

DEP SPECIFICATION

**LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR
ASSEMBLIES**

(AMENDMENTS/SUPPLEMENTS TO IEC 61439)

DEP 33.67.01.31-Gen.

February 2017

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 is based on IEC 61439-2:2011. Part III of this DEP amends, supplements and deletes various clauses of IEC 61439-2:2011. Part III follows the clause numbering of IEC 61439-2:2011 for easy reference.

All clauses of IEC 61439-2:2011 not modified by this DEP remain valid as written.

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 covered in Appendix A.

The requirements specified apply to power switchgear and controlgear assemblies (PSC-ASSEMBLIES). For assemblies used as sub-distribution systems, with incoming feeders protected by short-circuit current limiting devices of a nominal current of maximum 400 A, less rigorous requirements can be accepted; see (Part I, Section 2).

This DEP is a revision of the same number dated February 2016; see (1.5) regarding the changes

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

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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
Integrated Motor Control System (IMCS)	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).
Panel	A constructional unit of a (multi-) cubicle type ASSEMBLY between two successive vertical delineations.
Requisition Sheet	A requisition sheet is one of the following: DEP 33.67.01.93-Gen. (requisition sheet for LV switchboard). DEP 33.67.01.94-Gen. (requisition sheet for lighting distribution switchboard). DEP 33.67.01.80-Gen. (schedule for LV switchboard) is normally attached to the requisition.
Section	A constructional unit consisting of a number of panels connected to a continuous busbar system.
Sectionaliser Unit	A mechanical switching device to connect the busbar of two sections.
Skeleton Compartment	A spare compartment for later completion but so equipped that completion can take place safely without the need to de energise the switchboard or any other panel.
Supply Authority	An entity which provides electric power

1.3.3 Abbreviations

Term	Definition
CT	Current Transformer
CTI	Comparative tracking index
HBC	High breaking capacity
Ics	Service short-circuit breaking capacity
Icu	Ultimate short-circuit breaking capacity
tE	Maximum locked rotor time
Un	Rated voltage
VT	Voltage Transformer

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 2016. The only changes are to DEP cross-references to reflect changes in the DEP library in 2017.

PART II GENERAL

Part III of this DEP is written as amendments and supplements to IEC 61439-2:2011.

Wherever reference is made to IEC 61439, it shall be understood to mean IEC 61439-2:2011 as amended/supplemented by this DEP.

For ease of reference, the clause numbering of IEC 61439-2 has been used throughout Part III of this DEP.

Clauses in IEC 61439-2, which are not mentioned in this DEP, shall remain valid as written.

IEC 61439-2 is based upon requirements of IEC 61439-1, uses the same titles and paragraph numbering scheme as IEC 61439-1 and contains amendments, supplements or new clauses to IEC 60439-1.

Unless modified in this DEP or in IEC 61439-2, all clauses in IEC 61439-1 shall remain applicable as written.

For simplicity, reference is only made to IEC 61439-2 in (Part III), but it shall be understood that text amendment may have been taken from base standard IEC 61439-1 rather than from IEC 61439-2.

The same numbering of clauses is used in Part III as that used in IEC 61439-1 and IEC 61439-2.

PART III AMENDMENTS/SUPPLEMENTS TO IEC 61439-2

1 Scope

Add the following to this clause:

1. Although this standard is mainly concerned with fully withdrawable gear of (multi-) cubicle type ASSEMBLIES for indoor installation, it shall also apply to the following:
 - a. fixed and semi-withdrawable cubicle type ASSEMBLIES and combinations thereof;
 - b. multi-box type ASSEMBLIES and ASSEMBLIES located outdoors.

5 Interface characteristics

5.2 Voltage ratings

5.2.1 Rated voltage (Un) (of the ASSEMBLY)

Add the following to this clause:

1. During normal system operation and under steady-state conditions, the supply voltage shall not deviate from the rated voltage by more than 5%.
2. Transient voltage deviations during, e.g., motor or group motor starting/reacceleration shall be such as to maintain a minimum of 85% and maximum of 110% of rated voltage on switchgear busbars.
3. The ASSEMBLY shall be suitable to form part of a system with coordinated insulation values in accordance with IEC 60664-1 and overvoltage category IV.
 - a. The ASSEMBLY shall be type tested in accordance with IEC 60664-1 and overvoltage category IV.
4. The overvoltage category of ASSEMBLIES with a rated voltage in excess of 600 V shall be as a minimum category III.
5. Switchgear installed on some installations (typically on mobile and fixed offshore locations) shall be suitable for continuous operation from a supply which is subject to voltage waveform distortions caused by thyristor controlled loads.
6. In the quotation stage, the Principal shall advise the percentage Total Harmonic Distortion that has to be taken into account if it exceeds limits given in IEC 61439-2.
7. Deviation from the supply characteristics, if any, shall be stated on the requisition.

5.3 Current ratings

Add the following to this clause:

1. Unless otherwise specified in the requisition, the ASSEMBLY shall be arranged for a TN-S power system, i.e., with separate neutral and protective earth (PE) busbars throughout the system.
2. The main busbars shall be rated for the nominal current over the entire length of the ASSEMBLY.
3. The main busbars shall not be rated lower than the incoming and sectionaliser units.

5.4 Rated diversity factor (RDF)

Add the following to this clause:

This supplement does not apply to ASSEMBLIES used as sub-distribution systems as defined in (Part I; (1.1)), to which the original clause of IEC 61439-1 shall apply.

1. For temperature rise tests or temperature rise calculations, a diversity factor of 1.0 shall be applied for each switchboard panel containing only one functional unit.
2. If a panel contains two or more functional units, the rated diversity factor applied shall be a minimum of 0.9 when considering the circuit loads as known at the time of final inspection at the Manufacturer's works.
3. Spare circuits and skeleton compartments shall be considered as being loaded to 90% of their rated current.
4. Where IMCS is specified, the equipment shall be included in the temperature test.

6 Information

6.1 ASSEMBLY designation marking

Add the following to this clause:

1. Nameplates including circuit labels, instruction and warning plates and caution notes shall be made of durable, corrosion resistant material.

Add the following new clauses:

6.1.101 General equipment nameplate

1. The following information shall be given on the general equipment nameplate, mounted on the front of the ASSEMBLY, e.g., on the sectionaliser or incoming feeder:
 - a. Manufacturer's name or trademark;
 - b. Type designation;
 - c. Purchase order number;
 - d. Year of manufacture;
 - e. Rated voltage;
 - f. Rated frequency;
 - g. Rated current of busbar system;
 - h. Rated voltage of auxiliary circuits (if applicable);
 - i. Rated peak and short time withstand current and withstand time;
 - j. Degree of protection;
 - k. Form of internal separation.
2. The information in (6.1.101, Item 1) together with the information of IEC 61439-1 clause 5.1 shall be given in the relevant documents of the Manufacturer.

6.1.102 Circuit labels

1. Each circuit of the ASSEMBLY shall be provided with the following circuit identification labels:
 - a. Circuit identification tag number in accordance with standard drawing S 67.021.
 - i. The circuit labels shall be installed on the front of the fixed and the removable part of a withdrawable or removable unit.
 - ii. The circuit labels shall be installed at the main and auxiliary cable terminations that are not clearly identifiable from the physical layout, e.g., cable compartments at the rear or bottom of the ASSEMBLY.
 - b. Identification number of connected equipment or circuit destination as specified in DEP 33.67.01.80-Gen.

6.1.103 Synoptic diagram

1. Assemblies shall be provided with a durable one-line synoptic diagram, indicating the busbar circuit and the specific function of the different compartments.
2. Synoptic diagrams are not required if the busbar system and the branch circuits can be viewed via transparent covers.

6.1.104 Instruction plates

1. If the operating sequence or procedure of certain equipment items in the 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.

6.1.105 Warning plates, caution notices

1. In locations where there may be an HSSE risk, warning plate(s) or caution notice(s) shall be installed, identifying the danger point(s). This may be either in a compartment or on the outside of an ASSEMBLY.

6.2 Documentation

6.2.2 Instructions for handling, installation, operation and maintenance

Add the following to this clause:

1. The Manufacturer/Supplier shall supply at least the following drawings/documents in the quantities and at the times stated in form DEP 40.10.01.93-Gen. attached to the requisition:
 - a. Final ASSEMBLY arrangement drawing showing main circuits, main dimensions, panel layout, floor plan and shipping sections. The following may be included on the ASSEMBLY drawing or provided as separate documents:
 - i. Final single-line diagram;
 - ii. Minimum clearances around the ASSEMBLIES for ventilation and safety during operation and maintenance;
 - iii. Total mass of the ASSEMBLY and of the individual shipping sections;
 - b. Schematic diagrams of all different types of circuits,
 - c. Documentation as specified in Appendix 1 (in case of IMCS only),
 - d. Transport, installation, commissioning, operation and maintenance instructions, limited and specific to the ASSEMBLY and its components,
 - e. Instructions of measures to be taken, if any, with regard to EMC associated with the installation, operation and maintenance of the ASSEMBLY,
 - f. List of recommended spare parts and SPIR forms (see DEP 70.10.90.11-Gen.),
 - g. List of applicable type test certificates,
 - h. Test report of the final routine testing.
2. All documents shall show the relevant order number, item and Manufacturer's/Supplier's references.
3. All documents shall be formatted and distributed as specified in the purchasing documents.
4. Documents shall be provided electronically in a format specified by the Principal.
5. Assemblies supplied in transport units shall have these units clearly marked to facilitate ASSEMBLY at site.
6. Erection instructions and any special tools required for erection and maintenance shall form an integral part of the order and be packed with the equipment.
7. The Manufacturer/Supplier shall provide with the quotation the following:
 - a. preliminary arrangement drawings and details of component ratings, e.g., by filling in the appropriate sections of DEP 33.67.01.80-Gen. (schedule for LV switchboard),
 - b. all other information as specified further on in this DEP.
8. The language used on the documents shall be as specified in the requisition.

7 Service conditions

7.1 Normal service conditions

Add the following to this clause:

1. The actual service conditions shall be specified in the requisition if they are more onerous than those stated in IEC 61439-1.
2. The requisition shall specify the location (land or offshore installation) where the ASSEMBLY will be installed and whether the ASSEMBLY will be installed indoors or outdoors.

7.1.3 Pollution degree

Add the following to this clause:

1. Unless otherwise specified in the requisition, the ASSEMBLY and the components installed therein shall be suitable for use in a pollution degree 3 environment and the air will be laden with dust, salt and/or sulphur as encountered in the petrochemical industries or in oil/gas fields.

7.2 Special service conditions

Add the following to this clause:

1. The requisition shall specify any special service condition that the switchgear may be required to withstand in its operational location and that may arise during transport, storage and erection, e.g., pollution, temperature and humidity, shock and vibration.
2. Equipment installed on mobile and fixed offshore installations shall be unaffected by vibration and shock.
 - a. Vendor shall state the applicable test standard to be applied unless stated in the Requisition.
3. Unless otherwise specified, the switchboard shall be suitable for installation in a non-hazardous area as defined in IEC 60079-10, 3.3.2.

7.3 Conditions during transport, storage and installation

Add the following to this clause:

1. Any special conditions that may arise during transport, storage and installation, e.g., shock and vibration and/or extreme temperatures, shall be stated on the requisition.

8 Constructional requirements

Add the following to this clause:

1. If space heaters are recommended by the manufacturer, they shall be included in the quotation as an option.
2. If anti-condensation heating is required inside the ASSEMBLY, it shall be supplied from a separate source connected between system phase and neutral.
 - a. The heating system of each section shall be separately protected and switched for isolation purposes by means of a miniature circuit breaker in combination with an earth leakage protecting device of 30 mA sensitivity.
 - b. When the heating system is live, this shall be indicated by means of a prominently situated red LED.
 - c. The heating system shall be designed in such a way that the heat is adequately distributed over all functional units.

8.1 Strength of materials and parts

8.1.1 General

Add the following to this clause:

1. The ASSEMBLIES shall be designed for continuous operation at full load for at least 90,000 h without maintenance that would require the main busbars and the distribution busbars (dropper system) to be de-energised.
2. The main and distribution busbars, including their connections, shall not require maintenance during the lifetime of the ASSEMBLY, when operating under the specified service conditions.

De-energising of the main busbar and distribution busbars after 90,000 h could be required, e.g., to inspect and clean the compartments.

Operation of switching devices could be required within the period of 90,000 h as mentioned above. For non-essential switchgear this could lead to de-energising of the busbar. Assemblies in vital and essential service will normally have dual feeders and bus section switches to cater for continuous operation, even when one of these switches is operated.

3. The ASSEMBLIES shall have a design lifetime of at least 25 years, under the service conditions specified and maintained according to the Manufacturer's/Supplier's recommendation.
4. Where IMCS is specified, the lifetime of this system shall be aligned with the lifetime of the ASSEMBLY. Refer to (APPENDIX A).
5. Switchgear ASSEMBLIES shall be completely enclosed in multi-cubicle or multi-box type structures that are self-supporting and suitable for floor or wall mounting. The floor shall not be considered as being part of the enclosure.
6. All structural work shall be adequately protected against corrosion.
 - a. Frame and partitions may be of galvanised steel without a further paint coating.
 - b. Those parts/covers requiring painting shall be properly pre-treated before the final coat(s) of oil resistant finishing paint is (are) applied.
 - c. The Manufacturer's/Supplier's standard colour is acceptable.
 - d. If a Manufacturer/Supplier does not have a standard colour, light grey is preferred for the external surface.
7. Cover bolts or nuts shall be retained in place when undone (captive bolts and nuts).
8. Assemblies shall comprise one or more sections of busbars to which incoming and outgoing units are connected.
9. Busbar sections shall be linked through sectionaliser units.

10. In addition to the outgoing units specified in the requisition or schedule, spare skeleton compartments shall be included in each switchboard.
 - a. The number of skeleton compartments shall be 10% of each size of outgoing units of which at least three units are installed.
 - b. Skeleton compartments shall be allocated to the switchboard sections in accordance with the actual load distribution and taking account of the maximum load that can be accommodated.
 - c. A skeleton compartment shall be equipped so that completion at its maximum capacity can take place safely without the need to de-energise the switchboard or any other 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
2. Outdoor switchgear shall be provided with a rain/sun canopy.
3. Details of specific installation requirements for e.g., offshore facilities shall be specified by the Principal.

8.4 Protection against electric shock

8.4.1 General

Add the following to this clause:

1. All switchgear components requiring maintenance shall be easily accessible.
2. All switchgear components in wall or back-to-back mounted switchgear shall be accessible from the front only.
3. Exposed parts within the ASSEMBLIES that have to be accessible during normal operation, maintenance or equipping of spare compartments, shall be one of the following:
 - a. not live in the opened position;
 - b. protected to a degree of protection of at least IP 2X.
4. The terminals of the incoming and sectionaliser switching devices may be live when the device is in the off position and consequently shall be protected to a degree of at least IP 2X.
5. HBC fuses and associated fuse carriers shall only be accessible when they are fully isolated or when they offer a degree of protection to live parts of at least IP 2X when the fuses are inserted, have been withdrawn or are being withdrawn.
6. 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.

The above IEC requirements for interlocking of doors when the isolating switch is in On position do not apply to ASSEMBLIES used as sub-distribution systems as defined in (Part I; (1.1) provided that all live parts inside the compartment have a degree of protection of at least IP 2X.

8.4.6 Operating and servicing conditions

8.4.6.2 Requirements related to accessibility in service by authorized persons

8.4.6.3 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.
 - a. Where shutters are fitted to comply with this protection, they shall be mechanically operated by the movement of the withdrawable unit and not depend on gravity or springs.
2. Each set of shutters shall be capable of being individually operated and padlocked in the closed position.
3. Shutters shall be marked as follows:
 - a. 'BUSBAR' on shutters covering busbars,
 - b. 'INCOMING SUPPLY' on shutters covering incoming feeder cables,
 - c. 'CIRCUIT' on shutters covering outgoing feeder cables.
4. If a test position is provided (partly withdrawn unit), the degree of protection shall be at least IP 2X.
5. Interlock systems shall be of a mechanical lever type and not rely on the operation of springs or gravity.
6. All practicable measures shall be taken to prevent danger to personnel working on a disconnected functional unit with adjacent units still in operation.
7. Parts likely to be removed for maintenance shall have retainable fastening means (e.g., captive screws).

8.5 Incorporation of switching devices and components

8.5.2 Removable and withdrawable parts

Add the following to this clause:

1. Withdrawable units which are mechanically identical but electrically have a different function shall be non-interchangeable, e.g., so that it is not possible to install a motor starter unit into a space for a plain feeder unit of the same size.

8.5.3 Selection of switching devices and components

Add the following to this clause:

1. All components should be standardised as far as practical.
2. The connections of the auxiliary circuits of withdrawable units shall be of the plug-and-socket type, automatically operated by the unit.
3. Circuits, components, wiring and terminal arrangements shall be installed in accordance with the relevant standard drawings of group S 67.