

## DEP SPECIFICATION

# LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES (ADOPTION OF IOGP S-560 AMENDMENTS/SUPPLEMENTS TO IEC 61439)

DEP 33.67.01.31-Gen.

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## DESIGN AND ENGINEERING PRACTICE



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## **PART I INTRODUCTION AND GENERAL**

### **1.1 SCOPE**

This DEP specifies requirements and gives recommendations for low voltage switchgear and controlgear assemblies.

This DEP endorses the application of the International Association of Oil & Gas Producers document IOGP S-560 "Supplementary Requirements to IEC 61439-1 & 2 LV Switchgear & Controlgear" for low voltage power switchgear and controlgear assemblies (PSC-Assemblies).

IOGP S-560 is aligned with IEC 61439-1:2011 Edition 2.0 and IEC 61439-2:2011 Edition 2.0.

Part III of this DEP defines minimum requirements to be selected in the LV switchgear and controlgear Data Sheets. Part III follows the clause numbering of IEC 61439 Parts 1 and 2 for easy reference.

The additional requirements specified in this DEP are required in order to:

- a) Make selections from the options given in IEC 61439-2;
- b) Specify additional and more stringent requirements, as necessary, to operate and maintain the switchgear in continuously operating plants;
- c) Specify supplementary provisions required to make the gear suitable for operation in the overall process control design.

Integrated Motor Control Systems (IMCS) are not covered by IOGP S-560 and requirements for the Shell equivalent to IOGP Electrical Control & Management Systems (ECMS) are covered in Appendix A of this DEP.

Lighting and small power distribution boards rated less than 250 A are not covered by IOGP S-560 and assemblies used as sub-distribution systems, with incoming feeders protected by short-circuit current limiting devices of a nominal current of maximum 250 A, are covered in Appendix B of this DEP.

This DEP is a revision of the same number dated February 2017; see (1.5) regarding the changes

### **1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS**

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorisation to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

## 1.3 DEFINITIONS

### 1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

### 1.3.2 Specific definitions

| Term                                          | Definition                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Circuit Schedule</b>                       | DEP 33.67.01.80-Gen. (schedule for LV switchboard)                                                                                                                                                                                                                                                 |
| <b>Data/ Requisition Sheet</b>                | A requisition sheet is one of the following:<br>DEP 33.67.01.93-Gen. (requisition sheet for LV switchboard).<br>DEP 33.67.01.94-Gen. (requisition sheet for lighting distribution switchboard).                                                                                                    |
| <b>Integrated Motor Control System (IMCS)</b> | A system comprising control modules, central unit(s), a serial bus connecting the control modules to the central unit and a communication facility enabling connection of the central unit to a distributed control system (DCS) and/or a Supervisory Control and Data Acquisition System (SCADA). |
| <b>Requisition</b>                            | A document defining material quantities with attached technical, quality and inspection requirements, document and data requirements and other items as required to define the purchase scope.                                                                                                     |
| <b>User Diagrams</b>                          | LV PSC-Assembly defining diagrams, such as Single Line Diagrams or Schematic Diagrams. S 67.004 or similar.                                                                                                                                                                                        |

## 1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets ( ). Other documents referenced by this DEP are listed in (PART IV).

## 1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated February 2017. It is a complete re-write to endorse the use of IOGP S-560 to leverage and improve industry standardisation.

## **PART II GENERAL**

1. Low voltage power switchgear and controlgear assemblies (PSC-Assemblies) shall comply with IOGP Specification S-560 "Supplementary Requirements to IEC 61439-1 & 2 LV Switchgear & Controlgear" Version 2.0 dated November 2016 and the supplementary requirements in (Part III) of this DEP Specification.
2. Low voltage power switchgear and controlgear assemblies (PSC-Assemblies) shall comply with the technical parameters and options as defined in the Data Sheets for each equipment item, including the pre-defined options and selections defined in (Part IV) of this DEP.
3. Integrated Motor Control Systems (IMCS) shall additionally comply with the requirements of (Appendix A)
4. Assemblies used as sub-distribution systems, with incoming feeders protected by short-circuit current limiting devices of a nominal current of maximum 250 A shall additionally comply with the amendments in (Appendix B).

## PART III SUPPLEMENTS TO IOGP S-560

### 6 Information

#### 6.2 Documentation

##### 6.2.2 Instructions for handling, installation, operation and maintenance

*Add the following to this clause:*

1. If the operating sequence or procedure of certain equipment items in the PSC-Assembly is not evident (e.g., mechanical interlocking features), instruction plates shall be fixed near the point of operation.
  - a. The instruction shall be given in a pictorial manner.
2. In locations where there is a potential HSSE risk, warning plate(s) or caution notice(s) shall be installed to identify this risk.

### 8 Constructional requirements

#### 8.0.102 Provision for future development

*Add the following to sub-clause b.:*

1. Unequipped space provision (skeleton compartments) shall be equipped so that completion at its maximum capacity can take place safely without the need to de-energise the switchboard busbars or an adjacent section (panel).

#### 8.2 Degree of protection provided by a PSC-ASSEMBLY enclosure

##### 8.2.2 Protection against contact with live parts, ingress of solid foreign bodies and water

*Add the following to this clause:*

1. The degree of protection as defined in IEC 60529 for any ASSEMBLY shall be:
  - a. For indoor use (in enclosed buildings) IP 41;
  - b. For outdoor use (protected by, e.g., rain canopy) IP 55.

#### 8.4 Protection against electric shock

##### 8.4.1 General

*Add the following to this clause:*

1. Terminals of equipment installed on a compartment door and which can be live when the door is opened shall be shrouded to a degree of protection of at least IP 2X.
2. Outgoing cabling shall not pass internally through other functional units.

##### 8.4.6 Operating and servicing conditions

###### 8.4.6.2 Requirements related to accessibility in service by authorized persons

###### 8.4.6.2.3 Requirements related to accessibility for maintenance

*Add the following to this clause:*

1. When a withdrawable unit has been removed from the ASSEMBLY, the live parts inside the fixed compartment shall be protected against touch, with a degree of protection of at least IP 2X.

## 8.5 Incorporation of switching devices and components

### 8.5.3 Selection of switching devices and components

*Add the following to this clause:*

1. The connections of the auxiliary circuits of withdrawable units shall be of the plug-and-socket type, automatically operated by the unit.

#### 8.5.3.101 Incoming and sectionaliser units

*Add the following to this clause:*

1. Incoming and sectionaliser units shall be mounted in separate compartments and provided with independent manually operated air break switches (fault make, load break) or circuit breakers.
  - a. When circuit breakers are specified they shall be mounted in separate panels.

#### 8.5.3.102 Isolating switching devices (disconnectors)

*Add the following to this clause:*

1. All switches used for isolating a circuit shall be padlockable in the 'OFF' position.

#### 8.5.3.103 Circuit breakers

##### 8.5.3.103.2 Moulded case circuit breakers

*Add the following to this clause:*

1. Circuit breakers in outgoing circuits (MCCBs or MCBs) used for isolating a circuit shall be padlockable in the 'OFF' position.

#### 8.5.3.104 Main circuit fuses

*Add the following to this clause:*

1. Metal removal tags of 'DIN' fuses shall be potential free.
2. 'DIN' fuses of the D-type shall meet the following:
  - a. only be applied up to maximum 63 A;
  - b. be backed up by short-circuit current limiting devices of maximum 400 A rating.

#### 8.5.3.105 Motor starters and contactor feeders

*Add the following to this clause:*

1. Local front-of-panel contactor closing facilities shall not be provided on the motor starter functional units.
2. For motors in inshing or reversing rotating service, Utilisation category AC-4 shall be used.
3. All control schemes shall be in line with the existing standard RCU/SS arrangement as shown on Standard Drawing S 67.004.

#### 8.5.3.106 Motor protection

*Add the following to this clause:*

1. Overload protection relays shall meet the following requirements:
  - a. be at least of trip class 20 in accordance with IEC 60947-4-1;
  - b. be equipped with manually reset facilities on the front of the compartment (resettable without opening the ASSEMBLY).

2. Motors of 30 kW and above shall be fitted with core balance type earth fault protection relays.
  - a. Use of alternative measurement methods, which provide the same accuracy, shall be subject to approval of the Principal.

#### 8.5.3.109 Current transformers

*Add the following to this clause:*

1. If specified in the requisition, an automatic restart facility shall be provided to restart the motor after voltage dips of a duration up to 4 s.
  - a. This facility shall be incorporated in motor starters as indicated in the 'Schedule for LV switchboard', and be fully configurable per drive.
2. The automatic restart facility shall be initiated under the following conditions:
  - a. Voltage-dip detection level at 65% of  $U_n$ .
  - b. Voltage restoration detection level at 90% of  $U_n$ .
  - c. Immediate restart after voltage dips  $\leq 0.2$  s.
  - d. Delayed restart after voltage dips of  $> 0.2$  s with an adjustable maximum of 60 s in steps of 5 s after which the unit shall be not restarted without an external start command.
  - e. If a second voltage dip, with duration less than 0.2 s, occurs within 1 s after the first voltage dip, a delayed restart command shall be given.
  - f. The undervoltage memory time buffer shall be at least 4.5 s.
3. The minimum detection time for a voltage dip shall be less than the drop time of the contactor (considered to be 10 ms) therefore ensuring that a voltage dip is detected even after a transient interruption has occurred.
4. It shall be possible to set the maximum dip duration, after which the system will initiate a restart, between 4 s and 30 s.

*This longer time might be required if the motor is reconnected to an emergency supply after a power failure in the normal supply.*

#### 8.6 Internal electrical circuits and connections

##### 8.6.1 Main circuits

*Add the following to this clause:*

1. The busbar system shall be accessible for construction and maintenance duties.

#### 8.8 Terminals for external conductors

*Add the following to this clause:*

1. For main incoming and outgoing power circuit cabling of conductor size less than 300 mm<sup>2</sup>, terminals shall be provided that allow the conductors to be connected without the use of cable lugs.

##### 8.8.1 Terminals for control and auxiliaries

*Add the following to this clause:*

1. Each conductor of external auxiliary cables shall have an individual terminal of the non-loosening wedge type or cage type construction such that there is no direct contact between screw, bolt or nut and the conductor.

## **9 Performance requirements**

### **9.2 Temperature rise limits**

*Add the following to this clause:*

1. The temperature rise limits as given in Table 6 shall not be exceeded when the PSC-Assembly is fully loaded in accordance with the rated diversity factors defined in the Data/Requisition Sheets.

### **9.3 Short-circuit protection and short-circuit withstand strength**

#### **9.3.1 General**

*Add the following to this clause:*

1. In the event of an internal fault in a functional unit, the damage shall be confined to that unit, so that the busbar system and all other functional units remain fit for further service.
2. An internal fault in a dropper system shall be confined to the associated panel, so that the busbar system and the other panels of the PSC-Assembly remain fit for further service.

## **10 Design verification**

### **10.1 General**

*Add the following to this clause*

1. All design verification shall be confirmed by test except for the following:
  - a. 10.6: Incorporation of switching devices and components.
  - b. 10.7: Internal electrical circuits and connections.
  - c. 10.8: Terminals for external conductors.