International Association of Oil & Gas Producers

SPECIFICATION
S-560J

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2022

Supplementary Specification to IEC 61439-1 & 2 Low-voltage Switchgear and Controlgear Assemblies

NOTE This version (S-560J) of the specification document provides the justification statements for each technical requirement, but is otherwise identical in content to S-560.

Public Review Draft

JIP33
JOINT INDUSTRY PROGRAMME

Revision history

VERSION	DATE	PURPOSE
2.1	January 2022	Issued for Public Review
2.0	December 2018	Second Edition
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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 this specification is to define a minimum common set of requirements for the procurement of low voltage switchgear and control gear assemblies in accordance with IEC 61439-1, Edition 3, May 2020 and IEC 61439-2, Edition 3.0, July 2020, Corrigendum 1, 2021 for application in the petroleum and natural gas industries.

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



JIP33 Specification for Procurement Documents
Supplementary Technical Specification

This specification is to be applied in conjunction with the supporting procurement data sheet, information requirements specification (IRS) and quality requirements specification (QRS) as follows.

IOGP S-560: Supplementary Specification to IEC 61439-1 & 2 Low-voltage Switchgear and Controlgear

This specification defines the technical requirements for the supply of the equipment and is written as an overlay to IEC 61439-1 and IEC 61439-2, following the IEC 61439-1 and IEC 61439-2 clause structure. Clauses from IEC 61439-1 and IEC 61439-2 not amended by this specification apply as written to the extent applicable to the scope of supply.

Modifications to IEC 61439-1 or IEC 61439-2 defined in this specification are identified as Add (add to clause or add new clause), Replace (part of or entire clause) or Delete.

IOGP S-560D: Procurement Data Sheet for Low-voltage Switchgear and Controlgear

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

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IOGP S-560L: Information Requirements for Low-voltage Switchgear and Controlgear

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

IOGP S-560Q: Quality Requirements for Low-voltage Switchgear and Controlgear

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

The terminology used within this specification and the supporting procurement data sheet, IRS and QRS follows that of IEC 61439-1 and IEC 61439-2, and is in accordance with ISO/IEC Directives, Part 2 as appropriate.

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

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

a) regulatory requirements;

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

c) purchaser defined requirements (procurement data sheet, QRS, IRS);

d) this specification;

e) IEC 61439-1 and IEC 61439-2.

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1 Scope

Add to subclause

This specification does not cover:

a) requirements for integration with the electrical control and management systems (ECMS);

b) requirements for integration of any switchgear condition monitoring systems;

c) explosion protected 'Ex' equipment, (addressed by IEC 60079 series);

d) pillar type or construction site distribution equipment, (addressed by IEC 61439-4 and IEC 61439-5);

e) lighting and small power distribution boards rated less than 250 A.

Justification

Scope definition.

Add new subclause

1.1 General

1.1.1

This specification details the requirements for the design, materials, fabrication, inspection and testing of low-voltage power switchgear and controlgear assemblies (PSC-assemblies). This specification amends and supplements IEC 61439-1:2020 and IEC 61439-2:2020, referring sequentially to the same clause numbers.

Justification

Scope definition.

1.1.2

Clauses of IEC 61439-1 and IEC 61439-2 that are not addressed within this specification remain fully applicable as written. Where there is no direct corresponding IEC 61439-1 or IEC 61439-2 clause, a new reference clause number has been added in this specification.

Justification

Scope definition.

1.1.3

This specification addresses fully withdrawable switchgear and controlgear of cubicle and multi-cubicle type assemblies for indoor installation. This specification also applies, where specified in the requisition documents to fixed and withdrawable cubicle type assemblies and combinations thereof.

Justification

Scope definition.

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2 Normative references

Add to clause

ANSI/IEEE C37.2, *Standard for Electrical Power System Device Function Numbers, Acronyms, and Contact Designations*

IEC 60034-11, *Rotating electrical machines – Part 11: Thermal protection*

IEC 60051, *Direct acting indicating analogue electrical-measuring instruments and their accessories*

IEC 60079-14, *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*

IEC 60092-101, *Electrical installations in ships – Part 101: Definitions and general requirements*

IEC 60684, *Flexible insulating sleeving*

IEC 60688, *Electrical measuring transducers for converting A.C. and D.C. electrical quantities to analogue or digital signals*

IEC 60947-2, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-4-2, *Low-voltage switchgear and controlgear – Part 4-2: Contactors and motor-starters – Semiconductor motor controllers, starters and soft-starters*

IEC 60947-5-1, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

IEC 60947-7-1, *Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors*

IEC 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*

IEC 61511-1, *Functional safety – Safety instrumented systems for the process industry sector – Part 1: Framework, definitions, system, hardware and application programming requirements*

IEC TR 61641, *Enclosed low-voltage switchgear and controlgear assemblies – Guide for testing under conditions of arcing due to internal fault*

IEC 61850 (all parts), *Communication networks and systems for power utility automation*

IEC 61869-2, *Instrument transformers – Part 2: Additional requirements for current transformers*

IEC 61869-3, *Instrument transformers – Part 3: Additional requirements for inductive voltage transformers*

IEC 62052-11, *Electricity metering equipment (a.c.) – General requirements, tests and test conditions – Part 11: Metering equipment*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

IEC 62402, *Obsolescence management*

ISO 7010, *Graphical symbols – Safety colours and safety signs – Registered safety signs*

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3 Terms and definitions

3.4 Structural parts of assemblies

Add new term

3.4.16
bus section
number of functional units normally connected together in service by a physically continuous main busbar

Add new term

3.2.13
bus coupler
functional unit that contains a mechanical switching device, which electrically connects together two bus sections

5 Interface characteristics

5.1 General

Add to subclause

The PSC-assembly and ancillary components shall be rated for nominal supply voltage variations of ±10 %.

Justification

+/-10 % aligns with the IEC default value stated in IEC 60038 Table 3. It is also acknowledged that IEC 61892-1 Table 1 states +6/-10 %, however if we standardise on +/-10 % this should be as per manufacturer standard offering in most cases and therefore satisfies offshore application also. Note: This has been transferred from the DS to the TRS to improve standardization.

Add to subclause

The PSC-assembly and ancillary components shall be rated for nominal supply frequency variations of ±5 %.

Justification

To account for variance in power supply due to network issues. The electrical grid is expected to experience voltage sags, voltage swells, and change in frequency. This requirement ensures that the switchgear can withstand these variations.

5.2 Voltage ratings

5.2.1

Add to subclause

The assembly shall be rated to operate with a power system supply voltage harmonic content not exceeding 8 % total harmonic distortion (THD) in accordance with IEC 61000-3-2.

Justification

To define the excessive level of harmonics where it should not exceed 8% is required in IEC 61000-3 (where IEEE is 5%). 8% is more suitable for applications since it is not connected to the grid directly. In addition, the IEC standards referenced the 40th harmonic order requirement where Total harmonic distortion is calculated using harmonics orders from 2 to 40.

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5.3 Current ratings

5.3.1

Add to subclause

The rated current shall be a continuous rating following de-rating for specified service conditions.

Justification

Explicitly stating that current ratings are in relation to continuous use and account for specified service conditions removes any ambiguity and ensures the user gets an assembly which is as per design with those service conditions factored in from the outset.

5.4 Rated diversity factor (RDF)

Add new subclause

5.4.101

5.4.101.1

A rated diversity factor of 1,0 shall be applied to main (horizontal) busbars.

Justification

Ensures that the bus is designed to supply maximum rated current for the outgoing feeders.

5.4.101.2

For temperature rise tests or temperature rise calculations, a rated diversity factor of 1,0 shall be applied for sections containing a single functional unit.

Justification

To ensure that the switchgear/controlgear is tested for temperature rise for the worst case scenario which is diversity factor of 1, where all devices are running at their maximum current.

5.4.101.3

Spare equipped functional units shall have an assumed loading factor of 0,9.

Justification

To consider the spare capacity and space in sizing of switchgear and also in temperature rise tests.

5.4.101.4

Spare unequipped functional units shall have an assumed loading factor of 0,9 of the maximum potential rated current until the functional unit is equipped.

Justification

To consider the spare and space in sizing of switchgear and also in temperature rise tests.

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6 Information

6.1 Assembly designation marking

Add new list item h)

h) rated peak withstand current;

Justification

Information desirable for operation and maintenance phase of the PSC-assembly.

Add new list item i)

i) short-time withstand current;

Justification

Information desirable for operation and maintenance phase of the PSC-assembly.

Add new list item j)

j) short-time withstand duration;

Justification

Information desirable for operation and maintenance phase of the PSC-assembly.

Add new list item k)

k) degree of protection (IP rating);

Justification

Information desirable for operation and maintenance phase of the PSC-assembly.

Add new list item l)

l) form of internal separation;

Justification

Information desirable for operation and maintenance phase of the PSC-assembly.

Add new list item m)

m) internal arc resistance rating (current and duration);

Justification

Information desirable for operation and maintenance phase of the PSC-assembly.

Add new list item n)

n) arcing class.

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Justification

Information desirable for operation and maintenance phase of the PSC-assembly.

Add to subclause

The main nameplate or an adjacent label shall include the assembly identification (tag) number, purchase order number and year of assembly manufacture.

Justification

Information beneficial to solving field issues with the vendor. Usually this information is critical for the supplier to be able to retrieve the equipment data and design history.

6.2 Documentation

6.2.1 Information relating to the assembly

Add to subclause

All documents excluding manufacturer catalogues and manuals shall state the assembly identification number, user's purchase order number and manufacturer's reference number.

Justification

To ensure that all equipment documentation display the assembly identification number, purchase order number, and manufacturer reference number. Information is vital for managing the files and facilitates referencing to the supplier in case of issues during operation where manufacturer support is needed.

6.2.2 Instructions for handling, installation, operation and maintenance

Add to subclause

Assemblies supplied in multiple transport units shall be identified to facilitate reassembly at site.

Justification

To avoid misinformation and confusion during the assembly phase on site. Marking will ensure an efficient installation.

Add to subclause

Operational removable or withdrawable parts weighing more than 25 kg shall be provided with labels confirming the actual weight.

Justification

To support manual handling guide-lines, protect the workforce and facilitate the installation and removal of heavy parts of the PSC assembly such as circuit breaker, large starters, etc.

6.3 Device and/or component identification

Add to subclause

Informative labels shall have black characters on a white background.

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Justification

Standardizes signage to optimise legibility.

Add to subclause

Text only warning labels shall have white characters on a red background.

Justification

Standardizes signage to optimise legibility.

Add to subclause

The functional unit shall have circuit designation labels at the front of panel and main/auxiliary cable terminations.

Justification

Minimum requirement for information of labels on front of functional units. As per current industry minimum and all information is required to align with existing operating and insolation procedures.

Add to subclause

The functional unit shall contain the following information:

a) functional unit compartment number;

b) tag number of connected equipment;

c) service description of connected equipment;

d) circuit kW or kVA rating.

Justification

Circuit designation label with this basic information is helpful in operation, troubleshooting, and maintenance of switchboard.

Add to subclause

Identification and label plates shall be attached to non-removable parts of the PSC-assembly with stainless steel 316 fixings.

Justification

To ensure having robust fixing system for the circuit designations. Non corrodible screws will ensure having good fixation of labelling.

7 Service conditions

7.2 Special service conditions

Replace list item l) with

l) voltage harmonics in the system with a THD greater than 8 % with frequencies up to 40th;

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Justification

Defines the excessive level of harmonics where it should not exceed 8% in accordance with IEC61000-3 (where is IEEE is 5%). 8% is more suitable for applications since it is not connected to the grid directly. In addition, the IEC standards referenced the 40th harmonic order requirement where total harmonic distortion is calculated using harmonics orders from 2 to 40.

8 Constructional requirements

8.1 Strength of materials and parts

8.1.1 General

Add new subclause

8.1.1.101 General

8.1.1.101.1

PSC-assemblies shall be fully enclosed and consist of multi-cubicle sections joined to form a rigid freestanding assembly for floor mounting.

Justification

To limit PSC assemblies to multi-cubical type, floor mounting, fully enclosed types because these are suitable for typical oil & gas substation application.

8.1.1.101.2

The floor shall not be considered as being part of the enclosure.

Justification

This reduces variants and eliminates ambiguity or interpretation where an assembly is provided which the floor which was intended to be part of the enclosure or this arrangement compromises its integrity.

8.1.1.101.3

PSC-assemblies shall have one or more bus sections to which incoming units and outgoing units are connected.

Justification

To ensure that switchgear bus sections are connected through buses and coupler and not through cables. in addition, to ensure all circuit breakers are withdrawable which is important feature for interchangeability and availability.

8.1.1.101.4

Bus sections shall be linked through bus coupler units.

Justification

To ensure that the bus sections when we have more than one bus, are connected through circuit breaker which is bus coupler.

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8.1.1.101.5

Functional units with the greatest mass shall be in the lowest cubicles of the tier.

Justification

For human factors purposes inc. manual handling and also constructability.

8.1.1.101.6

PSC-assemblies specified for marine installation shall be in accordance with IEC 60092-101.

Justification

IEC 60092-101 Electrical installation in ships - Part 101: Definitions and general requirements is an industry recognised minimum standard and ensures consistency of supplier offerings for marine applications. It is an established benchmark to identify suitability and has been proven to meet purchaser requirements.

8.1.1.101.7

PSC-assemblies specified for offshore installation shall be in accordance with IEC 61892-3.

Justification

IEC 61892-3 Mobile and fixed offshore units - Electrical installations - Part 3: Equipment requirements is an industry recognised minimum standard and ensures consistency of supplier offerings for mobile and fixed offshore applications. It is an established benchmark to identify suitability and has been proven to meet purchaser requirements.

8.2 Degree of protection provided by an assembly enclosure

8.2.1 Protection against mechanical impact

Replace subclause with

PSC-assemblies shall have a degree of protection against mechanical impacts of at least IK08 in accordance with IEC 62262.

Justification

To provide mechanical impact protection against 5 joules of impact. IK08 = Protected against 5 joules impact Equivalent to impact of 1.7kg mass dropped from 300mm above impacted surface.

8.2.2 Protection against contact with live parts, ingress of solid foreign bodies and water (IP code)

Add to first paragraph

Enclosures shall have a degree of protection of at least IP3X in accordance with IEC 60529.

Justification

To indicate minimum requirement for degree of protection. IP3X will ensure protection from tools and wires greater than 2.5 mm. This is understood to be the standard offering from the majority of suppliers and is deemed essential minimum for indoor applications. The data sheet will provide options for specifying a higher ingress protection rating for applications where it is deemed necessary.

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Add new subclause

8.2.2.100 Space heaters

8.2.2.100.1

Space heaters internal to PSC-assemblies shall have a degree of protection of at least IP2X in accordance with IEC 60529.

Justification

A safety feature to prevent personnel from coming into contact, with directly or indirectly e.g. by contact via a hand tool or inspection apparatus. IP2X stands for an IP rating 2 for solids with no testing performed for liquids.

8.2.2.100.2

Space heaters internal to PSC-assemblies shall incorporate a mechanical guard where heater surface temperature exceeds 60 °C.

Justification

Prevents personnel from being injured from contact with heater surface. 60 °C is deemed as the maximum temperature metal can reach for which no injury will be incurred in accordance with IEC 60950-1.

8.2.2.100.3

PSC-assembly space heaters and motor space heaters shall be individually powered from external discrete sources.

Justification

To add safety requirements and indications about space heater which is not included in parent standard. This includes RCD MCB to avoid electrocution, indications that heater is ON. in addition to define method of control which should be by thermostats.

8.2.2.100.4

Assembly and motor space heaters shall be protected by a 30 mA residual current device with volt free contacts wired to terminals.

Justification

To provide protection against ground faults for space heater of the bus section. In addition, to ensure that there is indication signal that can report the failure of the bus section heater.

8.2.2.100.5

The bus section heater supply shall have a front of panel indicating LED lamp with a label engraved "Heater supply on".

Justification

To show the operation status of the space heater.

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8.2.3 Assembly with removable parts

Add to second paragraph

When a removable part has been removed, the minimum degree of protection shall be IP2X.

Justification

To ensure that the live parts cannot be accessed by finger (IP2X) to avoid electrocution.

Add to third paragraph

Shutters shall automatically open/cover the main circuit contact apertures and not be dependent on gravity.

Justification

To ensure robust operation of shutters which is critical to pesonnel safety.

Add to third paragraph

NOTE Where the apertures inherently provide the degree of protection IP2X, shutters may be omitted.

Justification

To ensure robust operation of shutters which is critical to people safety.

Add to subclause

Accessible shutters preventing access to normally live parts shall be marked in accordance with ISO 7010, Graphical Symbol W012 "Warning; Electricity".

Justification

Enhances the safety of personnel and is common industry practice.

Add to subclause

Accessible shutters for main circuit compartments (e.g. ACBs and larger MCCBs) shall be individually operated.

Justification

To ensure that each set of shutters for each feeder can be operated individually, which means the load side and bus side shutters can be operated individually. This feature is needed where sometimes load side need to be accessed for testing purposes while the bus side is live.

Add to subclause

Shutters shall be lockable in the closed position.

Justification

A safety feature which prevents shutters from being opened when in an unsafe condition.

Add to subclause

Accessible shutters shall be labelled in conformance with Table 16.

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Justification

To know which shutter is connected to the load and which is connected to the bus. This is safety critical during maintenance to prevent accessing live parts.

Add new Table 16

Table 16 – Accessible shutters labelling

Equipment	Label
Busbars	BUSBAR
Incoming unit supply circuit	SUPPLY
Outgoing unit feeder cables	CIRCUIT

8.4 Protection against electric shock

8.4.6 Operating and servicing conditions

8.4.6.1 Devices to be operated or components to be replaced by ordinary persons

Delete second sentence of second paragraph

Justification

Contradicts 8.2.3 paragraph 2 sentence 3 in this JIP33 overlay.

8.4.6.2 Requirements related to accessibility in service by authorized persons

Add to first paragraph

Functional unit auxiliary and control supplies from external sources shall be protected by a dedicated lockable 2-pole MCB per functional unit.

Justification

This is a safety function which also ensures production/service is not interrupted with regards to surrounding functional units.

8.4.6.2.2 Requirements related to accessibility for inspection and similar operations

Add new list item

– auxiliary and control terminals shall have a degree of protection of at least IP2X in accordance with IEC 60529.

Justification

To provide safety measures to avoid accidental contact of terminals. IP2X will ensure the connections are finger-safe.

8.4.6.2.4 Requirements related to accessibility for extension when energized

Add to subclause

Pre-drilled holes shall be provided at free ends of bus bars for future on-site extension.

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Justification

It is possible to have more than one identical unit removed, and therefore it is possible these could be reinserted into compartments which they weren't originally intended.

8.5 Incorporation of switching devices and components

8.5.2 Removable parts

8.5.2.101 Withdrawable parts

Add to subclause

Removable hardware shall be labelled to facilitate identification of its functional unit.

Justification

To facilitate the interchangeability between ACBs in the switchgear assembly. This is often the case to balance units on either side of a tie breaker. To enhance redundancy when you have an A and B unit where one is a standby...the standby should be on the opposite side of the bus.

Add to subclause

Stab-in connection fixed contact surfaces shall be protected against oxidation.

Justification

To reduce the oxidation of stab in contacts which is subjected to movement and subjected to oxidization as a result.

Add to subclause

When specified, facilities for remote testing of withdrawable main circuit units shall be provided by means of extension umbilicals or specific test modules.

Justification

Makes explicit the requirement for provision of those test facilities to perform remote testing. These are necessary for performing testing and inspection during the lifetime of the equipment, however may be deemed as outside the basic scope of supply, unless specifically requested

Add to subclause

Withdrawable functional units shall have the following positions:

a) service (main circuit and auxiliary circuit contacts connected);

b) test (auxiliary circuits connected but main circuit contacts disconnected);

c) isolated (main and auxiliary circuits disconnected);

d) removed.

Justification

These clear four positions will ease the operation and maintenance of withdrawable unit.

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Add to subclause

Withdrawable functional units which are physically identical but electrically have a different function shall be non-interchangeable.

Justification

To provide mechanical interlock to avoid insertion of non-compatible units which could result in risk to equipment and people.

Add to subclause

Withdrawable functional units that have an identical duty and rating shall be interchangeable.

Justification

This interchangeability provides operational flexibility, and can be useful during maintenance and fault finding activities.

Add to subclause

Mandatory interlocks shall be of mechanical type.

Justification

To avoid defeating the mechanical interlock, and to ensure that during failure of electrical interlock that the system will fail safe to a de-energized condition.

Add to subclause

Electrical interlocks shall "fail safe" to a de-energized state.

Justification

Safety feature which maximises equipment safety by reducing variants and always defaulting to a state to protect personnel and plant.

8.5.3 Selection of switching devices and components

Add to subclause

Circuit breakers above 100 A shall be selectivity category B in accordance with IEC 60947-2.

Justification

Category B designates circuit-breakers specifically intended for selectivity with devices on the load side. Such circuit-breakers will incorporate some form of time delay, and therefore allowing graded selectivity between circuit-breakers in series.

Add to subclause

Main incomers, bus couplers and outgoing power feeders rated 800 A and above shall be provided with withdrawable ACBs or non-withdrawable load switches.

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Justification

Reduces variants by standardising of equipment types of larger apparatus, thus aligning with other site equipment and plant, and ensuring operator familiarity with high current carrying equipment.

Add to subclause

Outgoing power feeders rated 630 A and below shall be provided with fuse switch units or MCCBs.

Justification

Standardises mode of operation for power feeders rated below 630 amps and provides.

Add to subclause

Motor starters shall be provided with a combination of fuse-switch units or MCCBs, contactors and protection relays.

Justification

To specify that the starter should include fuse-switch or MCCB for short circuit protection, contactors for controlling the motor, and protection relay to do protection functions. This is to avoid controlling the motors by MCCBs only.

Add to subclause

Lighting and small power feeders shall be provided with fuse-switch units or MCCBs.

Justification

Lighting load and small power feeders can be protected by only fuse or MCCBs as they do not need to be operated frequently, and does not sophisticated protection.

Add to subclause

Switching devices shall switch all phases and neutrals where present.

Justification

To ensure switching all phases and neutral, which is safety critical requirement to avoid electrical shocks from neutral.

Add to subclause

Outgoing circuit breakers that do not require selective protection shall be selectivity category A in accordance with IEC 60947-2.

Justification

To ensure having coordination between switching devices. category B is required when coordination is needed such as income feeder for example, category A where selective protection is not needed such as MCCBs.

Add to subclause

Outgoing circuit breakers that require selective protection shall be selectivity category B in accordance with IEC 60947-2.

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Justification

To ensure having coordination between switching devices. category B is required when coordination is needed such as income feeder for example, category A where selective protection is not needed such as MCCBs.

Add to subclause

Auxiliary control circuit breakers shall be selectivity category A in accordance with IEC 60947-2.

Justification

To ensure having coordination between switching devices. category B is required when coordination is needed such as income feeder for example, category A where selective protection is not needed such as MCCBs.

Add to subclause

Load switches shall be of the "fault make, load break" type.

Justification

A switch capable of closing onto a fault and capable of breaking on load. This provides protection to the operator where they may inadvertently close on to a short circuit scenario and the load break ensures the load does not have to be stopped before opening the switch.

Add to subclause

Load switches shall be utilization category AC-22 in accordance with IEC 60947-3

Justification

AC 22 utilization category is needed for switching of mixed loads, inductive and resistive loads including moderate overloads.

Add new subclause

8.5.3.101 Incoming and bus coupler units

8.5.3.101.1

Metering supplies shall be protected by fully insulated pattern HRC type fuses fixed directly to the busbar system with provision for safe change-out.

Justification

To provide adequate protection for the metering devices, and safety protection to prevent bus bar fault. in addition, HRC fuse is needed as speed is needed to this application as it is connected to the bus bar.

8.5.3.101.2

For metering supplies, a secondary means of isolation shall be provided.

Justification

This is a safety measure due to the fuses being fixed directly to the busbar system as described in the requirement

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8.5.3.101.3

For three-phase and neutral functional units, the neutral pole current rating shall be not less than that for the PSC-assembly neutral busbars.

Justification

To avoid having underrated neutral pole which is current carrying conductor, depending on the method of grounding.

Add new subclause

8.5.3.102 Isolating switching devices (disconnectors)

8.5.3.102.1

An isolating switching device shall be a mechanical switch, a disconnector fuse or a fuse disconnector.

Justification

To provide the requirements/selection of options for isolation switches.

8.5.3.102.2

Switches, disconnectors, switch-disconnectors and fuse combination units shall be in accordance with IEC 60947-3.

Justification

To ensure that all switches, disconnectors, switch-disconnectors and fuse combination are type tested according to their original standard which is IEC 60947-3

8.5.3.102.3

Switches, disconnectors, switch-disconnectors and fuse combination units shall have a utilization category AC 22 when switching mixed resistive and inductive loads.

Justification

To define the right duty for the switches, disconnectors, switch-disconnectors and fuse combination. Aligns with definition of AC 22 in IEC 60947-3.

8.5.3.102.4

Switches, disconnectors, switch-disconnectors and fuse combination units shall have a utilization category AC 23 when switching motor loads or highly inductive loads.

Justification

To define the right duty for the switches, disconnectors, switch-disconnectors and fuse combination. Aligns with definition of AC 23 in IEC 60947-3.

8.5.3.102.5

The number of operating cycles shall be in accordance with category A of IEC 60947-3, Table 4.

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Justification

To indicate that the number of operating cycles shall be as per default value for category A as per table 4 of IEC 60947-3.

8.5.3.102.6

Disconnector fuse and fuse disconnectors shall be utilization category AC 23B for uninterrupted duty.

Justification

To provide the requirements/selection of options for isolation switches. Aligns with definition of AC-23B in IEC 60947-3.

8.5.3.102.7

Disconnector fuse and fuse disconnector rated short-circuit making capacity shall be at least equal to the busbar prospective short-circuit current.

Justification

To provide the requirements/selection of options for isolation switches.

8.5.3.102.8

Switching mechanisms shall be of independent manual operating, air-break type with quick-snap action "make and break" features.

Justification

To provide the requirements/selection of options for isolation switches.

8.5.3.102.9

Switching mechanisms shall be accessible and operable from the front of the assembly without opening a cover.

Justification

To provide the requirements/selection of options for isolation switches.

8.5.3.102.10

Switching mechanisms shall have the "I" (on) and "O" (off) positions of the switches identified at the front of the switching device.

Justification

To provide the requirements/selection of options for isolation switches.

Public Review Draft

8.5.3.103 Circuit breakers

Add new subclause

8.5.3.103.1 Air circuit breakers

8.5.3.103.1.1

Circuit-breaker operating mechanisms shall have spring stored energy.

Justification

Circuit-breaker operating mechanisms shall have spring stored energy.

8.5.3.103.1.2

Circuit-breaker operating mechanisms shall have a spring charging motor.

Justification

Standardizes circuit breaker features to that which align with our industries requirements and ensures operator familiarity is maintained, as this is critical to safety. Also aligns with existing OpCo operating and isolation procedures which must be adhered to.

8.5.3.103.1.3

Circuit-breaker operating mechanisms shall have a shunt trip coil release of energized-to-trip type.

Justification

Standardizes circuit breaker features to that which align with our industries requirements and ensures operator familiarity is maintained, as this is critical to safety. Also aligns with existing OpCo operating and isolation procedures which must be adhered to.

8.5.3.103.1.4

Circuit-breaker operating mechanisms shall have a closing release coil with an interlock to inhibit closing when a trip condition exists.

Justification

Standardizes circuit breaker features to that which align with our industries requirements and ensures operator familiarity is maintained, as this is critical to safety. Also aligns with existing OpCo operating and isolation procedures which must be adhered to.

8.5.3.103.1.5

Circuit-breaker operating mechanisms shall have an anti-pumping device.

Justification

Standardizes circuit breaker features to that which align with our industries requirements and ensures operator familiarity is maintained, as this is critical to safety. Also aligns with existing OpCo operating and isolation procedures which must be adhered to.

8.5.3.103.1.6

Circuit-breaker operating mechanisms shall have spring charged/discharged indicator.

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Justification

Standardizes circuit breaker features to that which align with our industries requirements and ensures operator familiarity is maintained, as this is critical to safety. Also aligns with existing OpCo operating and isolation procedures which must be adhered to.

8.5.3.103.1.7

Circuit-breaker operating mechanisms shall have a manual spring charge facility.

Justification

Standardizes circuit breaker features to that which align with our industries requirements and ensures operator familiarity is maintained, as this is critical to safety. Also aligns with existing OpCo operating and isolation procedures which must be adhered to.

8.5.3.103.1.8

Circuit-breaker operating mechanisms shall have an operations counter.

Justification

Standardizes circuit breaker features to that which align with our industries requirements and ensures operator familiarity is maintained, as this is critical to safety. Also aligns with existing OpCo operating and isolation procedures which must be adhered to.

8.5.3.103.1.9

Contactor feeders shall have a manual mechanical trip facility with a guarded manual release.

Justification

The above requirements will enhance the reliability and flexibility of the ACB.

8.5.3.103.1.10

Circuit-breakers shall have at least two normally open (52a) auxiliary contacts wired to terminals in the outgoing terminal block.

Justification

Provides a minimum level of interfacing with site systems so circuit breaker status indication can be integrated.

8.5.3.103.1.11

Circuit-breakers shall have at least two normally closed (52b) auxiliary contacts wired to terminals in the outgoing terminal block.

Justification

Provides a minimum level of interfacing with site systems so circuit breaker status indication can be integrated.

8.5.3.103.1.12

Withdrawable circuit-breakers shall have an "in service" position auxiliary contact wired to terminals in the outgoing terminal block.

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Justification

Provides a minimum level of interfacing with site systems so circuit breaker status indication can be integrated.

8.5.3.103.2 Moulded case circuit breakers

8.5.3.103.2.1

MCCB outgoing feeder functional units that are not in combination with a contactor shall have a shunt trip facility when remote tripping is provided.

Justification

To have shunt trip which is extra tripping mechanism that is needed to trip the breaker externally such as remote tripping. in addition, to add for the feature of actuating the breaker while the door is closed which is safety feature. in addition, breaker auxiliary contacts are sometimes needed for protection and control purposes.

8.5.3.103.2.2

MCCB outgoing feeder functional units that are not in combination with a contactor shall be manually actuated from the front of the panel without opening the door.

Justification

To have shunt trip which is extra tripping mechanism that is needed to trip the breaker externally such as remote tripping. in addition, to add for the feature of actuating the breaker while the door is closed which is safety feature. in addition, breaker auxiliary contacts are sometimes needed for protection and control purposes.

8.5.3.103.2.3

MCCB outgoing feeder functional units that are not in combination with a contactor shall have clear indication of the "O" (off), "Trip" and "I" (on) positions on the front of the device.

Justification

To have shunt trip which is extra tripping mechanism that is needed to trip the breaker externally such as remote tripping. in addition, to add for the feature of actuating the breaker while the door is closed which is safety feature. in addition, breaker auxiliary contacts are sometimes needed for protection and control purposes.

8.5.3.103.2.4

MCCBs shall be provided with auxiliary volt free contacts for trip and status indication.

Justification

To have shunt trip which is extra tripping mechanism that is needed to trip the breaker externally such as remote tripping. in addition, to add for the feature of actuating the breaker while the door is closed which is safety feature. in addition, breaker auxiliary contacts are sometimes needed for protection and control purposes.

Public Review Draft

Add new subclause

8.5.3.104 Main circuit fuses

8.5.3.104.1

Fuses used for main circuit protection shall be in accordance with IEC 60269-2.

Justification

To specify the type, and utilization category, and coordination type of fuses that need to be used.

8.5.3.104.2

Fuses shall be high rupture capacity (HRC) type general purpose fuse links, utilization category gG for feeders and aM / gM for motor circuits to provide type 2 co-ordination.

Justification

To specify the type, and utilization category, and coordination type of fuses that need to be used

8.5.3.104.3

DIN D type fuses shall only be offered with ratings up to 63 A and be provided with short-circuit limiting devices up to 400 A.

Justification

Limits the size of DIN fuses and improves standardisation.

8.5.3.104.4

Fuse holders shall have a minimum degree of protection of at least IP2X.

Justification

IP2X is considered finger safe thus protecting personnel removing or replacing fuses.

Add new subclause

8.5.3.105 Motor starters and contactor feeders

8.5.3.105.1

Motor starters and contactor feeders shall be provided with fuse or MCCB protected electromagnetic contactors.

Justification

To confirm the motor must be controlled through fuse and contractor or MCC and contractor, as motors require high number of start/stop operations which will be achieved by the contractor.

8.5.3.105.2

Emergency stop pushbuttons shall be red, mushroom head, stay-put with a manual reset.

Public Review Draft

Justification

To ensure the emergency stop button is visible, cannot be operated by mistake, and trip free where it should operate as needed irrespective of status of other control switches.

8.5.3.105.3

Front of panel actuators shall be shrouded and operable only with the functional unit in the test position.

Justification

To specify colour of start pushbutton and to specify shrouded type to avoid unintentional operation of the pushbutton, and to ensure that it will not be operative unless the unit is in test position. This is used for testing the functional unit and as the actual start pushbutton is from field.

8.5.3.105.4

The colour and marking of actuators (push buttons) shall be in accordance with IEC 60204-1.

Justification

Consistency with regards to colouring and marking is a safety factor to aid operator familiarity with equipment. IEC 60204-1 Safety of machinery - Electrical equipment of machines - Part 1: General requirements.

8.5.3.105.5

Where colour defines function, actuators shall be green for start/on and red for stop/off.

Justification

Consistency with regards to colouring and marking is a safety factor to aid operator familiarity with equipment. IEC 60204-1 Safety of machinery - Electrical equipment of machines - Part 1: General requirements. The colour and marking of actuators (push buttons) shall be in accordance with IEC 60204-1. Where colour is used to define function, start/on actuators shall be green and stop/off actuators, red. The colour and marking of actuators (push buttons) shall be in accordance with IEC 60204-1. ***Where colour defines function, actuators shall be green for start/on and red for stop/off. See IEC 60204-1, 10.2:***
Actuators (see 3.1.1) shall be colour-coded as follows.
The colours for START/ON actuators should be WHITE, GREY, BLACK or GREEN with a preference for WHITE. RED shall not be used.
The colour RED shall be used for emergency stop and emergency switching off actuators (including supply disconnecting devices where it is foreseen that they are for use in an
emergency). If a background exists immediately around the actuator, then this background shall be coloured YELLOW. The combination of a RED actuator with a YELLOW background shall only be used for emergency operation devices.
The colours for STOP/OFF actuators should be BLACK, GREY, or WHITE with a preference for BLACK. GREEN shall not be used. RED is permitted, but it is recommended that RED is not used near an emergency operation device.
WHITE, GREY, or BLACK are the preferred colours for actuators that alternately act as START/ON and STOP/OFF actuators. The colours RED, YELLOW, or GREEN shall not be used.

8.5.3.105.6

Contactors, motor starters and associated protective devices shall be in accordance with to IEC 60947-4-1.

Public Review Draft

Justification

This to ensure starters are constructed for the right duties, short circuit rating, coordination and etc.. in addition, contact, and also testing and verification of contactor performance.

8.5.3.105.7

Contactors shall be rated for uninterrupted duty and class 12 intermittent duty, with utilization category at least AC 3 in accordance with IEC 60947-1, Annex A.

Justification

Confirms the duty of the contractor to match oil and gas applications where AC 3 contractor are preferred for the starting of squirrel-cage motors, and switches off motor during the running time.

8.5.3.105.8

Labels shall be provided adjacent to fuses, confirming fuse ratings in accordance with circuit design.

Justification

Confirms intended fuse rating of circuit, where fuses may have been removed, therefore avoids incorrect fuses being installed.

8.5.3.105.9

No-load operating mechanical endurance shall not be less than 1 million cycles.

Justification

As per industry standard, which is readily achievable and not considered a significant cost-adder.

8.5.3.105.10

For three-phase, four wire (TN) systems, contactors shall have a control voltage derived from the phase and neutral on the circuit (load) side of the isolating device.

Justification

To ensure that every starter has it is own dedicated control power supply which increase the reliability and availability of control power. in addition, it needs to be provided on load side of isolating device to ensure people safety where the control power will be off when the isolating device is opened.

8.5.3.105.11

Control circuit supplies shall be provided with fuse or MCB protection within each functional unit.

Justification

Provides protection for control circuit to clear faults.

8.5.3.105.12

For three-phase, three-wire (IT) systems, contactors shall have an operating control voltage of 230Vac, supplied via a control transformer.

Public Review Draft

Justification

To ensure that there is a dedicated control power transformer to serve each section, to enhance reliability of the control voltage supply.

8.5.3.105.13

Primary windings of control transformers shall be fuse or MCB protected.

Justification

To ensure that faults in control power transformer are cleared without impacting the whole bus. without fuse, a fault on CPT is a fault in the bus.

8.5.3.105.14

The secondary star point shall be earthed at a single point via an accessible removable link.

Justification

Reduces variants with the specification defined above being the default offering as is industry norm where this configuration offers many perceived advantages. Whilst it should also be noted that there are some perceived disadvantages to this configuration its accepted that the Y-Y offering accounts for >80% of applications

8.5.3.105.15

Control circuit supplies shall be protected by fuse or MCB, located external to the functional units.

Justification

Protection to the secondary control circuit is required to clear faults in control circuit.

8.5.3.105.16

Motor space heater circuits shall be energized when the main circuit switching device is in the open, service or test position.

Justification

To ensure that the space heater will work immediately when the motor is de-energized, to avoid any condensation on the motor.

8.5.3.105.17

The motor heater supply shall be automatically isolated when the main circuit is isolated.

Justification

This is a safety requirements to ensure that there is no presence of voltage including space heater when the starter is isolated. this is to avoid shock hazard.

8.5.3.105.18

The motor space heater power supply shall be distributed from dedicated motor heater auxiliary bus wiring within each bus section of the PSC-assembly.

Public Review Draft

Justification

To ensure that there is a reliable power supply for the motor space heaters

8.5.3.105.19

When earth fault protection is specified, it shall be manual reset only.

Justification

Earth fault protection is needed for some sizes of motors, and reset device is needed to return the motor back to service after investigating the trip. in addition, the earth fault protection should not reset on loss of control power as this could happen if there is a voltage dip in the system.

Add new subclause

8.5.3.106 Motor protection

8.5.3.106.1

Motor protection functionality shall be in accordance with ANSI/IEEE C37.2.

Justification

Industry recognised standard for motor protection functionality.

8.5.3.106.2

Three-phase thermal overload protection shall be in accordance with ANSI 49.

Justification

Industry recognised standard for thermal overload protection of motors.

8.5.3.106.3

Motor protection functionality shall be three-phase instantaneous or definite-time short circuit protection ANSI 50/51.

Justification

Industry recognised standard for three-phase instantaneous or definite-time short circuit protection of motors.

8.5.3.106.4

Motor protection functionality shall be provided by relays supplied by current transformers within the withdrawable part of the functional unit.

Justification

To specify the default protection of the motor which is thermal overload and instantaneous short circuit protection and when to use earth fault protection. These requirements are considered the base for protection of electric motors.

8.5.3.106.5

Protection relay settings shall be configurable by a single-phase test supply.

Public Review Draft

Justification

Ensures that configuration is standardised.

8.5.3.106.6

Earth fault protection shall be provided for motors rated equal to or greater than 30 kW.

Justification

Standardises on where earth fault protection is provided and 30 kW has been agreed by the industry as being a pragmatic introduction point.

8.5.3.106.7

Earth fault protection sensitivity shall be less than 10 % of the rated nominal motor current or 5 A.

Justification

Standardises earth fault protection sensitivity and ensures its always set at a pragmatic level.

8.5.3.106.8

Circuits supplying motors with type of protection "e" shall be in accordance with IEC 60079-14.

Justification

There are specific requirements relating to motors with a type of protection "e" in IEC 60079-14, this requirement ensures brings this to the attention of the supplier.

8.5.3.106.9

Motors located in a hazardous area and have a power rating exceeding 1,0 kW shall be individually protected against overload.

Justification

Ensures overload protection for motors in a hazardous area is appropriate for the environment, and that potential overheating in an explosive atmosphere is safeguarded against.

8.5.3.106.10

Motor thermal protection units shall be in accordance with IEC 60034-11.

Justification

To ensure that thermistors conform to IEC 60034-11 which is the industry standard.

8.5.3.106.11

Contactors shall be selected in accordance with the associated HRC fuse earth fault breaking current.

Justification

This ensures that contactor will be protected by the fuse under fault conditions.

Public Review Draft

8.5.3.106.12

Where IEDs are specified, the additional requirements listed in Table 17 shall be provided.

Justification

Motor protection can be done through IEDs and this requirement is to define the default requirements whenever an IED is used. it includes basic protection functions including locked rotor, undercurrent protection, unbalance protection, lockout, etc.

Add new Table 17

Table 17 – IED requirements

	ANSI device code	IEC nomenclature	Motors < 110 kW	Motors ≥ 110 kW	Motors ≥ 185 kW
Locked rotor protection	51LR			X	X
Definite-time undercurrent protection	37	I<	O	O	O
Inverse-time unbalance protection based on negative phase-sequence current	46	I2>	O	O	O
Motor start-up supervision based on thermal stress calculation	48	Is ts 2		X	X
Cumulative start-up time counter and restart disable function	66	Σtsi		X	X
Lockout relay	86			X	X
Front-of-panel protection reset			O	O	O
Key X = user required O = fit only if defined as required in user diagrams					
NOTE For IED motor protection relays, protection reset should be via the IED HMI.					

Add new subclause

8.5.3.107 Integrated adjustable speed drives and power semiconductor systems

8.5.3.107.1

Adjustable speed drives (ASD) and power semiconductor systems (PSS) shall be in accordance with IEC 60947-4-2.

Justification

This is industry standard and reduces variants.

8.5.3.107.2

ASDs and PSSs forming an integral part of the PSC-assembly shall be selected and rated for continuous duty at kW rating.

Public Review Draft

Justification

Standardises duty rating of these integrated units. Continuous duty aligns with other JIP33 specifications.

8.5.3.107.3

Compartments upstream of protective devices shall have arc containment ratings in accordance with the IEC TR 61641 requirements specified.

Justification

Aligns those compartments with that of the overall arc rating of the assembly as defined in IEC TR 61641 Enclosed low-voltage switchgear and controlgear assemblies – Guide for testing under conditions of arcing due to internal fault.

Add new subclause

8.5.3.108 Current transformers

8.5.3.108.1

Current transformers shall be in accordance with IEC 61869-2.

Justification

To define the CT parameters that are required later in using and maintaining the current transformer.

8.5.3.108.2

Current transformer accuracy class shall be class 1 for measuring incoming devices.

Justification

To define the minimum accuracy requirement for metering and protection CTs.

8.5.3.108.3

Current transformer accuracy class shall be class 3 for measuring outgoing devices.

Justification

To define the minimum accuracy requirement for metering and protection CTs.

8.5.3.108.4

Current transformer accuracy class shall be class 5P for protective devices.

Justification

To define the minimum accuracy requirement for metering and protection CTs. 5P confirms 5% composite error at rated accuracy limit primary current in accordance with IEC 61869-2.

8.5.3.108.5

Current transformers connected to external circuits shall have shorting links located at the outgoing terminals.

Public Review Draft

Justification

The CT shorting links are required to prevent high voltages being induced at the CT secondary terminals.

8.5.3.108.6

Current transformers secondary windings shall be connected to earth via a single disconnecting link.

Justification

The CT shorting links are required to prevent high voltages being induced at the CT secondary terminals.

Add new subclause

8.5.3.109 Voltage transformers

8.5.3.109.1

Voltage transformers shall be in accordance with IEC 61869-3.

Justification

To provide the details of the VTs which are necessary to operate and maintain the VT.

8.5.3.109.2

Voltage transformers shall be of dry insulation type with an earthed screen between the primary and secondary winding.

Justification

Dry insulation are more reliable and earned screen will reduce electrical stresses. in addition, to show how the VT should be protected to ensure it is fully protected.

8.5.3.109.3

Voltage transformers shall be protected by MCBs or fuses on the primary side.

Justification

Standardises protection type whilst ensuring this is as per industry standard for what will inevitably be the higher voltage side.

8.5.3.109.4

Voltage transformers shall be protected by MCBs on secondary windings.

Justification

Standardises protection type whilst ensuring this is as per industry standard for what will inevitably be the lower voltage side.

8.5.3.109.5

Voltage transformer accuracy class shall be class 1,0 for measuring devices.

Public Review Draft

Justification

To define the default minimum accuracy requirements.

8.5.3.109.6

Voltage transformer accuracy class shall be class 3P for protective devices.

Justification

To define the default minimum accuracy requirements.

8.5.3.109.7

With the exception of IT systems with insulation monitoring, three-phase voltage transformers shall be provided with star connection and neutral earthed at one point on the secondary.

Justification

To define the connection type for the three phase transformer. star-star grounded voltage transformer is considered in this application as it can pass all harmonics between primary and secondary.

8.5.3.109.8

For IT systems with insulation monitoring, the voltage transformer on the primary side shall be connected line to line.

Justification

To define the connection type for the three phase transformer.

8.5.3.109.9

Voltage transformer secondary connections shall be wired to terminals for external wiring when remote metering is required.

Justification

To provide provision for remote measuring.

8.5.3.109.10

Secondary circuits shall be equipped with terminals with measuring bushings.

Justification

To provide provision for voltage testing/measurement using portable or other stationary devices. example of that is the portable power quality device.

8.5.3.109.11

When the voltage transformer secondary voltage is used for control or interlock, an MCB with signal contacts for trip indication shall be provided.

Public Review Draft

Justification

To provide indication about the status of the MCB to show that the MCB has tripped. This is because the VT secondary is critical as there is control or interlock functions dependent on that.

Add new subclause

8.5.3.110 Unearthed electrical supplies (IT)

8.5.3.110.1

Insulation monitoring and earth fault detection shall be provided for PSC-assemblies with unearthed electrical supplies (IT).

Justification

Because each fault will not be detected by the protection devices, as there is no path to ground.

8.5.3.110.2

Insulation monitoring and earth fault detection shall have continuous monitoring of insulation resistance of each bus section.

Justification

to be able to detect the ground faults in the system.

8.5.3.110.3

Insulation monitoring and earth fault detection shall have provision for audible and electronic alarm indication of low insulation resistance.

Justification

To ensure that the ground faults are detected and attended in ungrounded system. Ground faults in ungrounded system are limited and not easy to detect.

8.5.3.110.4

Insulation monitoring and earth fault detection shall have a data interface for transmission of insulation resistance values and alarms to switchgear data management units.

Justification

To ensure that the ground faults are detected and attended in ungrounded system. Ground faults in ungrounded system are limited and not easy to detect.

8.5.3.110.5

Insulation monitoring and earth fault detection systems shall provide automatic location of earth faults by the use of current transformers fitted in motor starters or feeders.

Justification

To ensure that the ground faults are detected and attended in ungrounded system. Ground faults in ungrounded system are limited and not easy to detect.

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8.5.3.110.6

Insulation monitoring and earth fault detection shall have selectable insulation impedance ranges.

Justification

To ensure that the ground faults are detected and attended in ungrounded system. Ground faults in ungrounded system are limited and not easy to detect.

8.5.3.110.7

Insulation monitoring and earth fault detection shall have local display of system insulation resistance value at each PSC-assembly.

Justification

To ensure that the ground faults are detected and attended in ungrounded system.

8.5.3.110.8

Insulation monitoring and earth fault detection systems shall be compatible with adjustable speed drive and power semiconductor systems.

Justification

To ensure that the ground faults are detected and attended in ungrounded system.

Add new subclause

8.5.3.111 Transfer systems

8.5.3.111.1

Automatic transfer systems (ATS) or manual transfer systems (MTS) shall be rated for switchgear operating at normal conditions with the bus section circuit breaker open.

Justification

To ensure seamless transfer of power in redundant systems with tie open.

8.5.3.111.2

The principle for operation shall be that ATS operates as non-synchronous transfer and MTS operates as synchronous transfer.

Justification

To ensure seamless transfer of power in redundant systems with tie open.

8.5.3.111.3

Instantaneous overcurrent (ANSI 50) and earth fault (ANSI 50N) relays shall be provided in the incomer to inhibit the auto-transfer facility on detection of a bus section fault.

Public Review Draft

Justification

These protection function elements will check if there is fault in the bus section. the transfer will be blocked in case the there is a fault in the bus section.

8.5.5 Accessibility

Add new subclause

8.5.5.101

8.5.5.101.1

Equipment shall be accessible from the front, except for cable termination chambers accessible from the rear or front.

Justification

Front access is easier for accessibility and maintenance and also safer as the operator or maintenance personnel will work on the intended functional unit.

8.5.5.101.2

Components in back-to-wall or back-to-back mounted assemblies shall be accessible from the front only.

Justification

Front access is needed in back to back installations to ensure that the maintenance can be done easily.

8.5.5.101.3

Hinged doors shall open at least 95° on the vertical axis and not be obstructed by adjacent equipment or doors.

Justification

Hinged doors provides easy and handy access to the functional unit without the need to open bolts. in addition, the use of restraints help to fix the door especially when three is vibration and movement such as floating offshore, outdoor. in addition, restraints are needed to when the door is equipped with electrical components to avoid operating them by mistake.

8.5.5.101.4

Door restraints shall be provided for securing doors in the open position in the following cases:

a) when placed on floating offshore installations;

b) when located outdoors (exposed to wind);

c) when door is equipped with electrical components.

Justification

To facilitate the operation and maintenance, and also to avoid miss-operation of control/protection devices by mistake. Door restrains will ensure that the door is fixed.

8.5.5.101.5

Hinged doors shall not require the use of tools to open.

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Justification

To ensure that the doors are readily used without the need to use tools. in addition, the door should be bonded to the body of the switchgear for the earthing purposes.

8.5.5.101.6

Doors or covers that are required to be locked when equipment is in operation shall facilitate padlocking.

Justification

To ensure that the doors are readily used without the need to use tools. in addition, the door should be bonded to the body of the switchgear for the earthing purposes.

8.5.5.101.7

Key operated fixed door locking devices shall not be provided.

Justification

To ensure that the doors are readily used without the need to use tools. in addition, the door should be bonded to the body of the switchgear for the earthing purposes.

8.5.5.101.8

The PSC-assembly height shall be a maximum of 2,5 m.

Justification

To specify the default maximum hight which is 2.5 m which is adequate to conduct operation and maintenance of the assembly.

8.5.6 Barriers

8.5.6.1

Add to subclause

PSC-assemblies shall provide the following minimum degrees of protection in accordance with IEC 60529 and Table 18.

Justification

To indicate the minimum degrees of protection between compartments, which is necessary to avoid migration of faults between units, and movements of objects between units which can cause a fault.

Public Review Draft

Add new Table 18

Table 18 – Minimum degrees of protection

Location	Minimum degree of protection
Between horizontal busbar compartments and any other compartment	IP 2X
Between incoming and bus-coupler sections	IP 2X
Between main busbar systems of two separate sections	IP 2X
Between panels	IP 2X
Between compartment of each functional unit and other compartments	IP XXB

8.5.8

Replace subclause with

Discrete indication lamps shall be light emitting diode (LED) types.

Justification

To ensure the used lamps are LED type and are interchangeable.

Add to subclause

Discrete indication lamps shall operate at the same voltage for interchangeability purposes except those directly connected to heater supply circuits.

Justification

To ensure the used lamps are LED type and are interchangeable. provides rationalization of spare parts.

Add to subclause

Indicator light colour coding shall be in accordance with IEC 60073 and Table 19.

Justification

To build a common convention of the colors meanings for each functional unit. For example red means danger which is meaning the circuit breaker is closed and the unit is operational.

Add new Table 19

Table 19 – Colour coding of status indicator

Colour	Meaning	PSC-assembly application	
	Safety of persons or environment	ACB	Motor starter / contactor feeder
Red	Danger	Closed (On)	Running (On)
Yellow	Warning/caution	Tripped	Tripped
Green	Safe	Open (Off)	Stopped (Off)
Blue	Mandatory significance	Trip circuit healthy (or unhealthy)	
White	No specific meaning assigned	Voltage indication (Heater On)	Motor heater on

Public Review Draft

Add new subclause

8.5.10 Auxiliary components

8.5.10.1 General

8.5.10.1.1

Control and indication devices mounted on the front of the panel shall be in a consistent, logical, ergonomic and symmetrical arrangement.

Justification

To facilitate the correct operations and to allow the end user for easy access and understanding.

8.5.10.1.2

Where specified, facilities for calibration and injection testing protection relays from the front of the functional unit and without disconnection of secondary wiring shall be provided.

Justification

The purpose of test blocks is allow easy access to test relays, and also to avoid altering internal wiring which could introduce additional faults.

8.5.10.1.3

Control and auxiliary device utilization categories shall be in accordance with IEC 60947-5-1.

Justification

Standardises performance requirements for the auxiliary relays and other control devices.

8.5.10.1.4

Control and auxiliary devices shall be mechanical duration class 1.

Justification

Standardises performance requirements for the auxiliary relays and other control devices.

8.5.10.1.5

Control and auxiliary devices shall be rated for 120 cycles per hour (each relay).

Justification

Standardises performance requirements for the auxiliary relays and other control devices.

8.5.10.1.6

Rated operational currents (I_e) shall be at least 5 A at 230 V AC rated operational voltage and 1 A at 110 V DC rated operational voltage.

Justification

Standardises performance requirements for the auxiliary relays and other control devices.

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8.5.10.1.7

DC switching elements shall be at least utilization category DC-13.

Justification

Standardises performance requirements for the auxiliary relays and other control devices.

8.5.10.1.8

AC switching elements shall be utilization category AC-15.

Justification

Standardises performance requirements for the auxiliary relays and other control devices.

8.5.10.1.9

Plug-in type auxiliary components shall be provided with retaining clips.

Justification

To prevent false tripping of equipment which may be caused by vibration or end-user interaction

8.5.10.1.10

Where required, emergency shutdown interface relays shall be SIL rated in accordance with IEC 61511-1.

Justification

To prevent false tripping of equipment which may be caused by vibration or end-user interaction

8.5.10.2 Indicating and measuring devices

8.5.10.2.1 General

Indicating instruments shall be digital or analogue and have minimum accuracy class of 2.5.

Justification

To indicate that that indicating instrument can be either analogue or digital. In addition, the analogue instrument shall be flush mounted to ensure safe wire connections, and better feasibility to operators.

8.5.10.2.2 Analogue instruments

Analogue instruments shall be flush mounted and conform to relevant parts of IEC 60051.

Justification

To indicate that that indicating instrument can be either analogue or digital. In addition, the analogue instrument shall be flush mounted to ensure safe wire connections, and better feasibility to operators.

8.5.10.2.3 Digital instruments

8.5.10.2.3.1

Multi-functional digital measuring devices shall have an accuracy class of 1,0.

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Justification

Digital measuring devices need higher accuracy, and defining accuracy class of 1,0 will ensure ability to measure voltage, current, power, and power factor accurately.

8.5.10.2.3.2

Multi-functional digital measuring devices shall display current, voltage and power factor per phase together with instantaneous and a running total of kWhrs.

Justification

To provide real data about voltage, current and consumption which is vital information for effective operation and maintenance of the switchgear/controlgear.

8.5.10.2.3.2

Multi-functional digital measuring devices displays shall be visible without ambient lighting.

Justification

To ensure visibility of the readings.

8.5.10.2.3.1

When specified, static energy meters shall be rated for three-phase unbalanced loads in accordance with IEC 62052-11.

Justification

To indicate the minimum accuracy class for the energy meter, and also to indicate that the energy meter should have pulse transmitter to ensure the measurement can be sent to remote end.

8.5.10.2.3.2

Energy meters and maximum demand meters shall be suitable for three-phase unbalanced load.

Justification

To ensure that the meter is reading on all three phases to have accurate measurements about demand.

8.5.10.2.3.3

Watt-hour integrating meters shall be fitted with a pulse transmitter.

Justification

To ensure that there is provision for sending consumed watt-hour for input to a remote supervisory system or a metering summation scheme..

8.5.10.2.3.4

Where required, test terminal blocks shall be provided on the panel front for kWh meter testing.

Justification

To ensure that there is testing facility (access) to test the energy meters.

Public Review Draft

8.5.10.2.3.5

Where specified, maximum current demand indicators with a period of 30 min shall be provided for incomers and outgoing feeders in accordance with IEC 62052-11.

Justification

To ensure high accuracy in the maximum demand measured.

8.5.10.2.4 Transducers

8.5.10.2.4.1

Transducer outputs shall be in accordance with IEC 60688 and wired to terminals in the outgoing terminal block.

Justification

To define requirement for transducers which need to be wired to a separate terminal block for external connections. in addition, the output should not exceed 20 mA, even during up normal conditions such as motor starting, for safety purposes

8.5.10.2.4.2

The output signal of the transducer shall not exceed 20 mA, even when the input value is more than 100 % of the defined output range (e.g. during motor starting).

Justification

To define requirement for transducers which need to be wired to a separate terminal block for external connections. in addition, the output should not exceed 20 mA, even during up normal conditions such as motor starting, for safety purposes

8.5.10.3 Analogue instruments

8.5.10.3.1

Analogue devices shall display black print on a white background identifying actual primary circuit values.

Justification

To ensure the current or voltage reading is easily visible for the operator to read. Having while fascia and black pointer will enhance visibility.

8.5.10.3.2

External zero adjustment shall be provided.

Justification

To ensure that there is a provision for device adjustment.

8.5.10.3.3

Analogue ammeters and voltmeters shall have a deviation at the rated value of about 80 % of the full scale range.

Public Review Draft

Justification

To ensure that the analogue ammeter scale can measure the switchboard voltage.

8.5.10.3.4

Analogue meters shall conform to IEC 60051-2.

Justification

To specify the details of the analogue voltmeter including selector switch between phases, and off position. in addition, to indicate that it take input from voltage transformer only.

8.5.10.3.5

Analogue meters shall have a selector switch and an off position.

Justification

To specify the details of the analogue meter including selector switch between phases, and off position.

8.5.10.3.6

Voltmeters shall be operated from the VT secondary windings.

Justification

To indicate that it take input from voltage transformer only.

8.5.10.3.7

Ammeter selector switches shall be "make before break" type.

Justification

When ammeters are current transformer fed the switch must have make-before-break contacts when switching between phases, as an open circuit could generate dangerously high voltages.

8.5.10.3.8

Analogue ammeters shall have a maximum demand indicator where used for incomers and ACB outgoing feeders.

Justification

An electric demand meter records the highest average kilowatts reached and maintained within an interval of 15 minutes. A demand meter's needle advances as electricity consumption increases, just as a speedometer needle advances speed increases in a car. When you stop the car, the needle moves back to zero, regardless of the highest miles per hour reached on the trip. Unlike a speedometer needle, demand meters record the highest average kilowatts reached and maintained within an interval period.

8.5.10.3.9

Analogue motor ammeters shall monitor single phase only.

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Justification

To ensure that non-motor loads can measure the motor starting current which is usually up to 6-7 times of full load current of the motor.

8.5.10.3.10

Analogue motor ammeters shall be rated for motor starting currents.

Justification

To ensure that non-motor loads can measure the motor starting current which is usually up to 6-7 times of full load current of the motor.

8.5.10.3.11

Analogue watt-meters and VAr meters shall be rated for three-phase unbalanced load in accordance with IEC 60051-3.

Justification

This requirement ensures compliance with IEC 60051-3 which ensures direct acting indicating analogue electrical measuring instruments and their accessories with special requirements for wattmeters and varmeters requirements are to a defined standard. Reduces variant and provides an essential minimum which is as per existing industry best practice and previous version of S-620 which suppliers have not identified as a cost adder to their standard offering.

8.5.101 Description of the types of electrical connections of functional units

Add to subclause

For withdrawable type functional units, the electrical connections shall be type W.W.W.

Justification

For withdrawable units, the bus bar connection is withdrawable, connection of load side and control cable are withdrawable (guided connections). This will enable three positions which are in service, test position, and disconnected position. This will facilitate the testing maintenance / replacement of the unit in timely manner. This standardises options and is as per 80 % of withdrawable applications in our industry.

Add to subclause

For disconnectable type functional units the electrical connections shall be type D.D.F.

Justification

For disconnectable units, the connection to main bus bar is D "removable", and to load is D "removable" and the control circuit is connected permanently (F) as integrated to the unit. This standardises options and is as per 80 % of disconnectable applications in our industry.

Add new subclause

8.5.102 Operation

8.5.102.1

The PSC-assemblies shall be rated for continuous operation at rated load for at least 90 000 h (10 years) without maintenance that requires de-energization of the busbars.

Public Review Draft

Justification

To ensure that the switchgear is designed to operate for 10 years without the need for vertical bus or main bus bar maintenance. This is to avoid the frequent outage of the switchgear for maintenance.

8.5.102.2

Functional units shall be designed for continuous operation at full load for at least 35 000 h (4 years) without maintenance.

Justification

To ensure that the functional unit can be operated for 4 years without the need for maintenance. this is to ensure the continuity of operations with minimal maintenance period.

8.6 Internal electrical circuits and connections

8.6.1 Main circuits

Add to first paragraph

Partitions shall be incorporated to prevent an internal arc occurrence in a bus section propagating to adjacent bus sections.

Justification

To prevent further damage to unaffected equipment or compartments, ensuring it can return back to normal operation after an event with minimal need to repair.

Add to subclause

Busbars shall be manufactured from hard drawn, high conductivity electrolytic copper.

Justification

Hard drawn copper has lower electrical resistance, lower power loss, lower voltage drop and higher ampacity. so therefore provides optimal performance with regards to high voltage power distribution. It also requires minimal maintenance compared to aluminium, which is also offered by suppliers. This is partly due to the busbar being manufactured from oxygen free copper, as opposed to aluminium, which is prone to oxidisation, therefore needs regular monitoring. Also aluminium typically required more CSA for the equivalent current than copper, hence this can result in a larger footprint of switchboard. It should be noted that aluminium is lighter, but this generally doesn't outweigh the benefits stated above.

Add to subclause

The main busbars shall be of the same cross sectional area throughout the entire length of the PSC-assembly to achieve the defined rated current.

Justification

To ensure that the bus bar has similar fating across the whole line up. This is to avoid tapered a bus.

Add to subclause

Where busbars are insulated, insulating materials shall be of a flame retardant type in accordance with the relevant part of IEC 60684, and non-hygroscopic and non-tracking.

Public Review Draft

Justification

To ensure that the insulating material used can sustain the fire.

Add to subclause

The insulation of the main busbar joints and to interconnecting busbar joints shall be removable and replaceable for inspection.

Justification

To ensure that the system can be maintained whenever needed.

8.6.2 Auxiliary circuits

Add to subclause

Earthed poles shall be connected via a removable link.

Justification

To provide the option to disconnect the earthed pole for maintenance purposes.

Add to subclause

Auxiliary circuits powered from an external source shall be via auxiliary main switch contacts in accordance with the status of the main switching device.

Justification

To ensure people safety by disconnecting the external supply within the main circuit switching device is isolated. This is because people assume that there is no voltage present when it is disconnected.

Add new subclause

8.6.2.101 Interface with supervisory systems

8.6.2.101.1

Incoming auxiliary supplies shall be monitored with an alarm for loss of availability.

Justification

To ensure that the control circuit is monitored as it is critical part of the assembly. it need to be functional to be able to trip the circuit breaker whenever it is needed.

8.6.2.101.2

A healthy circuit condition shall be indicated by a closed circuit signal.

Justification

To ensure that the control circuit is monitored as it is critical part of the assembly. it need to be functional to be able to trip the circuit breaker whenever it is needed.

Public Review Draft

8.6.2.101.3

The PSC-assembly shall be provided with potential free contacts wired to a terminal strip for sending the following alarm signals to a remote supervisory system or substation annunciator panel:

a) tripped on fault for each ACB;

b) protection / control supply failure for each bus section;

c) common trip alarm for each bus section of busbar, with all individual motor starter fault controls wired together;

d) trip circuit healthy alarm;

e) relay watchdog alarm.

Justification

To report essential signal's regarding the status of circuit breaker, power supply, trip circuit healthiness, and relay watchdog.

8.6.5 Identification of the conductors of main and auxiliary circuits

Add to subclause

The identification of the conductors of main and auxiliary circuits shall be as per Table 20.

Justification

To ensure consistency of color coding, which facilitate the safe operation of switchgear/controlgear.

Add new Table 20

Table 20 – Identification of conductors

Conductor	Mandatory marking	Supplementary colour marking (when used)
AC circuits		
Phase 1	L1	Brown
Phase 2	L2	Black
Phase 3	L3	Grey
Neutral	N	(Light) Blue
Protective earth	PE and/or earth symbol	Yellow/Green
DC circuits		
Positive pole	(+)	Red
Negative pole	(–)	Black

Public Review Draft

Add new subclause

8.6.8 Neutral

8.6.8.1

For a TN-S system, each incoming circuit (downstream of the transformer) shall be provided with a removable link between the neutral and the PE bar at the PSC-assembly.

Justification

The removable link is needed to test the grounding of the assembly.

8.6.8.2

The removable link shall be removable without exposure to live parts.

Justification

To ensure that the link can be accessed in safely manner to avoid electrical shocks.

Add new subclause

8.6.9 Earth bar

8.6.9.1

A hard-drawn high conductivity copper earth bar shall be incorporated.

Justification

High conductivity copper earth bar provides good path for ground as it exhibit high conductivity.

8.6.9.2

Dedicated termination points for all functional unit earthing and external earthing requirements shall be provided.

Justification

To ensure that there is connection point for earth for every compartment.

8.6.9.3

Earth bars shall incorporate spare M10 connection points at the bottom of outgoing cable compartments and incoming panels to facilitate external earth connections.

Justification

To ensure the earth contact is being maintained. getting less than M10 might compromise the connection.

8.6.9.4

Protection against electric shock shall be in accordance with IEC 60364-4-41.

Public Review Draft

Justification

To ensure that all metallic parts are grounded to avoid having induced voltage on these parts, to avoid shocks hazards and to avoid overheating of cable glands.

8.7.1

Replace subclause with

The PSC-assembly shall be naturally ventilated.

Justification

This is to ensure that the switchgear can deliver the maximum current at natural ventilation, and without active cooling. This is to avoid failure of active cooling system that could result in reduction of switchgear continues current rating.

8.8 Terminals for external cables

Replace fifth paragraph with

Internal cable compartment width shall be in accordance with specified cable quantity and sizes and at least 400 mm.

Justification

To ensure that the power cables can easily be terminated. The 400 mm requirement is to ensure that there is enough spacing for cable termination and space for having clip on ammeter for maintenance purposes.

Add to fifth paragraph

Space shall be provided in outgoing cable compartments for the use of a clip-on ampere meter.

Justification

To ensure that the power cables can easily be terminated. The 400 mm requirement is to ensure that there is enough spacing for cable termination and space for having clip on ammeter for maintenance purposes.

Add to fifth paragraph

At least 300 mm free space shall be provided between the gland plate and internal equipment to facilitate cable installation and connection.

Justification

Power cables in certain circumstances can be large due to the distance to the utilization load, and voltage drop requirements. Hence, having adequate space to meet the bending radius requirements. It is perceived that 300mm will be ok for the 80/20 rule.

Add to subclause

In the absence of user defined field cable information, guidance shall be taken from IEC 61439-1, Table A.1 using the maximum cross-section values.

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Justification

To ensure that the selected terminals, cable entries, and support facilities, and earthling facilities shall be in accordance with the size and number of cables as defined in the data sheet.

Add to subclause

Cable supports and bracing points spanning the entire height at intervals not exceeding 450 mm shall be incorporated in cable compartments.

Justification

To ensure that there are enough cable support to hold the cable in place during the short circuit conditions. Base standard does not specify specific intervals where cable supports need to be installed.

Add to subclause

Terminals shall be provided for all spare cable cores.

Justification

To ensure there are spare terminals that can be used in future for control, monitoring and interlocking purposes. The base standard does not include requirement for future sparing.

Add to subclause

Power cable terminals shall be provided with phase separation screens.

Justification

The insulating phase separation screen is needed to ensure that there is no reduction in the clearances between the phases. in addition, it will ensure that there is no crossing of phase cores.

Add to subclause

The largest incomers/feeders shall be located at the bottom of the PSC section with provision for direct entry and termination.

Justification

Large incomers/feeders to be installed at the bottom to make it easy for maintaining/servicing such unit, as they are usually heavy.

Add to subclause

Removable, undrilled gland plates shall be provided in each panel for glanding of power and control cables.

Justification

Removable undrilled gland plates allow cable entries to be drilled on site to optimise cable installation and final location. They are removable so they can be drilled in a workshop and removed/replaced if necessary.

Add to subclause

When single core line conductors are specified, associated gland plates shall be of non-magnetic material.

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Justification

Gland plates requirements are necessary to ensure that there is no circulating current and there is no issue magnetic field that can result in overheating issues for the terminations.

Add to subclause

Gland plates and multi-cable transit frames shall be connected directly to the main protective earth.

Justification

To facilitate and ensure low impedance earth paths for cable glands, this is a safety feature.

Add new subclause

8.8.101 Terminals for control and auxiliaries

8.8.101.1

Wiring for external connections shall be brought out to individual terminals on an accessible terminal block.

Justification

This requirement is to ensure that terminal block is readily accessible, and also to ensure that we have one wire per each terminal connection to ensure each control cable has rigid connection.

8.8.101.2

Terminals shall be of modular design in accordance with IEC 60947-7-1.

Justification

Standard terminations intended for industrial applications.

8.8.101.3

Not more than one wire shall be inserted into a single terminal.

Justification

Good installation practice to ensure wire crimp has maximum surface contact at the termination.

8.8.101.4

Parallel connections shall be made using cross connection links approved by the terminal manufacturer.

Justification

To avoid poor terminations only used manufacturer recommended parts.

8.8.101.5

Terminal blocks shall be grouped by function and operating voltage.

Justification

To ensure having convenient grouping of cables for easy maintenance and troubleshooting.

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8.8.101.6

Terminal blocks shall be separated from other groups using barrier plates or earthed terminals.

Justification

To provide increased creepage distance between terminations and also aid avoid errors identifying terminations.

8.8.101.7

Terminals that remain live following a functional unit isolation shall display a warning label.

Justification

To ensure having warning labels when they are live when the functional unit is off, to avoid electric shock.

8.8.101.8

Terminals associated with external sources of supply shall display a warning label.

Justification

To ensure having warning labels when they are live when the functional unit is off, to avoid electric shock.

8.8.101.9

Space for a minimum of 10 % spare terminals to be installed, shall be provided for future use.

Justification

To provide provision for future use of terminal blocks which can be used to add extra control or monitoring functionality.

8.8.101.10

Spare I/O contacts of protection/auxiliary relays shall be wired to terminal blocks and numbered.

Justification

To ensure that all I/O contacts for protection relays are wired up to terminal block to ensure it is ready for use in future. additionally, it allow testing of all outputs without the need to remove the relay. In addition, shorting links shall be provided for current transformers to avoid high voltages on the secondary winding.

8.8.101.11

Terminals associated with inductive current transformer circuits shall be provided with shorting links.

Justification

shorting links shall be provided for current transformers to avoid escalated voltage on the secondary for the current transformer.

8.8.101.12

Earthing links for control supplies and current transformers shall be removable.

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Justification

The availability of movable links will help to conduct testing for control supply whenever the ground need to be removed.

8.8.101.13

Instrument circuits requiring dedicated earthing shall have separate instrument earth bars isolated from main earth bars.

Justification

To ensure there is provision in the switchgear for the special earthing requirement of instrument cables.

8.101 Internal separation of PSC-assemblies

Add to subclause

Internal separation shall be Form 4a for ACBs and Form 3b for all other functional units.

Justification

Minimum of form of separation of 4a for ACBs, and 3 b for other units, are needed to ensure that Busbars are segregated from the functional units and terminals. Functional units are also segregated from each other. The reason for switchgear assembly separation is to avoid electrical hazards for operations and maintenance personnel during operating and servicing the unit. in addition, it will ensure the service continuity of other units that are operative.

Add new subclause

8.102 Provision for future development

8.102.1

The PSC-assemblies shall have a design and post-FAT supported lifetime of at least 20 years under service conditions.

Justification

To ensure obsolescence management requirements are covered.

8.102.2

The manufacturer shall have an obsolescence management plan in accordance with a recognized system for all PSC-assembly components by example to IEC 62402.

Justification

To ensure obsolescence management requirements are covered

8.102.3

Provided equipment shall be field proven for at least three years.

Justification

This is to ensure that the product has satisfactory performance and to avoid buying unmatured products.

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9 Performance requirements

9.3 Short-circuit protection and short-circuit withstand strength

9.3.1 General

Add to subclause

When required, internal arc fault mitigation system (IAMS) shall be provided and integrated into the PSC-assembly in accordance with IEC/TS 63107.

Justification

This requirement standardises the minimum requirements for the arc fault mitigation system. These system provides extra measures in detecting and suppressing arc faults.

Add to subclause

Internal arc tests shall be for a rated three-phase arc fault current (IA) value at least that of the specified short-time withstand current (Ik) for at least an arc fault duration of 0,5 s.

Justification

This requirement ensures that rated arc fault current is of a value which is appropriate to the short circuit current for which it may be subjected.

9.3.4 Co-ordination of protective devices

Replace third paragraph with

Series rated (combination rated) switching devices shall not be used.

Justification

Series rating requires combination testing, and requires simultaneous operation of both switching devices to reach rated short circuit. O&G industry does not use this kind to avoid limitations in operation and in maintenance.

11 Routine verification

Add new subclause

11.101 ECMS simulation test

11.101.1

When specified, a simulation test shall be carried out between the remote HMI and electrical control devices on the PSC-assemblies and the specific functions.

Justification

This requirement to detail the testing requirement of the interface with protection and automation system

11.101.2

The simulation test shall check and validate the ECMS and interfaces with interconnected electrical assemblies.

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Justification

This requirement to detail the testing requirement of the interface with protection and automation system

11.101.3

The tests shall be carried out in accordance with the tools and support proposed by the ECMS provider.

Justification

To show that the testing of the Control & Management Systems to be done according to their supplier requirement.

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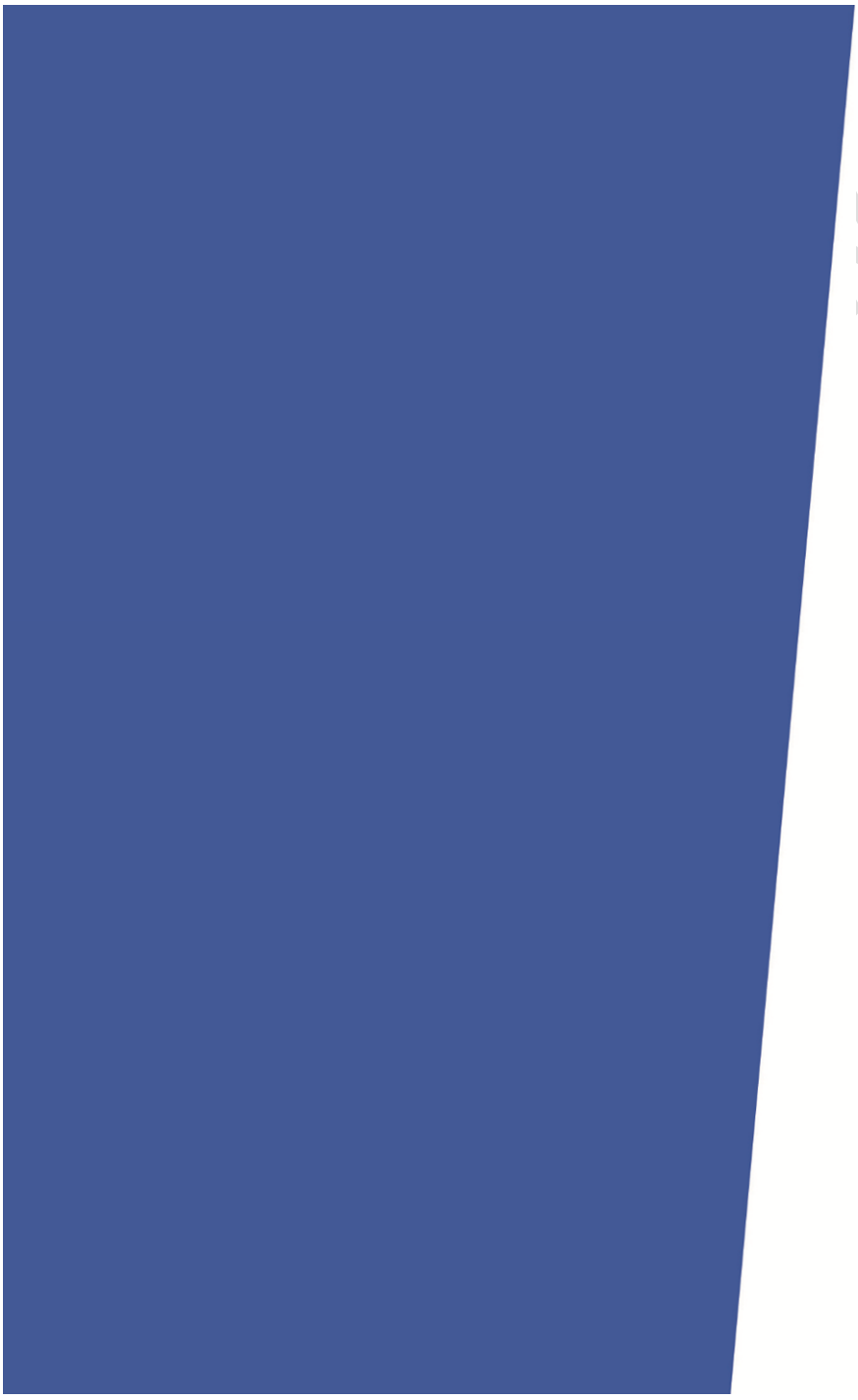
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