

DEP SPECIFICATION

DESIGN AND FABRICATION OF MV SWITCHGEAR FOR NORTH AMERICAN APPLICATIONS (AMENDMENTS/SUPPLEMENTS TO IEEE C37.20.2)

DEP 33.67.40.30-Gen.

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DESIGN AND ENGINEERING PRACTICE



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PART I INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design and fabrication of metal-clad (MC) medium voltage (MV) switchgear, including instruments and control, for North American application.

Part I and Part II include introductory and general information.

Part III covers requirements for MV switchgear from 4.76 kV up to 38 kV and it is written as amendments and supplements to IEEE Standard C37.20.2:2005. Part III follows the clause numbering of IEEE Standard C37.20.2:2005 for easy reference. All clauses of IEEE Standard C37.20.2:2005 not modified by this DEP remain valid as written.

Part IV covers documentation requirements.

Part V covers supplemental non-technical requirements.

Part VI covers references associated with this DEP.

This is a revision of the DEP of the same number dated February 2014; 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 authorization 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.

In IEEE Standard C37.20.2:2005, the term Purchaser or Buyer is used and is equivalent to the term "Contractor" that is used in this DEP.

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

In IEEE Standard C37.20.2:2005, the term Seller is used and is equivalent to the term "Manufacturer/Supplier" that is used in this DEP.

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.

In IEEE Standard C37.20.2:2005, the term Owner or User is used and is equivalent to the term "Principal" that is used in this DEP.

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
Arc resistant accessibility Type 2B	Arc resistant equipment constructed so that arcing does not cause holes in the freely accessible front, sides and rear of the enclosure or in the walls isolating the low-voltage control or instrument compartment(s).
Arc resistant equipment	Equipment designed to withstand the effects of an internal arcing fault, as indicated by meeting test requirements of IEEE C37.20.7.
Internal arcing fault:	An unintentional discharge of electrical energy in air within the confines of an electrical equipment enclosure.
Observed	The word Observed means that the Principal and Contractor shall be notified of the timing of the inspection or test; however, the inspection or test shall be performed as scheduled, and if the Principal or Contractor is not present, the Manufacturer/Supplier shall proceed to the next step.
Witnessed	The word Witnessed means that a hold shall be applied to the production schedule and that the inspection or test shall be carried out with the Principal or Contractor in attendance.

1.3.3 Abbreviations

Term	Definition
ACO	Accredited Certification Organization
AHJ	Authority Having Jurisdiction
DEP	Design and Engineering Practice
NETA	International Electrical Testing Association
NRTL	Nationally Recognized Testing Laboratory

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 VI).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated February 2014. The following are the main, non-editorial changes.

Section/Clause	Change
All	Restructured and clarified requirements, enforced shall/should.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://sww.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

1.9 REQUISITION/DATASHEETS

The applicable data sheet sections shall be completed and returned by the Manufacturer/Supplier as part of the quotation:

- a. Use data sheet DEP 33.67.40.90-Gen. to specify MV switchgear.

PART II GENERAL REQUIREMENTS

1.1 GENERAL

1. (Part III) of this DEP amends, supplements and replaces various clauses/paragraphs of IEEE C37.20.2:2005.
 - a. Wherever reference is made to IEEE C37.20.2, it shall be understood to mean IEEE C37.20.2:2005 as amended by this DEP.
2. Clauses of IEEE C37.20.2 that are not mentioned shall remain applicable as written.

For ease of reference, the clause numbering of IEEE C37.20.2 has been used throughout (Part III) of this DEP.
3. Switchgear for Canadian applications shall in addition comply with CSA Std. C22.2 No. 31-10, be CSA approved and bear a cUL label or an approved label acceptable to the AHJ.
4. In the event of conflicts between and/or among documents, the Manufacturer/Supplier shall contact the Contractor for resolution.
5. Where conflicting requirements exist between the mentioned CSA standards in (1.1 item 3) and the IEEE standard to which this DEP is amended, the CSA standards prevail for Canadian applications.
6. Switchgear assemblies shall be provided in accordance with the Single Line Diagram and Data Sheet (DEP 33.67.40.91-Gen.).

1.2 STATEMENT OF COMPLIANCE

1. The Manufacturer/Supplier of the switchgear and its ancillary equipment shall confirm that the equipment fully complies with the quotation and the whole system is properly designed, constructed and suitable for the specified duty.
2. All performance values established in the pre-ordering meeting or quotation (whichever is the later) shall be regarded as maximum or minimum values as applicable.
3. All the equipment forming part of the order shall be tested individually and in combination at the Manufacturer/Supplier's works to prove their capability and compliance with this DEP and the performance data.

1.3 LIFETIME AND RELIABILITY

1. The equipment (including auxiliaries) covered by this standard shall be suitable for the specified operating conditions.
2. Equipment shall be designed and constructed for a minimum service life and uninterrupted continuous operations as specified.

It is recognized that this is a design criterion and that uninterrupted operation for this period of time involves factors beyond the Manufacturer/Supplier's control.

1.4 PRE-ORDERING MEETING

1. If deemed necessary by one of the parties involved, a pre-ordering meeting shall be arranged to define clearly the overall scope of supply, individual responsibilities and test methods.

PART III REQUIREMENTS FOR MV SWITCHGEAR FOR NORTH AMERICAN APPLICATIONS (AMENDMENTS/SUPPLEMENTS TO IEEE C37.20.2:2005)

2 References

Add to this clause:

1. United States Coast Guard Requirements, 46 CFR, Chapter 1, Subchapter J, and Electrical Engineering (Offshore applications only).

5 Ratings

5.5 Temperature limitations

5.5.2 Temperature limits for insulating materials

Add to this clause:

1. Insulating materials shall be Class 105.

5.5.3 Temperature limits for buses and connections

Add to this clause:

1. Buses and connections tin-surfaced or equivalent connecting joints, shall have a hot-spot temperature rise of 65 °C (120 °F) and a total temperature of 105 °C (220 °F).
2. Connections to insulated cables tin-surfaced or equivalent, shall have a hot-spot temperature rise of 45 °C (80 °F) and a total temperature of 85 °C (185 °F).

Add new clause:

5.8 Current transformer (CT) requirements

1. CTs shall be window type, single primary, and secondary and installed in a manner that can be readily maintained or replaced.
2. CTs shall be installed on the stationary circuit breaker stabs in order to be front accessible.
3. CTs shall be installed to allow for ease of maintenance or replacement.
4. The Manufacturer/Supplier shall match the selected protection relays and required instruments with the burden and accuracy class of the CTs.
5. CT polarity marker should be visible from the front of the switchgear with shutters open or rear of the switchgear with the door open or cover removed where possible.
6. Opening of zero sequence CTs shall be large enough to accommodate power cables.
7. CT secondary circuits shall be routed away from high voltage components.

6 Tests

6.2 Design tests

Add to this clause:

1. Design tests for load interrupter switches for Canadian applications shall be in accordance with CSA C22.2 No.193.

6.3 Production tests

Add to this clause:

1. The entire switchgear should be electrically and mechanically assembled into one single line-up prior to final testing and inspection.

7 Construction

7.1 Buses and primary connections

Add to this clause:

1. Bus contact areas shall be tin-plated unless otherwise specified on the Data Sheet.
2. Silver plating shall not be used in environments exposed to H₂S contamination.
3. All power busbars shall be provided with an insulation system.
4. All bus insulators and bus bar inserts shall be non-tracking, non-hygroscopic, flame retardant glass polyester or cycloaliphatic.
5. Bus lengths between insulators shall be insulated with either fluidized bed epoxy applied, liquid dipped, or extruded sleeving.
 - a. Sleeve type or heat shrink tubing shall not be permitted.
6. Tapered bus shall not be used.
7. Non-tracking, non-hygroscopic, and flame retardant insulators shall be used whenever buswork passes through a barrier of any material.
8. All joints shall be plated and bolted using high tensile strength steel hardware, and conical (Belleville) washers.
9. All bus bar joints and insulator connection shall be covered with formed insulating boots and reusable non-metallic hardware.
10. The torque requirements for connections should be determined, posted (in the rear of each cell) and used on all connections.
 - a. The torque requirements should be noted on the Manufacturer/Supplier's drawings.
11. The load bus shall extend from the circuit breaker compartment into the cable compartment by means of insulating bushings.
12. The primary bus shall extend into the bus compartment by means of insulated bushings.

7.1.3 Cable, cable bus and bus duct terminations

Add to this clause:

1. Provisions for cable terminations shall be provided for each circuit breaker.
2. The cable entry shall be as specified on the Data Sheet.
3. The compartment shall have adequate space for the installation of stress cones, termination hardware, and a minimum bend radius based on the Contractor's MV power cable sizes.
4. Each cable terminal connection point shall meet the bolt hole requirements of NEMA CC 1-2009.
5. Lugs shall be furnished by the Manufacturer/Supplier and installed in the corresponding rear cable compartment in accordance with the contract drawings.
 - a. The lug type shall be long barrel crimp type using NEMA 2 hole spacing.
6. All switchgear connections for cables, cable bus, bus duct, or bus transition shall be located such that lugs or bus duct/bus transition links are readily accessible.
7. Removable boots shall be provided at each Contractor cable connection.

Add new clause:

7.1.6 Medium voltage wiring

1. All internal power wiring shall be rated for 8 kV service minimum, unshielded and NRTL approved.
2. The insulation shall be EPR with 175 mils of insulation thickness for sizes #2 AWG to 250 kcmil and 215 mils of insulation thickness for sizes 350 kcmil to 500 kcmil.

7.2 Grounding

Add to this clause:

1. The Manufacturer/Supplier should furnish and install lugs in the corresponding rear cable compartment on the ground bus.
2. Lugs should be NEMA 2-hole (except where not available due to ground cable size), long barrel crimp-type compression lugs and used for all power circuits that connect to the switchgear lineup.
3. Each cubicle shall have grounding provisions made for terminating the wire to the ground bus.
4. Ground bus connections shall be solidly bolted. Use of self-tapping screws shall not be permitted for ground bus connections.
5. The Manufacturer/Supplier should furnish one NEMA 2-hole, long barrel, crimp-type compression lug at each end of the ground bus for the Contractor connection of the field grounding conductors for the size specified on the data sheet.
6. In each cubicle, the ground bus shall be extended toward the incoming power cable termination points to allow easy access for safety grounding connection of a portable grounding clamp device.
7. If specified on the data sheet, each phase and ground bus power cable termination shall be provided with an apparatus ground clamp cable connection (ground ball stud) mounted as close as possible to the phase and ground bus cable termination point for voltage testing and grounding.

7.3 Control and secondary circuits and devices

7.3.1 General

Add to this clause:

1. All fuses shall be 250V rated and sized by the Manufacturer/Supplier.
2. The control power to each circuit breaker close and trip coil circuit shall be fused and wired as follows:
 - a. one main fuse to supply the close and trip coil circuits;
 - b. one branch fuse fed from, and coordinated with, the main fuse, to supply the close coil circuit; and,
 - c. the trip coil circuit wired directly from the main fuse.

7.3.2 Voltage transformer fusing

Replace this clause with:

1. The following requirements shall be met:
 - a. primary circuits of all voltage transformers shall include current-limiting fuses with an interrupting capacity of not less than the main switchgear power bus;
 - b. secondary circuits of all voltage transformers shall include fuses or their equivalent;
 - c. if fuses are used, pull-out dead front fuse blocks shall be provided for each potential transformer.

7.3.3 Control, secondary, and logic-level wiring

7.3.3.2 Wire size

Replace fourth of five paragraphs with:

1. Minimum wire size for control circuits shall be no less than AWG No. 14, regardless of load.
2. Current transformer circuits shall be AWG No. 10 minimum.
3. Instrument wiring shall be AWG No. 18 minimum.

7.3.3.3 Wire protection and support

Add to this clause:

1. Wiring shall be routed neatly in vertical or horizontal planes.
2. Flexible bundles shall be in accordance with IEEE C37.20.2 Clause 7.3.3.1.
3. An empty wireway shall be provided for Contractor wiring, as appropriate.
4. Individual wires shall be secured with cable ties that are fastened to screw or positive tab type tie mounts.
 - a. Adhesive backed mounts shall not be used.
5. Wiring shall be installed in such a manner that its insulation does NOT contact sharp edges, burrs, or rough surfaces.