCC to accept the bus duct or cable bus shall be provided.

Justification

This requirement ensures that the necessary bus duct or cable bus interface components are incorporated into the MV MCC at the factory, reducing the risk of field modification, installation difficulties, rework, or schedule delays.

NOTE: Required components include, but are not limited to, interface flange, bus extensions, supports, hardware, gaskets.

Justification

This note identifies the typical components required to accommodate bus duct or cable bus connections, supporting complete factory provision of the incoming interface and reducing the risk of missing hardware or field modification.

Add new clause

5.102.202.10

Controllers shall have sufficient space for the separation of MV feeder and LV field control cables.

Justification

This requirement ensures adequate segregation between MV feeder cables and LV field control cables, reducing the risk of personnel exposure to MV hazards during installation or maintenance activities.

Add new clause

5.102.202.11

An enclosed continuous horizontal metal wireway for control and communications wiring shall be provided in each section along the entire MV MCC.

Justification

This requirement ensures segregated and continuous routing of LV control and communication wiring throughout the MV MCC, reducing the risk of personnel exposure to MV hazards during maintenance or troubleshooting activities.

Add new clause

5.102.202.12

Barriers shall be provided to separate the extendable power bus from other compartments.

Justification

This requirement ensures segregation of the extendable power bus from other compartments, reducing the risk of personnel exposure to energized components and electric shock during operation or maintenance activities.

5.102.203 Control centers

Add new clause

5.102.203.1

The MV MCC shall be designed to allow the safe installation of additional controllers, i.e., contactor, control and auxiliary cabling, into a factory-prepared space for future controller(s) (see Clause 5.212.3) while the MV MCC is energized and in operation.

Justification

This requirement ensures that future controller spaces can be equipped while the MV MCC remains energized and in operation, reducing the need for main bus de-energization, grounding, or turnaround-related outages when adding new controllers.

Add new clause

5.102.203.2

The MV MCC shall be extendable on at least one end.

Justification

This requirement ensures that the MV MCC can be extended without field modification of the enclosure or main bus, reducing the risk of conductive debris, dielectric breakdown, arc faults, or installation rework.

5.102.209 Barriers

Add to clause

With the isolating switch open, any MV parts within the controller compartment that remain energized shall be protected from incidental contact as determined by the rod entry test in Clause 6.207.

Justification

This requirement ensures that energized MV parts remaining within the controller compartment are protected from incidental contact when the isolating switch is open, reducing the risk of electric shock or personnel injury during maintenance or troubleshooting activities.

5.102.210 Outdoor enclosure considerations

Add new clause

5.102.210.1

Outdoor MV MCC exterior door gaskets shall be held in metal retainers, channels, or other means to prevent the gasket from being misaligned or dislodged during operation.

Justification

This requirement ensures that outdoor enclosure gaskets remain correctly positioned and secured during operation, reducing the risk of water or contaminant ingress and associated loss of equipment reliability.

Add new clause

5.102.210.2

Roofs of outdoor MV MCCs shall be sloped to permit drainage away from the front of the assembly.

Justification

This requirement ensures effective drainage of water away from the front of the outdoor MV MCC, reducing the risk of water ingress, contamination, or degraded equipment reliability.

Add new clause

5.102.210.3

External joints of outdoor MV MCCs shall be seal welded for the full length of the joint or bolted with gaskets.

Justification

This requirement ensures that external joints maintain an effective weather-tight seal, reducing the risk of water or contaminant ingress and associated degradation of equipment reliability.

Add new clause

5.102.210.4

Bolted and gasketed external joints of outdoor MV MCCs shall be covered with a metal cap to prevent the entry of dust, rain and snow.

Justification

This requirement ensures that bolted and gasketed external joints are protected from environmental exposure, reducing the risk of dust, rain, or snow ingress and associated degradation of equipment reliability.

Add new clause

5.102.210.5

An outdoor MV MCC assembly of three or fewer vertical sections shall have at least one 120-volt GFCI-protected receptacle located inside an exterior door.

Justification

This requirement ensures a readily available GFCI-protected power source for outdoor operation and maintenance activities, reducing the risk of electric shock and the need for temporary power arrangements.

Add new clause

5.102.210.6

An outdoor assembly of four or more vertical sections shall have at least one 120-volt GFCI-protected receptacle located on each end and inside an exterior door.

Justification

This requirement ensures that GFCI-protected power is readily available at both ends of larger outdoor MV MCC assemblies for operation and maintenance activities, reducing the risk of electric shock and the need for temporary power arrangements.

Add new clause

5.102.210.7

In an outdoor assembly of four or more vertical sections, the distance between the 120-volt GFCI-protected receptacles shall be no more than 7.5 m (25 ft).

Justification

This requirement ensures that GFCI-protected receptacles are distributed within a practical distance for outdoor operation and maintenance activities, reducing the need for excessive extension leads and associated electrical or trip hazards.

Add new clause

5.102.210.8

Outdoor MV MCC enclosures shall have one LED-type light fixture per vertical section located inside the exterior door.

Justification

This requirement ensures that adequate illumination is provided within each outdoor MV MCC section, supporting safe operation and maintenance activities and reducing the risk of errors or personnel injury due to poor visibility.

Add new clause

5.102.210.9

For outdoor MV MCC applications, handles, latches, hinges and fastening hardware shall be made of corrosion-resistant material.

Justification

This requirement ensures that external hardware maintains reliable operation in outdoor environments, reducing the risk of corrosion, seizure, degraded functionality, or maintenance difficulties.

Add new clause

5.103 Arc-resistant enclosures

5.103.1

Arc-resistant enclosures shall be tested in accordance with the requirements of IEEE Std C37.20.7-2017, for not less than 0.5 second.

Justification

This requirement ensures verified arc-resistant performance of the enclosure, reducing the risk of personnel injury during operation or maintenance activities involving internal arc-fault conditions.

5.103.2

Arc-resistant enclosures shall be tested at the rated maximum voltage of the equipment.

Justification

This requirement ensures that arc-resistant performance is verified at the maximum rated equipment voltage, reducing the risk of inadequate arc-fault containment and personnel injury during operation or maintenance activities.

5.103.3

The manufacturer shall identify the methodology defined in IEEE Std C37.20.7-2017 that is utilized to achieve the arc resistance certification of the MCC (full withstand capability without protective device, self-extinguishing, current-limiting fuses or duration-limiting device).

Justification

This requirement ensures that the basis of arc-resistant certification is clearly identified, supporting correct application of the arc-resistant design and reducing the risk of personnel exposure due to inappropriate or misunderstood arc-fault mitigation methods.

5.103.4

If current-limiting or duration-limiting devices are used to achieve the arc resistance certification, the details of these devices shall be provided with the proposal.

Justification

This requirement ensures that the arc-resistant performance basis and associated limiting devices are clearly defined at the proposal stage, reducing the risk of incorrect protective device application, inadequate arc-fault mitigation, or personnel exposure.

5.103.5

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

Justification

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

5.103.6

If a plenum with an outdoor exhaust is required, it shall be provided with a wall penetration kit and exterior exhaust outlet equipped with environmental-type seals.

Justification

This requirement ensures that the arc-resistant plenum exhaust interface is properly sealed against the outdoor environment, reducing the risk of driven rain, insects, or uncontrolled air ingress affecting equipment reliability and safe operation.

5.103.7

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

Justification

This requirement ensures that the plenum has adequate mechanical strength to withstand the forces generated by an internal arc fault, reducing the risk of plenum failure, loss of arc containment, or personnel injury.

5.103.8

Minimum room dimension requirements and other guidelines (e.g., for arc vents, plenum or arc duct) required for the performance of the MV MCC arc-resistant features shall be provided to ensure the building integrity and personnel safety.

Justification

This requirement ensures that installation constraints necessary for arc-resistant performance are clearly defined, reducing the risk of compromised building integrity, ineffective arc-fault mitigation, or personnel injury.

5.103.9

Front doors (main and instrument compartments) of the MV MCC shall be secured with latches, i.e., cam or twist-type with less than one rotational turn.

Public Review Draft

Justification

This requirement ensures that front doors can be securely fastened while allowing practical access for operation and maintenance, reducing the risk of improper door securement, personnel exposure to energized parts, or compromised arc-resistant performance.

NOTE: The use of tie-down bolts to secure front doors will not meet this requirement.

Justification

This note clarifies that tie-down bolts are not considered an acceptable means of securing the front doors, supporting consistent application of the requirement and maintaining safe access and arc-resistant performance.

5.103.10

Special tools shall not be required to latch the controller or instrument doors.

Justification

This requirement ensures that controller and instrument doors can be operated using standard means without special tools, supporting safe and efficient access during operation and maintenance and reducing the risk of improper door handling or personnel exposure to energized parts.

5.103.11

The provisions for penetrating the LV compartment for field wiring within the controller shall not compromise the arc-resistant integrity of the compartment.

Justification

This requirement ensures that field wiring penetrations do not compromise the arc-resistant integrity of the LV compartment, reducing the risk of arc-fault exposure, loss of containment, or personnel injury.

5.103.12

The arc-resistant design shall have provisions for the future expansion of the MV MCC.

Justification

This requirement ensures that future MV MCC expansion can be accommodated without compromising the arc-resistant design, reducing the risk of loss of arc-fault containment, unsafe field modification, or personnel injury.

5.201 Latched controllers

5.201.3 Stored-energy electrical release

Replace clause with

An electrical release provided on latched controllers shall be powered from an external control power supply.

Justification

This requirement ensures reliable operation of the electrical release during short-circuit or brownout conditions, reducing the risk of contactor misoperation or failure due to loss of internal control power.

5.202 Power circuit isolating means

5.202.3 Operation of isolating means

Add new list item d)

d) isolated from the line connectors with a mechanically-driven isolating shutter, leaving no exposure to medium voltage.

Justification

This requirement ensures that energized line connectors are mechanically isolated from the controller compartment, reducing the risk of incidental contact with MV parts and personnel injury during maintenance or troubleshooting activities.

Add new clause

5.202.7

Isolating switches shall be constructed to ground the load side of the switch in the open position.

Justification

This requirement ensures that the load side of the isolating switch is grounded in the open position, reducing the risk of personnel exposure to stray or backfed voltages during fuse replacement, maintenance, or troubleshooting activities.

5.205 Internal wiring

5.205.1 Conductors

5.205.1.1

Replace second sentence with

Conductors shall have a temperature rating no less than 90 °C (194 °F) unless shown suitable with corresponding temperature rise test data.

Justification

This requirement ensures that conductor insulation is suitable for the applicable operating temperature, reducing the risk of insulation degradation, premature wiring failure, or reduced reliability of the MV MCC.

Add new clause

5.205.1.4

Flame-retardant, 600 V insulated stranded tinned copper wire shall be used for internal control wiring between components of MV MCC assemblies and terminals for connection to external controls, metering or instrumentation.

Justification

This requirement ensures standardized internal control wiring construction and material selection, supporting alignment with IEEE Std C37.20.1 and IEEE Std C37.20.2 and reducing the risk of inconsistent wiring practices or reduced control circuit reliability.

Public Review Draft

NOTE: Preferred wire is type SIS as listed in NFPA 70 (NEC) or an equivalent such as XHHW, RFHH-2, RFHH-3.

Justification

This note identifies the preferred control wire types that meet the specified insulation and construction requirements, supporting consistent wire selection and standardization.

Add new clause

5.205.1.5

Minimum conductor sizes shall be as detailed in Clauses 5.205.1.5.1 through 5.205.1.5.3.

Justification

This requirement ensures standardized minimum conductor sizing for internal control and current transformer circuits, reducing the risk of insufficient mechanical durability, overheating during fault conditions, or equipment damage.

5.205.1.5.1

Minimum conductor sizes for CT secondary wiring shall be No.12 AWG.

Justification

This requirement ensures adequate conductor sizing for CT secondary circuits, reducing the risk of overheating or wiring damage during prolonged fault current conditions and supporting standardized design.

5.205.1.5.2

Minimum conductor sizes for control wiring shall be No. 14 AWG.

Justification

This requirement ensures standardized minimum conductor sizing for control circuits, reducing the risk of insufficient mechanical durability, wiring damage, or reduced control circuit reliability.

5.205.1.5.3

Minimum conductor sizes for analog and digital signals shall be No. 16 AWG shielded.

Justification

This requirement ensures reliable transmission of analog and digital signals used for remote operation, diagnostics, alarms, and status monitoring, reducing the risk of signal interference, loss of communication, or incorrect information being transmitted to control systems.

Add new clause

5.205.1.6

Wiring that crosses a door or panel hinge shall be provided as detailed in Clauses 5.205.1.6.1 through 5.205.1.6.7.

Justification

This requirement ensures that wiring exposed to repeated flexing across doors or panel hinges is suitably constructed and protected, reducing the risk of conductor damage, insulation failure, or loss of control circuit reliability.

5.205.1.6.1

Wiring shall be stranded single conductor.

Justification

This requirement ensures that wiring subject to repeated flexing at doors or panel hinges has suitable flexibility and durability, reducing the risk of conductor fatigue, breakage, or loss of control circuit reliability.

5.205.1.6.2

Wiring shall withstand repeated door movement without sustaining damage to wire strands or insulation.

Justification

This requirement ensures that wiring exposed to repeated door movement maintains its mechanical and electrical integrity, reducing the risk of conductor strand damage, insulation failure, or loss of control circuit reliability.

5.205.1.6.3

A strain relieving loop shall be formed across the hinge and secured to the equipment at both ends.

Justification

This requirement ensures that wiring crossing hinges is strain-relieved and securely supported, reducing the risk of mechanical stress, insulation damage, conductor fatigue, or loss of control circuit reliability during repeated door movement.

5.205.1.6.4

The wiring installation shall not prevent the door from opening less than 90 degrees.

Justification

This requirement ensures that wiring across hinged doors is arranged to allow adequate door opening, reducing the risk of restricted access, excessive wire strain, or damage during operation and maintenance activities.

5.205.1.6.5

The wire loop shall be protected between the securements to prevent damages to the wire insulation as the door is moved.

Justification

This requirement ensures that wiring loops across hinged doors are protected during repeated movement, reducing the risk of insulation damage, conductor deterioration, or loss of control circuit reliability.

Public Review Draft

5.205.1.6.6

No sharp edges or objects shall be allowed in the path swept by the wire loop as the door is operated.

Justification

This requirement ensures that wiring loops are protected from sharp edges or objects during door movement, reducing the risk of insulation damage, conductor failure, or loss of control circuit reliability.

5.205.1.6.7

If the wire is No. 14 AWG or larger, the wire shall be no less flexible than Class C or D stranding.

Justification

This requirement ensures wiring subject to repeated flexing has sufficient conductor flexibility, reducing the risk of strand fatigue, conductor breakage, or loss of control circuit reliability.

Add new clause

5.205.1.7

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

Justification

This requirement ensures continuous internal wiring between termination points, reducing the risk of connection failures, troubleshooting difficulties, maintenance errors, or reduced control circuit reliability.

Add new clause

5.205.1.8

If MV MCC data communication is specified, the cabling and connection to the devices intended to be monitored and controlled shall be provided as detailed in Clauses 5.205.1.8.1 through 5.205.1.8.3.

Justification

This requirement ensures that the data communication infrastructure is fully integrated with the monitored and controlled devices, improving operational safety and enabling remote condition monitoring while reducing the need to open equipment compartments for maintenance or troubleshooting.

5.205.1.8.1

Data communication cabling and connection shall be compatible with the specified communication protocol or combination of protocols.

Justification

This requirement ensures that data communication cabling and connections are compatible with the specified communication protocols, reducing the risk of communication failure, loss of monitoring or control functionality, or inconsistent system integration.

5.205.1.8.2

Data communication cabling and connection shall have a mechanical means (e.g., screw-type connectors, RJ-45 connector) to prevent unintended separation of the communication network cable connections.

Justification

This requirement ensures secure and reliable data communication connections, reducing the risk of unintended disconnection, loss of monitoring or control functionality, or degraded communication network reliability.

5.205.1.8.3

Data communication cabling shall be shielded type to minimize interference from electromagnetic interference or radio frequency interference within the MV MCC assembly.

Justification

This requirement ensures communication signal integrity within the MV MCC assembly, reducing the risk of electromagnetic or radio-frequency interference affecting remote control, diagnostics, alarms, or status information provided to DCS and other process control systems.

5.205.2 Support for internal wiring

Add to clause

Adhesive-type supports shall not be permitted.

Justification

This requirement prevents the use of supports that may detach over time, reducing the risk of wiring displacement, maintenance or troubleshooting delays, rework, and increased lifecycle cost.

Wire and cable supports shall be permanently attached to the enclosure or assembly (e.g., screws or fasteners).

Justification

This requirement ensures that wire and cable supports remain securely attached throughout the equipment service life, reducing the risk of wiring displacement, maintenance or troubleshooting delays, rework, and increased lifecycle cost.

5.206 Terminals and connections

5.206.2 Wiring terminals

5.206.2.2

Replace clause (including list items) with

Terminal points for field connection of MV incoming and outgoing conductors shall consist of bus bars provided with a NEMA two-hole pattern as a minimum.

Justification

This requirement ensures robust and standardized MV cable termination points, reducing the risk of lug rotation or loosening, localized overheating, connection failure, or reduced long-term reliability.

Public Review Draft

Add new clause

5.206.4 Internal Wiring

5.206.4.1

Exposed energized terminals of LV components (e.g., relays, terminal blocks, fuse holders) having a line to ground voltage of greater than 50 V shall be provided as touch-safe or covered by an insulating barrier to prevent incidental contact.

Justification

This requirement ensures energized LV terminals above 50 V are protected from incidental contact, reducing the risk of electric shock or personnel injury during troubleshooting or maintenance activities.

5.206.4.2

Wiring for CTs secondary leads shall be terminated with insulated, compression, ring-type lugs.

Justification

This requirement ensures secure and standardized CT secondary terminations, reducing the risk of inadvertent open-circuit conditions, electric shock, CT failure, or personnel injury during maintenance and troubleshooting activities.

5.206.4.3

Control wiring shall be terminated using insulated compression lugs on screw-type terminals.

NOTE: Spade, fork, ring, or bootlace lugs are the typical lug types used for the terminals and connectors on the components.

Justification

This requirement ensures secure and standardized control wiring terminations, reducing the risk of inadvertent disconnection due to vibration, maintenance, or troubleshooting activities and supporting reliable control circuit performance.

5.206.4.4

Control wiring terminated on intelligent electronic devices (IEDs) (e.g., microprocessor-based multifunction protective relays and meters) that do not have screw-type terminals shall be terminated with crimp-type ferrules or pin lugs.

Justification

This requirement ensures standardized and reliable control wiring terminations for IEDs without screw-type terminals, reducing the risk of poor connections, inadvertent disconnection, or reduced control and protection circuit reliability.

5.206.4.5

DC control power circuits leaving the MV MCC for any external location (e.g., motor start/stop circuits) shall be individually fused.

Public Review Draft

Justification

This requirement ensures that external DC control circuits are individually isolated from the MV MCC control power system, reducing the risk of external circuit faults compromising the reliability or operation of the complete lineup.

5.206.4.6

Terminal blocks shall be provided for all external connections to the MV MCC.

Justification

This requirement ensures that external connections are terminated at dedicated terminal blocks, supporting safe repair and troubleshooting activities and reducing the risk of wiring errors or inadvertent contact with energized components.

5.206.4.7

The MV MCC internal wiring shall be connected to only one side of the field wiring terminal blocks.

Justification

This requirement ensures clear separation between internal and field wiring at terminal blocks, supporting safe and effective repair and troubleshooting activities and reducing the risk of wiring errors or unintended disturbance of internal circuits.

5.206.4.8

A maximum of two wires shall be terminated on an individual terminal.

Justification

This requirement ensures controlled and standardized terminal loading, reducing the risk of loose connections, wiring errors, or difficulties during repair and troubleshooting activities.

5.206.4.9

Terminal blocks and the associated wiring between shipping sections shall be permanently marked with identification matching the drawings.

Justification

This requirement ensures clear and consistent identification of terminal blocks and interconnecting wiring between shipping sections, reducing the risk of incorrect field connections, equipment malfunction, failure of protective devices to operate, or electrical fire.

5.206.4.10

Individual controllers shall be provided with a minimum of 10 % spare control terminal blocks.

Justification

This requirement ensures that standardized spare terminal capacity is available for future modifications or additional control connections, reducing the risk of field rework, additional hardware installation, or limited flexibility during the equipment service life.

Add new clause

5.206.5 Wire markers

5.206.5.1

Internal wire terminations shall be marked with heat shrink-type wire markers or permanently marked such that the markings are visible at the termination point without disassembling the cable bundle.

Justification

This requirement ensures durable and clearly visible identification of internal wire terminations, supporting circuit tracing and troubleshooting while reducing the risk of misidentification, maintenance delays, rework, or reduced maintainability.

5.206.5.2

Adhesive-type wire markers and labels shall not be used.

Justification

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

5.206.5.3

Internal wire terminations shall have a unique designation as assigned on the approved schematic and wiring diagrams.

Justification

This requirement ensures that internal wire terminations are uniquely identified in accordance with the approved drawings, supporting circuit tracing and troubleshooting and reducing the risk of misidentification, maintenance errors, or rework.

5.206.5.4

Internal wire terminations shall have the assigned designation at both ends.

Justification

This requirement ensures consistent identification of both ends of each internal wire, supporting circuit tracing and troubleshooting and reducing the risk of misidentification, maintenance errors, or rework.

5.206.5.5

Terminal blocks shall be clearly numbered and identified as assigned on the approved schematic and wiring diagrams.

Justification

This requirement ensures that terminal blocks are clearly and consistently identified in accordance with the approved drawings, reducing the risk of incorrect wiring connections, equipment malfunction, failure of protective devices to operate, or electrical fire.

5.209 Insulating material

Replace first sentence with

Material for the support of an uninsulated live part shall be porcelain, cycloaliphatic epoxy, glass polyester or other material found acceptable for the support of an uninsulated live part.

Justification

This requirement permits the use of cycloaliphatic epoxy as an acceptable insulating support material, supporting standardized material selection and reducing the risk of unsuitable support materials for MV applications.

NOTE: The use of porcelain or cycloaliphatic epoxy is generally recommended for higher voltages.

Justification

This note identifies porcelain and cycloaliphatic epoxy as preferred insulating support materials for higher-voltage applications, supporting reliable material selection for MV equipment.

5.210 Wire-bending space for field-installed conductors

Add new clause

5.210.1

The field cable termination area shall be sized to provide the necessary space for the following:

a) cable support and securement;

b) conductor separation;

c) cable and conductor bending;

d) conductor termination, including stress-cones.

Justification

This requirement ensures that sufficient space is provided for proper support, separation, bending, and termination of MV field cables, reducing the risk of excessive electrical or mechanical stress, termination failure, arc-flash events, or short circuits.

Add new clause

5.210.2

Cable entry provisions shall include removable gland plates for each vertical section.

Justification

This requirement ensures that suitable cable entry provisions are available for each vertical section, supporting proper field cable installation and termination while reducing the risk of excessive cable bending, installation difficulties, arc-flash events, or electrical fires.

Delete "optional" from clause 5.213 title

5.213 Insulated bus

5.213.1 General

Replace first sentence with

A system for insulating the bus bars and bus joints shall be supplied.

Justification

This requirement ensures that MV bus bars and bus joints are adequately insulated, reducing the risk of flashover, premature insulation failure, arc-flash events, or significant equipment damage.

5.213.2 Insulated bus requirements

Replace clause with

The MV MCC shall be provided with fully insulated bus as detailed in Clauses 5.213.2.1 through 5.213.2.8.

Justification

This requirement ensures that the MV MCC bus system is fully insulated for MV service, reducing the risk of flashover, arc-fault events, equipment damage, or personnel injury.

5.213.2.1

Extendable (main) and non-extendable (vertical) bus bars and bus connections shall be insulated.

Justification

This requirement ensures insulation of MV bus bars and connections, reducing the risk of incidental contact with energized parts, short-circuit events, or outages caused by rodent or insect intrusion.

5.213.2.2

The bus bar insulating material shall have high dielectric properties, be non-hygroscopic, flame retardant and track resistant.

Justification

This requirement ensures that bus bar insulation maintains adequate dielectric performance and resistance to moisture, flame, and tracking, reducing the risk of insulation degradation, short-circuit events, fire, or loss of equipment reliability.

5.213.2.3

MV MCC assembly bus joints shall be covered with formed insulating boots.

Justification

This requirement ensures that bus joints are provided with durable and maintainable insulation, reducing the risk of insulation damage, excessive maintenance time, or inconsistent joint insulation performance.

NOTE: The taping of bolted joints does not meet this requirement.

Justification

This note clarifies that taped bolted joints are not an acceptable insulation method, supporting durable and maintainable joint insulation and reducing the risk of difficult or time-consuming maintenance.

5.213.2.4

Bus joint insulating boots shall be attached with non-metallic hardware.

Justification

This requirement ensures that insulating boots can be securely attached without introducing conductive hardware at MV bus joints, supporting reliable insulation performance and simplifying removal and replacement during maintenance.

5.213.2.5

MV MCC assembly bus joints at shipping splits shall be supplied with boots, attachment hardware and installation instructions.

Justification

This requirement ensures that bus joints at shipping splits can be correctly insulated after field assembly, supporting compliance with the applicable insulation evaluation requirements and reducing the risk of incomplete joint insulation or installation errors.

5.213.2.6

A representative sample of each insulated bus bar size, insulation type and voltage rating shall withstand, without breakdown, the test for bus bar insulation described in Clause 6.2.202.5.

Justification

This requirement ensures that representative bus bar insulation systems are verified for adequate dielectric performance without breakdown, reducing the risk of insulation failure or exposure of energized parts.

5.213.2.7

MV MCC bus bar insulation, except at the joints, shall be bonded to the bus bar and be either heat shrink, liquid-dipped or fluidized-bed epoxy-type.

Justification

This requirement ensures that bus bar insulation is continuously bonded to the conductor surface, reducing the risk of partial discharge, premature dielectric breakdown, or failure within the main bus compartment.

5.213.2.8

The incoming supply connections (e.g., cable or bus) shall be covered with formed insulating boots.

Justification

This requirement ensures that incoming supply connections are fully insulated after installation, reducing the risk of exposed energized parts, electric shock, or personnel injury during maintenance activities.

Public Review Draft

5.214 Controllers – general requirements

Add new clause

5.214.1

Drawout-type contactors shall be provided with a separate stationary isolation means.

Justification

This requirement ensures positive isolation of drawout contactors from the main circuit by providing a separate stationary isolation means, reducing the risk of inadvertent exposure to energized MV parts during maintenance or troubleshooting activities.

Add new clause

5.214.2

Contactors shall be vacuum interrupter-type.

Justification

This requirement ensures standardized use of vacuum interrupter contactors, reducing the risk of inconsistent contactor technology and supporting reliable switching performance in MV MCC applications.

Add new clause

5.214.3

Controllers that have multiple contactors (e.g., multi-speed or reversing applications) shall have a common isolation switch and fuses.

Justification

This requirement ensures a common point of isolation for controllers with multiple contactors, reducing the risk of switching errors, complex isolation procedures, or unsafe maintenance activities.

Add new clause

5.214.4

Vacuum contactor interrupters shall be provided with visible wear indicators or wear gauge accessories.

Justification

This requirement ensures that the condition of vacuum interrupters can be readily assessed, reducing the risk of excessive contact wear, delayed maintenance, or premature contactor failure.

Add new clause

5.214.5

Contactors shall be electrically held for motor starters.

Public Review Draft

Justification

This requirement ensures that motor circuits are disconnected following a loss of control power, reducing the risk of unintended motor restart or unsafe equipment operation when power is restored.

Add new clause

5.214.6

Contactors shall be electrically operated and mechanically latched for transformer feeder units.

Justification

This requirement ensures that transformer feeder circuits are automatically re-energized following restoration of control power, reducing the risk of unnecessary manual intervention or delayed restoration of transformer service.

Add new clause

5.214.7

Contactors of the same type and ratings shall be interchangeable.

Justification

This requirement ensures that contactors of the same type and rating can be interchanged between units and cubicles, reducing the risk of maintenance delays, spare part complexity, or incorrect replacement.

Add new clause

5.214.8

Contactor shall be accessible without the need for removal of additional barriers or covers.

Justification

This requirement ensures that the contactor is readily accessible for maintenance or replacement, reducing the risk of unnecessary disassembly, extended maintenance time, or equipment downtime.

Add new clause

5.214.9

Each controller within a vertical section shall be segregated into three electrically and physically isolated areas, i.e., power bus compartment, the MV component compartment (e.g., isolation switch, power fuses, contactor), and the LV control compartment.

Justification

This requirement ensures clear physical and electrical segregation of the main power bus, MV components, and LV control circuits, reducing the risk of unintended exposure to energized parts and supporting safer operation, maintenance, and troubleshooting.

Public Review Draft

Add new clause

5.214.10

Separate hinged doors shall be provided for the MV and LV compartments within the controller assembly.

Justification

This requirement ensures separate access to the MV and LV compartments, supporting safe installation, inspection, and maintenance while reducing the risk of personnel exposure to energized components.

Add new clause

5.214.11

In addition to contacts required for design of control logic and indication, each controller shall be provided with the specified number of normally open and normally closed auxiliary contacts wired to terminal blocks.

Justification

This requirement ensures that spare auxiliary contacts are readily available for future control and indication needs, reducing the risk of field modification, additional wiring work, or limited flexibility during operation and maintenance.

Add new clause

5.214.12

Contactors shall have separate close and hold coils, or a single coil design with reduced hold-in voltage applied (e.g., economizer circuit).

Justification

This requirement ensures reduced continuous power consumption of the vacuum contactor holding circuit, reducing energy losses and associated heat generation during normal operation.

Add new clause

5.214.13

If individual CPTs are provided for the control power source, provisions for testing the controller shall be provided as detailed in Clauses 5.214.13.1 through 5.214.13.5.

Justification

This requirement ensures that provisions are available to support testing of individual controllers during commissioning, startup, and troubleshooting, reducing the risk of delays, incomplete functional verification, or difficulties interfacing with the DCS or other process control systems.

5.214.13.1

The circuit for testing the controller shall be provided with a male receptacle or an external power source for the test supply.

Justification

This requirement ensures that a suitable test power connection is available for controller testing, supporting commissioning, startup, and troubleshooting activities and reducing the risk of delays or incomplete functional verification.

5.214.13.2

The circuit for testing the controller shall be located in the LV compartment of the controller.

Justification

This requirement ensures that the controller test circuit is safely accessible within the LV compartment, supporting commissioning, startup, and troubleshooting activities while reducing the risk of personnel exposure to MV components.

5.214.13.3

The circuit for testing the controller shall be provided with a three-position selector switch to switch between normal CPT supply, “off” position, and test supply.

Justification

This requirement ensures that the controller can be safely switched between normal control power, isolation, and test power modes, supporting commissioning, startup, and troubleshooting while reducing the risk of incorrect test configuration or unintended operation.

5.214.13.4

The testing circuit for the controller shall be provided with an interlocking means to prevent the test supply source from back feeding the main bus via the CPT.

Justification

This requirement ensures that the test supply cannot back-feed the main bus through the CPT, reducing the risk of unintended energization, equipment damage, or personnel exposure during commissioning, startup, or troubleshooting activities.

5.214.13.5

The testing circuit for the controller shall be provided with an interlock to prevent the normal control power from feeding into the test power source when in NORMAL mode.

Justification

This requirement ensures that normal control power cannot energize the test power source, reducing the risk of unintended backfeed, equipment damage, or personnel exposure during commissioning, startup, or troubleshooting activities.

Add new clause

5.214.14

Looping or multi-turns of wiring through CTs shall not be permitted.

Justification

This requirement prevents the use of looped or multi-turn conductors through CTs, reducing the risk of exceeding cable bending limitations, incorrect CT configuration, or protection relay commissioning errors.

Add new clause

5.214.15

The controller shall be supplied with a means to detect a blown fuse (single phase condition) that causes the contactor trip.

Justification

This requirement ensures that a blown fuse or single-phase condition is detected and causes the contactor to trip, reducing the risk of prolonged single-phase operation and associated motor damage.

NOTE: This requirement may be satisfied by the protective relay on the controller.

Justification

This note clarifies that the required blown-fuse or single-phase detection function may be provided by the controller protective relay, supporting consistent implementation while maintaining protection against prolonged single-phase operation.

Add new clause

5.215 Instrument and control power transformers

5.215.1 Voltage transformers

5.215.1.1

Inductive VTs shall be in accordance with IEEE Std C57.13.

Justification

This requirement ensures that inductive voltage transformers meet recognized industry design, performance, and testing criteria, reducing the risk of inadequate VT performance, inconsistent equipment selection, or unreliable voltage measurement.

NOTE: This requirement does not preclude the use of other voltage sensing technologies.

Justification

This note clarifies that alternative voltage sensing technologies may be used, supporting design flexibility while maintaining the specified performance and functional requirements.

5.215.1.2

Secondary voltage shall be 120 V with primary voltage indicated on the one-line diagram.

Justification

This requirement ensures standardized VT secondary voltage and clear identification of the primary voltage, reducing the risk of inconsistent equipment selection and personnel exposure to higher control voltage levels.

5.215.1.3

VTs for metering or protective relaying purposes shall be protected by current-limiting primary fuses.

Justification

This requirement ensures standardized primary protection for VTs used for metering or protective relaying, reducing the risk of equipment damage and personnel exposure during maintenance or troubleshooting activities.

5.215.1.4

Each VT shall have the secondary winding protected by disconnecting-type current-limiting fuses or circuit breaker with one leg of the secondary winding grounded.

Justification

This requirement ensures standardized secondary protection and grounding of VTs, reducing the risk of electric shock, equipment damage, or unsafe conditions during maintenance and troubleshooting activities.

5.215.1.5

The VT BIL rating shall be the same as the MV MCC assembly.

Justification

This requirement ensures that the VT insulation level is coordinated with the MV MCC assembly, reducing the risk of premature insulation flashover, arc-fault events, or equipment damage.

5.215.1.6

Secondary protective devices for VTs shall be located in the LV control compartment.

Justification

This requirement ensures that VT secondary protective devices are located in the LV control compartment, reducing the risk of personnel exposure to MV hazards during maintenance or troubleshooting activities and supporting standardized equipment arrangement.

5.215.1.7

Fuse holders shall be labelled to indicate fuse size, fuse type and identification matching the drawings.

Justification

This requirement ensures that fuse holders are clearly identified with the applicable fuse rating, type, and drawing reference, reducing the risk of incorrect fuse replacement, maintenance errors, or equipment misoperation.

5.215.2 Control power transformers

5.215.2.1

The kVA rating of the CPT shall be sized to include the controller loads in addition to the external loads indicated on the project drawings.

Justification

This requirement ensures that the CPT has sufficient capacity for both controller and specified external loads, reducing the risk of undersizing, voltage drop, loss of control functionality, or the need for additional external power supplies.

5.215.2.2

The kVA rating of the CPT shall include at least 15 % additional capacity.

Justification

This requirement ensures that the CPT provides sufficient spare capacity for additional auxiliary loads, reducing the risk of overloading, insufficient capacity for motor space heaters, or the need for additional external power supplies.

5.215.2.3

Secondary windings for CPTs shall be protected by disconnect-type current-limiting fuses or circuit breakers with the neutral of the secondary winding grounded.

Justification

This requirement ensures standardized secondary protection and grounding of CPTs, reducing the risk of electric shock, equipment damage, or unsafe conditions during maintenance and troubleshooting activities.

5.215.2.4

Secondary voltage shall be 120 V.

Justification

This requirement ensures standardized 120 V secondary control voltage, reducing the risk of electric shock during operation, maintenance, or troubleshooting activities and supporting equipment commonality.

5.215.2.5

The primary fuses for the CPT shall coordinate with the secondary protection of the transformer.

Justification

This requirement ensures coordination between CPT primary and secondary protection, reducing the risk of unnecessary operation of primary fuses and avoiding additional LOTO or access to MV compartments for LV fault clearing.

5.215.2.6

CPTs shall be protected by current-limiting primary fuses.

Justification

This requirement ensures standardized primary protection of CPTs, reducing the risk of equipment damage and personnel exposure during maintenance or troubleshooting activities.

5.215.3 Current transformers

5.215.3.1

Inductive CTs for metering or protective relaying purposes shall be in accordance IEEE Std C57.13.

Justification

This requirement ensures that inductive current transformers meet recognized industry design, performance, and testing criteria, reducing the risk of inadequate CT performance, inconsistent equipment selection, or unreliable metering and protective relaying.

NOTE: This requirement does not preclude the use of the other current sensing technologies.

Justification

This note clarifies that alternative current sensing technologies may be used, supporting design flexibility while maintaining the specified performance and functional requirements.

5.215.3.2

CT secondary connections, including taps from multi-ratio CTs, shall be directly wired out to accessible short-circuiting terminal strips.

Justification

This requirement ensures that CT secondary connections are safely accessible for testing and maintenance, reducing the risk of electric shock, open-circuit CT conditions, or maintenance errors.

5.215.3.3

CTs with the same rating and application shall be identical and interchangeable.

Justification

This requirement ensures that CTs with the same rating and application are standardized and interchangeable, reducing the risk of maintenance delays, spare part complexity, or incorrect replacement.

5.215.3.4

CT polarity shall be visible (e.g., CT markings visible or label provided).

Justification

This requirement ensures that CT polarity is clearly identifiable, reducing the risk of incorrect wiring, metering or protection errors, and troubleshooting delays.

5.215.3.5

Window type 600 V class CTs shall not be used to monitor field installed MV conductors.

Justification

This requirement ensures that CT insulation levels are suitable for application on field-installed MV conductors, reducing the risk of insulation flashover, arc-fault events, or equipment damage.

Public Review Draft

Add new clause

5.216 Meters, protection, and control devices

5.216.1 Metering

5.216.1.1

If metering is indicated on the one-line or project drawings, microprocessor-based multifunction meters shall be provided as detailed in Clauses 5.216.1.1.1 through 5.216.1.1.5.

Justification

This requirement ensures the standardized use of multifunction metering with the monitoring and power measurement capabilities needed for reliable motor operation and power quality assessment.

5.216.1.1.1

Microprocessor-based multifunction meters shall be provided with digital communication capability.

Justification

This requirement ensures that multifunction meters can communicate measurement and monitoring data to external systems, supporting remote monitoring, diagnostics, and power quality assessment.

5.216.1.1.2

Microprocessor-based multifunction meters shall have 0.5 % accuracy or better.

Justification

This requirement ensures sufficient metering accuracy for reliable monitoring and power quality assessment, reducing the risk of inaccurate measurements, incorrect system evaluation and unreliable operational data.

5.216.1.1.3

Microprocessor-based multifunction meters shall display current and voltage for each phase.

Justification

This requirement ensures that phase-specific current and voltage measurements are readily available, supporting reliable monitoring, diagnostics and assessment of system operating conditions.

5.216.1.1.4

Microprocessor-based multifunction meters shall display kW, kVARS and power factor.

Justification

This requirement ensures that active and reactive power and power factor are readily available for operational monitoring, diagnostics, and assessment of motor and power system performance.

5.216.1.1.5

Microprocessor-based multifunction meters shall display harmonic order measurements.

Public Review Draft

Justification

This requirement ensures that harmonic order measurements are available for power quality assessment, supporting identification of harmonic distortion and its potential impact on motor and power system performance.

5.216.1.2

If specified, analog-type metering shall be provided as detailed in Clauses 5.216.1.2.1 through 5.216.1.2.4.

Justification

This requirement ensures that a standardized low-cost metering option is available where basic monitoring functionality is sufficient, reducing unnecessary complexity and equipment cost.

5.216.1.2.1

Analog-type metering shall have a circular 250-degree-scale switchboard-type.

Justification

This requirement ensures that a standardized analog meter format with clear and practical indication, supporting basic operational monitoring while maintaining a low-cost metering solution.

5.216.1.2.2

Analog-type metering shall have a minimum 1 % accuracy.

Justification

This requirement ensures that analog meters provide sufficient accuracy for basic operational monitoring, reducing the risk of misleading indications and incorrect assessment of system operating conditions.

5.216.1.2.3

Analog-type metering shall be 115 mm (4.5 in) square.

Justification

This requirement ensures a standardized analog meter size that provides clear visibility and consistent panel integration while maintaining a simple, low-cost metering solution.

5.216.1.2.4

Analog-type metering shall be flush mounted.

Justification

This requirement ensures standardized flush-mounted installation of analog meters, supporting consistent panel arrangement, clear visibility and a simple low-cost metering solution.

5.216.1.3

Analog ammeters shall be provided with four-position rotary-type switch.

Public Review Draft

Justification

This requirement ensures standardized phase-current selection for analog ammeters, providing basic operational monitoring while maintaining a simple, low-cost metering solution.

5.216.1.4

Analog voltmeters shall be provided with four-position rotary-type switch for open delta connected VTs or seven-position switch for wye connected VTs.

Justification

This requirement ensures standardized voltage selection for analog voltmeters based on the VT connection arrangement, providing basic operational monitoring while maintaining a simple, low-cost metering solution.

5.216.1.5

Instruments and meters shall have 5 A current and/or 150 V potential coils for operation with instrument transformers.

Justification

This requirement ensures standardized instrument and meter input ratings for use with instrument transformers, reducing the risk of incompatible equipment selection and supporting commonality across metering and protection applications.

5.216.1.6

Current coils of power monitoring equipment shall be capable of withstanding momentary CT secondary currents of 20 times the CT rating without sustaining damage.

Justification

This requirement ensures that power monitoring equipment can withstand high CT secondary currents during fault conditions, reducing the risk of thermal damage, equipment failure, fire and explosion.

5.216.2 Protective relays

5.216.2.1

If protective relays are indicated on the one-line or project drawings, they shall be provided as detailed in Clauses 5.216.2.1.1 through 5.216.2.1.7.

Justification

This requirement ensures that protective relays provide standardized monitoring, diagnostic, and communication functionality, supporting reliable motor protection, fault analysis, remote monitoring, and integration of the MV MCC with facility digital systems.

5.216.2.1.1

Protective relays shall be compliant with the service conditions, ratings and testing requirements in IEEE Std C37.90.

Justification

This requirement ensures that protective relays meet recognized service condition, rating, and testing requirements, reducing the risk of unreliable relay performance, incorrect operation and inadequate protection under specified operating conditions.

5.216.2.1.2

Protective relays shall be multifunctional microprocessor based.

Justification

This requirement ensures that protective relays provide multifunctional monitoring, protection, and diagnostic capability, supporting reliable motor operation, fault analysis, remote monitoring and integration with facility digital systems.

5.216.2.1.3

Protective relays shall have a trip indication with a manual reset function.

Justification

This requirement ensures that trip status remains clearly indicated until manually acknowledged, supporting effective fault diagnosis and reducing the risk of an unintended reset and restart following a protection trip.

5.216.2.1.4

Protective relays shall provide indication for each type of fault.

Justification

This requirement ensures that the specific fault condition is clearly identified, supporting effective diagnosis and troubleshooting and reducing the risk of delayed or incorrect corrective action.

5.216.2.1.5

Protective relays shall have digital communication capability.

Justification

This requirement ensures that protective relays can transmit protection, status, and diagnostic information to external systems, supporting remote monitoring, fault analysis, and integration of the MV MCC with facility digital systems.

5.216.2.1.6

Diagnostic information shall include device status, warning status, time to reset, trip status, time to overload trip and historical event recording.

Justification

This requirement ensures that comprehensive diagnostic information is available for monitoring, troubleshooting, and fault analysis, reducing the risk of delayed corrective action, misdiagnosis, or unnecessary equipment downtime.

Public Review Draft

5.216.2.1.7

A minimum of two digital inputs and two digital outputs shall be provided.

Justification

This requirement ensures sufficient digital input and output capacity for protection, control, status, and interlocking functions, reducing the risk of additional external interfaces, field modifications, or limited integration capability.

5.216.2.2

If specified, test switches shall be provided as detailed in Clauses 5.216.2.2.1 through 5.216.2.2.5.

Justification

This requirement ensures that test switches are available to support safe online testing, maintenance, and troubleshooting of protective relays and breaker trip and close circuits, reducing the risk of service interruption and personnel exposure to hazardous voltages.

5.216.2.2.1

Test switch shall be installed on the controller or associated instrument compartment door.

Justification

This requirement ensures that the test switch is readily accessible from the controller or instrument compartment door, supporting safe online testing and maintenance while reducing the risk of personnel exposure to hazardous voltages.

5.216.2.2.2

If specified, test switch shall allow for isolation of protective relay equipment inputs and outputs.

Justification

This requirement ensures protective relay inputs and outputs can be safely isolated for online testing, maintenance, or troubleshooting, reducing the risk of unintended operation, service interruption, or personnel exposure to hazardous voltages.

5.216.2.2.3

Test switches shall be FT-type or equivalent.

Justification

This requirement ensures the use of a standardized test switch design suitable for protective relay testing and isolation, supporting safe maintenance practices and reducing the risk of incorrect operation or personnel exposure to hazardous voltages.

5.216.2.2.4

Test switches shall be wired to provide three-phase bus potential and three-phase line current.

Public Review Draft

Justification

This requirement ensures that the test switches provide access to the required three-phase voltage and current signals for protective relay testing, supporting complete functional verification without interrupting service or exposing personnel to hazardous voltages.

5.216.2.2.5

If specified, test switches shall be wired in series with protective relay trip output contacts.

Justification

This requirement ensures that protective relay trip outputs can be safely isolated during online testing, maintenance, or troubleshooting, reducing the risk of unintended breaker operation, service interruption, or personnel exposure to hazardous voltages.

5.216.2.3

If motor protection relays are indicated on the one-line or project drawings, they shall include the following functions:

a) percentage of motor FLC;

b) percent thermal capacity utilized;

c) motor bearing temperature;

d) running time (cumulative) in hours;

e) operation count;

f) number of remaining starts;

g) motor start lockout;

h) protective functions including thermal overload, underload, locked rotor, current imbalance, stall, phase loss and zero sequence ground fault;

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

j) motor stator winding temperature.

Justification

This requirement ensures motor protection relays provide comprehensive protection, condition monitoring, operational status, and diagnostic information, supporting reliable motor operation, fault analysis, controlled restarting, and integration of the MV MCC with facility digital systems.

5.216.2.4

A separate dedicated set of fuses or circuit breakers shall be provided for each power supply that is utilized for protection, control or monitoring devices in each controller.

Public Review Draft

Justification

This requirement ensures that failures of individual power supplies used for protection, control or monitoring are selectively isolated, reducing the risk of loss of the main control circuit or compromised reliability of the MV MCC lineup.

5.216.2.5

If door-mounted lockout relays (device 86) are supplied, they shall be provided as detailed in Clauses 5.216.2.5.1 through 5.216.2.5.4.

Justification

This requirement ensures that door-mounted lockout relays provide a distinct, fast-acting, and physically latched means of emergency trip and lockout, reducing the risk of inadvertent reset, delayed fault clearing or equipment damage.

5.216.2.5.1

Lockout relays shall have a manual reset-type handle.

Justification

This requirement ensures that the lockout relay remains physically latched following operation until deliberately reset by personnel, reducing the risk of unintended re-energization, repeated fault exposure, or equipment damage.

5.216.2.5.2

Lockout relays shall operate in less than one cycle.

Justification

This requirement ensures rapid operation of the lockout relay during emergency or fault conditions, reducing fault duration and the risk of equipment damage.

5.216.2.5.3

Lockout relays shall have two positions, "Reset" and "Tripped".

Justification

This requirement ensures that the lockout relay provides clear and unambiguous indication of its operating state, reducing the risk of misinterpretation, incorrect reset or unsafe re-energization.

5.216.2.5.4

The coil "health" of lockout relays shall be monitored with a white indicating light.

Justification

This requirement ensures continuous indication of lockout relay coil health, providing immediate confirmation that the device is available to perform its emergency trip function and reducing the risk of an undetected loss of protection capability.

Public Review Draft

5.216.3 Indication and control devices

5.216.3.1

If status indicator lights are specified, they shall be in accordance with the requirements given in Clauses 5.216.3.1.1 through 5.216.3.1.4.

Justification

This requirement ensures clear local indication of controller status, enabling operations personnel to verify motor operating conditions without requiring electrical personnel support and reducing delays in routine operational activities.

5.216.3.1.1

Status indicator lights shall be installed on the controller LV compartment door.

Justification

This requirement ensures that status indication is provided at the LV controller interface, enabling safe and convenient local verification of motor status while avoiding unnecessary access to MV compartments.

5.216.3.1.2

Indicating light colors shall be red (contactor closed), green (contactor opened) and amber (tripped).

Justification

This requirement ensures standardized status indication using an agreed color scheme, reducing the risk of operator misinterpretation and supporting equipment commonality and cost efficiency.

5.216.3.1.3

Indicating lights shall be LED-type with a minimum of 100 000 hours illumination life.

Justification

This requirement ensures long-life and reliable status indication, reducing the need for lamp replacement, maintenance intervention and additional lamp-test circuitry while improving equipment availability and lifecycle cost.

5.216.3.1.4

Replacement of indicator lights shall not result in contactor operation.

Justification

This requirement ensures that indicator light replacement cannot inadvertently operate the contactor, reducing the risk of unintended equipment operation and associated personnel or process hazards.

5.216.3.2

Door mounted devices (e.g., push buttons, selector switches) shall have a heavy-duty rating as defined in NEMA ICS 5.

Public Review Draft

Justification

This requirement ensures that standardized heavy-duty door-mounted control devices with a defined quality and performance level, supporting safe and reliable operation while reducing the risk of premature device failure or inconsistent equipment selection.

5.216.3.3

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 control relay and auxiliary contacts have standardized switching capability suitable for the intended field interface duty, reducing the risk of contact damage, unreliable operation, or premature device failure.

5.216.3.4

If specified, an emergency stop button (E-stop) function shall be provided for all controllers as detailed in Clauses 5.216.3.4.1 through 5.216.3.4.4.

Justification

This requirement ensures that a standardized emergency stop function is provided for all controllers, enabling rapid motor shutdown during emergency conditions while supporting consistent operation and commonality across electrical switching equipment.

5.216.3.4.1

The color of the emergency stop button shall be red.

Justification

This requirement ensures that the emergency stop device is clearly and consistently identifiable, reducing the risk of operator confusion and supporting rapid response during emergency conditions.

5.216.3.4.2

The emergency stop button shall be mushroom-head type.

Justification

This requirement ensures that the emergency stop device is readily identifiable and can be operated quickly and reliably, reducing the risk of delayed motor shutdown during emergency conditions.

5.216.3.4.3

The emergency stop button shall be maintained push-to-operate.

Justification

This requirement ensures that the emergency stop remains in the operated position until deliberately reset, reducing the risk of unintended motor restart and supporting safe response during emergency conditions.

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5.216.3.4.4

The emergency stop button shall be provided with protective guard.

Justification

This requirement ensures that the emergency stop device is protected against inadvertent operation, reducing the risk of unintended motor shutdown while maintaining rapid access during emergency conditions.

5.216.3.5

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

Justification

This requirement ensures that control relay coils are protected against switching transients and voltage surges, reducing the risk of damage to electronic components, premature device failure, or unnecessary replacement of higher-cost equipment.

Add new clause

5.217 Accessories

5.217.1

If specified, a remote handheld control station shall be provided to operate the individual controllers in the MV MCC assembly as detailed in Clauses 5.217.1.1 through 5.217.1.5.

Justification

This requirement ensures that controllers can be operated from a safe distance from the MV MCC, reducing personnel exposure to arc-flash hazards and the need for increased electrical PPE during switching operations.

5.217.1.1

The control station shall allow for the operation of all controller types and sizes provided in the assembly.

Justification

This requirement ensures that the remote control station can operate all controller types and sizes within the MV MCC assembly, supporting consistent remote operation and reducing the need for personnel to enter the arc-flash boundary.

5.217.1.2

The control station shall perform open and close functions for the contactor.

Justification

This requirement ensures that the remote control station can perform the basic open and close functions of the contactor from a safe distance, reducing the need for personnel to enter the arc-flash boundary during switching operations.

5.217.1.3

The control station shall provide status of the contactor (open or closed).

Justification

This requirement ensures that the remote control station provides clear indication of contactor position, supporting safe remote switching and reducing the need for personnel to enter the arc-flash boundary to verify controller status.

5.217.1.4

The control station shall only operate the controller with the door closed.

Justification

This requirement ensures that the controller can only be operated remotely when the door is closed, reducing the risk of personnel exposure to energized components and arc-flash hazards during switching operations.

5.217.1.5

The control station shall be provided with a minimum of 6 m (20 ft) of control cable.

Justification

This requirement ensures that sufficient control cable length is provided to operate the MV MCC from a safe distance, reducing the need for personnel to remain within the arc-flash boundary during switching operations.

5.217.2

If specified, vertical section doors and panels shall include NRTL or ACO approved thermal scanning inspection windows for infrared scanning of the equipment without opening the equipment doors or removing covers.

Justification

This requirement ensures that infrared inspection can be performed without opening energized equipment compartments, reducing the risk of personnel exposure to live parts and arc-flash hazards while supporting detection of potential hotspots.

NOTE: Thermal scanning windows provided in arc-resistant MV MCC should be included in the type testing program for the qualification of the arc-resistant MV MCC.

Justification

This note clarifies that thermal scanning windows are to be included in the arc-resistant type testing program, ensuring their installation does not compromise the qualified arc-resistant performance of the MV MCC.

5.217.3

If applicable, a MV fuse puller shall be provided for each single controller type.

Justification

This requirement ensures that a suitable tool is available for safe removal and replacement of MV fuses, reducing the risk of direct hand contact with fuse components and associated personnel exposure to electrical hazards.

5.217.4

One set of spare MV fuses shall be provided for each size and type of fuse used.

Justification

This requirement ensures that spare MV fuses are readily available for each installed fuse size and type, reducing equipment downtime and supporting rapid restoration of service following a fuse failure.

NOTE: This requirement includes main unit fuses, CPT fuses, and fuses for VTs.

Justification

This note clarifies the types of MV fuses included in the spare fuse requirement, supporting complete spare provision and reducing the risk of delayed restoration of service following a fuse failure.

5.217.5

One set of special tools required for the installation and maintenance of the equipment supplied shall be provided.

Justification

This requirement ensures that the necessary special tools are available for equipment installation, maintenance and troubleshooting, reducing the risk of delays, improper servicing and equipment damage.

5.217.6 Condition-based monitoring

5.217.6.1

If specified, continuous thermal monitoring shall be as detailed in Clauses 5.217.6.1.1 through 5.217.6.1.3.

Justification

This requirement ensures continuous monitoring of abnormal temperature conditions within the MV MCC, supporting early detection of loose connections or overheating components while reducing the need to open equipment compartments and improving personnel safety and equipment reliability.

5.217.6.1.1

The continuous thermal monitoring system shall be factory integrated.

Justification

This requirement ensures that the continuous thermal monitoring system is fully integrated into the MV MCC at the factory, reducing the risk of field modification, installation errors, or inconsistent system performance.

5.217.6.1.2

Thermal monitoring shall include hotspot detection sensors for areas of concern (e.g., cable connections, fuse clips, stab connections and shipping split connections).

Justification

This requirement ensures that thermal monitoring is focused on locations most susceptible to abnormal heating, supporting early detection of loose or deteriorating connections and reducing the risk of equipment damage, unplanned outages, or personnel exposure during inspection activities.

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5.217.6.1.3

Continuous thermal monitoring systems shall include communications to convey temperature data, status and alarming for each monitored point.

Justification

This requirement ensures that temperature data, device status and alarms are available for each monitored point, supporting remote condition monitoring, timely identification of abnormal thermal conditions and effective maintenance response.

5.217.6.2

If specified, a local motor condition monitoring system (manual data collection) shall be provided as detailed in Clauses 5.217.6.2.1 through 5.217.6.2.3.

Justification

This requirement ensures that local motor condition monitoring can be performed without opening controller doors, supporting safe collection of diagnostic data, early detection of abnormal operating conditions and improved motor reliability.

5.217.6.2.1

The local motor condition monitoring system shall be equipped with factory-integrated components.

Justification

This requirement ensures that the motor condition monitoring components are fully integrated into the MV MCC at the factory, reducing the risk of field modification, installation errors, or inconsistent system performance.

5.217.6.2.2

Connections to internal CT and VT circuits shall be through a test port located on the front door of the MV MCC or at a remote interface panel.

Justification

This requirement ensures safe and convenient access to internal CT and VT signals for motor condition monitoring without opening MV MCC compartments, reducing personnel exposure to energized components and supporting efficient data collection.

5.217.6.2.3

Voltage at the test port shall be less than 50 V or be touch safe.

Justification

This requirement ensures that the test port voltage is limited to a touch-safe level, reducing the risk of electric shock during motor condition monitoring and diagnostic data collection.

5.217.6.3

If specified, continuous motor condition monitoring system shall be as detailed in Clauses 5.217.6.3.1 through 5.217.6.3.4.

Justification

This requirement ensures that continuous motor condition monitoring is provided to detect and trend abnormal operating conditions, reducing the need for manual data collection or access to energized compartments while supporting early identification of motor degradation and improved equipment reliability.

5.217.6.3.1

The continuous motor condition monitoring system shall be factory integrated.

Justification

This requirement ensures that the continuous motor condition monitoring system is fully integrated into the MV MCC at the factory, reducing the risk of field modification, installation errors, or inconsistent system performance.

5.217.6.3.2

The system shall be capable of continuous monitoring and sensing.

Justification

This requirement ensures continuous acquisition of motor condition data, supporting early detection and trending of abnormal operating conditions and reducing the risk of undetected motor degradation or failure.

5.217.6.3.3

The system shall include communications to convey status and alarming for each monitored point.

Justification

This requirement ensures that status and alarm information is available for each monitored point, supporting remote condition assessment, timely identification of abnormal operating conditions and effective maintenance response.

5.217.6.3.4

The system shall provide a methodology for the real-time analysis of rotor flux, rotor cage current signature analysis, end winding vibration, shaft voltage and shaft current.

Justification

This requirement ensures real-time analysis of key motor condition parameters, supporting early detection and trending of rotor, winding, vibration and shaft-related abnormalities and reducing the risk of undetected degradation and motor failure.

5.217.6.4

If specified, continuous partial discharge monitoring equipment shall be provided as detailed in Clauses 5.217.6.4.1 through 5.217.6.4.3.

Justification

This requirement ensures continuous monitoring of partial discharge activity within the MV MCC, supporting early detection and trending of insulation degradation and reducing the risk of dielectric failure, ground faults, or internal arcing events.

5.217.6.4.1

The continuous partial discharge monitoring system shall be factory integrated.

Justification

This requirement ensures that the continuous partial discharge monitoring system is fully integrated into the MV MCC at the factory, reducing the risk of field modification, installation errors, or inconsistent monitoring performance.

5.217.6.4.2

Partial discharge systems shall be capable of continuous sensing and monitoring of motor characteristics.

Justification

This requirement ensures that continuous acquisition and monitoring of partial discharge-related motor characteristics, supporting early detection of insulation degradation and reducing the risk of dielectric failure, ground faults, or internal arcing events.

5.217.6.4.3

The partial discharge monitoring system shall include communication to convey partial discharge data, status and alarming for each monitored point.

Justification

This requirement ensures that partial discharge data, system status, and alarms are available for each monitored point, supporting remote condition assessment, timely identification of insulation degradation and effective maintenance response.

5.217.7

Two-high assemblies shall be provided with a lifting device.

Justification

This requirement ensures that a suitable lifting device is available for handling heavy contactor assemblies, reducing the risk of personnel injury, equipment damage and maintenance delays during removal and replacement activities.

Add new clause

5.218 Enclosure space heaters

5.218.1

Enclosure space heaters shall be wired to an accessible terminal block provided for connection to a single external power source for the MV MCC assembly.

Justification

This requirement ensures a safe and readily accessible connection point for the enclosure space heater circuit, reducing the risk of incorrect wiring, maintenance difficulties and unsafe access to the external power supply.

5.218.2

Enclosure space heaters shall be guarded by an expanded metal cage around the heaters to prevent burns due to incidental contact.

Justification

This requirement ensures that personnel are protected from incidental contact with hot space heater surfaces, reducing the risk of burns during operation or maintenance activities.

5.218.3

Enclosure space heaters shall be operated at 120 Vac.

Justification

This requirement ensures that enclosure space heaters operate at a standardized low voltage, reducing the risk of electric shock and arc-flash exposure during operation or maintenance activities.

5.218.4

Enclosure space heaters shall be sized to provide a 5 K rise over ambient temperature to prevent condensation.

Justification

This requirement ensures that enclosure space heaters maintain the internal temperature above ambient to prevent condensation, reducing the risk of moisture-related insulation degradation, component failure, or arc-flash events.

5.218.5

Each enclosure space heater circuit shall be protected by a circuit breaker or fuse that also functions as a disconnect device with lockout provisions.

Justification

This requirement ensures that each enclosure space heater circuit can be safely isolated and locked out, reducing the risk of personnel exposure to energized conductors during maintenance or troubleshooting activities.

5.218.6

Each enclosure space heater circuit shall be provided with an ammeter.

Justification

This requirement ensures that space heater circuit operation can be readily verified by confirming current flow, supporting early detection of open-circuit heater failures and reducing the risk of undetected loss of condensation protection.

5.218.7

The ammeter for each enclosure space heater circuit shall have an appropriately sized scale so that the failure of a single space heater element results in a discernible change in ammeter reading.

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Justification

This requirement ensures that the ammeter scale is sufficiently sensitive to identify the loss of a single space heater element, supporting early detection of heater failure and reducing the risk of undetected loss of condensation protection.

5.218.8

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

Justification

This requirement ensures that the normal operating current is readily available for comparison with the ammeter reading, supporting identification of abnormal current conditions or failed space heater elements during inspection and troubleshooting.

5.218.9 Enclosure space heater thermostat control

If enclosure space heater automatic control is specified, a control unit shall be provided as detailed in Clauses 5.218.9.1 and 5.218.9.2.

Justification

This requirement ensures that automatic control of enclosure space heaters is provided using a defined and standardized arrangement, supporting consistent system implementation and reliable condensation control.

5.218.9.1

The control unit shall have a control circuit that includes a momentary test push button.

Justification

This requirement ensures that enclosure space heater operation can be manually verified through the automatic control circuit, supporting functional testing and reducing the risk of undetected heater or control system failure.

5.218.9.2

The control unit momentary push button shall energize the space heaters, bypassing the space heater controls, to verify the operation of the space heaters.

Justification

This requirement ensures that enclosure space heater operation can be directly verified by temporarily bypassing the automatic controls, reducing the risk of undetected heater or control circuit failure.

Add new clause

5.219 Motor space heaters

5.219.1

The controllers identified for motor applications on the project drawings shall be provided with a normally closed "M" contact wired in series with an external power source such that the motor space heater is energized when the contactor is open.

Justification

This requirement ensures that the motor space heater is automatically energized when the contactor is open, including during isolation and LOTO conditions, reducing the risk of condensation and associated motor insulation degradation.

5.219.2

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

Justification

This requirement ensures that a safe and accessible connection point is provided for field wiring of the motor space heater external power supply, reducing the risk of installation errors, unsafe terminations, or maintenance difficulties.

5.219.3

Motor space heater circuits shall have a fused disconnect or circuit breaker that is lockable and located within the respective controller LV compartment.

Justification

This requirement ensures that the motor space heater power supply can be safely isolated and locked out within the associated LV compartment, reducing the risk of electric shock during maintenance or troubleshooting activities.

5.219.4

If specified, the motor space heater circuit shall be supplied with an ammeter with an appropriately sized scale.

Justification

This requirement ensures that the ammeter scale is sufficiently sensitive to identify loss of the motor space heater element, supporting early detection of heater failure and reducing the risk of undetected loss of condensation protection.

5.219.5

The external power supply for the motor space heaters shall not be switched off with the MV controller isolation switch.

Justification

This requirement ensures that the motor space heaters remain energized when the MV controller is isolated, including during LOTO conditions, reducing the risk of condensation and associated motor insulation degradation.

5.219.6

If specified, a pushbutton shall be provided to test the motor space heater and ammeter circuit.

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Justification

This requirement ensures that the motor space heater and ammeter circuit can be readily verified during maintenance, reducing the risk of undetected heater or indication circuit failure where automatic controls would otherwise prevent straightforward functional testing.

Add new clause

5.220 Reduced-voltage solid state controllers

5.220.1

Solid state controllers shall be supplied with the following:

a) bypass vacuum contactor;

b) microprocessor-based control module.

Justification

This requirement ensures that solid state controllers provide the necessary bypass and microprocessor-based control functionality, enabling transition to direct-on-line operation after motor acceleration while supporting reliable motor protection, monitoring, diagnostics, remote monitoring and integration with facility digital systems.

NOTE: This requirement is in addition to the controller requirements identified in previous clauses.

Justification

This note clarifies that solid state controller requirements supplement the general controller requirements, supporting complete functionality for monitoring, diagnostics, remote operation and integration with facility digital systems.

5.220.2

Silicon controlled rectifiers shall be provided with the following:

a) voltage transient protection;

b) overvoltage protection;

c) optical isolation between the power section and the control section.

Justification

This requirement ensures that silicon controlled rectifiers are protected against transient and overvoltage conditions and maintain electrical isolation between the MV power section and LV control circuits, reducing the risk of power electronic device failure, control circuit damage and unsafe voltage transfer.

5.220.3

The solid state voltage controller shall provide at least the following starting functions:

a) voltage ramp;

b) current limit;

c) across-the-line.

Justification

This requirement ensures that solid state voltage controllers provide the commonly required motor starting modes, supporting flexible and reliable starting of a range of MV motor loads while reducing the risk of excessive starting current, voltage disturbance, or unsuccessful motor acceleration.

5.220.4

A separate protection relay shall be provided in accordance with Clause 5.216.2 to protect the controller.

Justification

This requirement ensures that a separate protective relay provides the necessary motor protection functions not normally included within the solid state starter controller, reducing the risk of inadequate protection, motor damage, or unreliable operation.

6 Type Tests

6.2 Dielectric tests

6.2.201 Impulse withstand tests

6.2.201.3 Impulse voltage withstand test sequence

Replace second sentence with

Control, CT secondary and auxiliary circuits shall be grounded in these tests.

Justification

This requirement ensures that control, CT secondary and auxiliary circuits are grounded during impulse withstand testing, reducing the risk that lower-insulation-class components connected within the MV circuit compromise the demonstrated dielectric strength of the assembly.

Add after second sentence

The MV motor circuit fuses (class E2 controllers) and control circuit fuses shall be in place during these tests:

Justification

This requirement ensures the MV motor circuit and control circuit fuses are included during dielectric testing, reducing the risk that lower-insulation-class components within the tested circuit compromise the demonstrated dielectric strength of the assembly.

7 Routine Tests

Add to clause

The MV MCC shall be electrically and mechanically assembled into a single line-up prior to testing and inspection.

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Justification

This requirement ensures that the complete MV MCC lineup, including all mechanical interfaces and electrical interconnections, is assembled before factory testing and inspection, reducing the risk of interface or wiring issues remaining undetected and minimizing field commissioning and startup activities.

7.1 Power-frequency voltage withstand test on the main circuit

Delete third paragraph

Justification

This deletion ensures that the specified dielectric test duration is maintained, avoiding use of a shorter test that may not adequately demonstrate the assembly's dielectric strength and creepage performance under applied AC test voltage.

Add to clause

If grounding ball studs are specified, they shall be installed at their designated termination points prior to the dielectric tests.

Justification

This requirement ensures that grounding ball studs are included in the dielectric test configuration, reducing the risk that their installation subsequently decreases electrical clearances and compromises the demonstrated AC withstand capability of the assembly.

7.201 Routine tests – general

Add to clause

Functional testing of the completed MV MCC assembly shall include the following:

a) operation of all controllers and associated isolation switches;

b) operation of switching devices;

c) electrical and mechanical interlocks;

d) control devices that are either hard wired or communicating over a network and, if applicable, local HMI;

e) VTs or sensors;

f) controller protective relays and metering devices;

g) indicator lights;

h) non-stationary contactor mechanical insertions and removals;

i) vertical section space heaters and thermostat if applicable;

j) condition monitoring equipment or systems if applicable;

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

l) fuse removal and replacement facilities.

Justification

This requirement ensures a standardized and comprehensive functional test of the completed MV MCC assembly, including controllers, switching and interlocking functions, protection and control devices, communications, indication, auxiliary systems, condition monitoring, space heaters, mechanical operations and fuse handling provisions, reducing the risk of undetected functional deficiencies and minimizing commissioning, troubleshooting and corrective work in the field.

Add new clause

8 Shipping and Preservation

8.1 Shipping splits comprised of multiple vertical sections

Shipping splits comprised of multiple vertical sections shall be furnished with removable lifting angles, lugs or plates engineered for use with crane hooks or slings.

Justification

This requirement ensures that shipping splits are provided with engineered lifting provisions suitable for crane handling, reducing the risk of equipment damage, unsafe lifting practices and installation and maintenance difficulties.

8.2 Items shipped separately from the MV MCC

Items shipped separately from the MV MCC, including removed contactors, shall be clearly identified with the item description and the location of installation.

Justification

This requirement ensures that separately shipped items are clearly identified for correct reassembly and installation, reducing the risk of misplaced components, installation errors and delays during site assembly.

8.3 Shipping identification labels

8.3.1

Shipping splits comprised of multiple vertical sections shall be provided with individual identification labels.

Justification

This requirement ensures that each shipping split is clearly identified for correct handling, positioning and reassembly during installation, reducing the risk of misplacement, assembly errors and installation delays.

8.3.2

Identification labels of shipping splits of multiple vertical sections shall display the equipment number of the assembly that the vertical sections are components of.

Justification

This requirement ensures that each shipping split is clearly linked to its parent MV MCC assembly, reducing the risk of misidentification, incorrect reassembly and installation delays at site.

8.3.3

Identification labels of shipping splits shall be securely attached and visible.

Justification

This requirement ensures that shipping split identification remains securely attached and readily visible throughout handling, storage and transportation, reducing the risk of misidentification, incorrect reassembly and installation delays.

8.4 Foreign materials requiring removal before energizing the equipment

Foreign materials (e.g., blocking, bracing) requiring removal before energizing the equipment shall be clearly identified with tags, signs or markings.

Justification

This requirement ensures that temporary foreign materials requiring removal are readily identifiable before energization, reducing the risk of equipment damage, operational failure and unsafe conditions caused by items being inadvertently left in place.

8.5 Electrical connection point for space heaters

The electrical connection point for the space heaters shall be as detailed in Clauses 8.5.1 through 8.5.3.

Justification

This requirement ensures that a defined and accessible electrical connection point is provided for space heaters during storage, reducing the risk of incorrect temporary connections, loss of condensation protection and damage to the equipment preservation arrangement.

8.5.1

The connection point shall be available without uncrating the equipment.

Justification

This requirement ensures that the space heater connection point remains accessible during storage without disturbing the equipment packaging, reducing the risk of compromising preservation or condensation protection.

8.5.2

The connection point shall be clearly labelled.

Justification

This requirement ensures that the space heater connection point is readily identifiable during storage, reducing the risk of incorrect connection, loss of condensation protection and disturbance to the equipment preservation arrangement.

8.5.3

The connection point shall indicate the electrical service required.

Justification

This requirement ensures that the required electrical service for the space heaters is clearly identified at the connection point, reducing the risk of incorrect temporary power connection, heater malfunction, or loss of condensation protection during storage.

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8.6 Protection against environmental and mechanical conditions

All equipment and removable items shall be protected from dust, water, humidity and vibration during shipping and storage.

Justification

This requirement ensures that equipment and removable items are adequately protected against environmental and mechanical conditions during shipping and storage, reducing the risk of contamination, moisture ingress, corrosion, vibration damage and degraded equipment reliability.

8.7 Instruments, relays, switches, and meters installed in MV MCC doors

Instruments, relays, switches and meters installed in the MV MCC doors shall be protected, blocked and braced to prevent damage during shipment.

Justification

This requirement ensures that door-mounted instruments and devices are adequately secured against movement and vibration during shipment, reducing the risk of mechanical damage, misalignment and loss of functionality before installation.

8.8 Shipment identification

The shipment shall be identified with the purchase order number, job number and equipment number.

Justification

This requirement ensures that the shipment is clearly identified and traceable to the correct purchase order, project and equipment assembly, reducing the risk of misidentification, incorrect handling and installation and commissioning delays.

8.9 Equipment release for shipment

Equipment release for shipment shall be approved by the purchaser's identified authority (e.g., third-party inspector).

Justification

This requirement ensures that equipment is formally inspected, accepted, and authorized for shipment by the purchaser’s designated authority, reducing the risk of unresolved quality issues, incomplete punch-list actions and unmet shipment requirements.

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Annex A
(Normative) — References

Add row items 28 to 36 to table

Item	United States	Canada	Mexico
28	ABS MODU, *Publication Number 6 Part 4 Rules for Building and Classing Mobile Offshore Drilling Units - Part 4 Machinery and Systems*	—	—
29	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*
30	ASTM-F855, *Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment*	ASTM-F855, *Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment*	ASTM-F855, *Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment*
31	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*
32	IEEE Std C37.20.7-2017, *Guide for Testing Metal-Enclosed Switchgear Rated Up to 52 kV for Internal Arcing Faults*	IEEE Std C37.20.7-2017, *Guide for Testing Metal-Enclosed Switchgear Rated Up to 52 kV for Internal Arcing Faults*	IEEE Std C37.20.7-2017, *Guide for Testing Metal-Enclosed Switchgear Rated Up to 52 kV for Internal Arcing Faults*
33	IEEE Std C37.90, *IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus*	IEEE Std C37.90, *IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus*	IEEE Std C37.90, *IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus*
34	IEEE Std C57.13, *IEEE Standard Requirements for Instrument Transformers*	IEEE Std C57.13, *IEEE Standard Requirements for Instrument Transformers*	IEEE Std C57.13, *IEEE Standard Requirements for Instrument Transformers*
35	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*
36	46 CFR 111, *Title 46 – Shipping, Chapter I - Department of Coast Guard, Subchapter J - Electrical Engineering, Part 111 - Electrical Systems - General Requirements (For United States offshore only)*	—	—

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Add Bibliography

Bibliography

The following documents are informatively cited in the text of this specification, the PDS (IOGP S-742D) or the IRS (IOGP S-742L).

ANSI/IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

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*

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