

DEP SPECIFICATION

ELECTRICAL INSTALLATION FOR NORTH AMERICAN APPLICATION

DEP 63.20.08.10-Gen.

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DESIGN AND ENGINEERING PRACTICE



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PREFACE

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The information set forth in these publications is provided to Shell companies for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual Operating Units to adapt the information set forth in DEPs to their own environment and requirements.

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- 3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) or 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the installation, inspection and testing of electrical facilities located in the United States of America and Canada.

This DEP does not specify requirements or give recommendations for design of electrical facilities. Refer to DEP 33.64.20.10-Gen. for this purpose.

This is a revision of the DEP of the same number dated September 2011, amended February 2013. Refer to (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
Accredited Certification Organization (ACO)	An organization that has been accredited by the Standards Council of Canada, in accordance with specific criteria, procedures and requirements, to operate, on a continuing basis, a certification program for electrical equipment. When a reference is made to a NRTL in this DEP, this also includes the Accredited Certification Organization in Canada.
Authority Having Jurisdiction (AHJ)	Organization, office, or individual responsible for enforcing the local regulatory requirements. Consult with the Principal for the applicable AHJs for the specific installation.
Location	The site where the new electrical facilities will be installed and operated.
Nationally Recognized Testing Laboratory (NRTL)	A part of OSHA's Directorate of Technical Support and Emergency Management in the US. The NRTL Program recognizes private sector organizations as NRTLs, and recognition signifies that an organization has met the necessary qualifications specified in the regulations for the Program. The NRTL determines that specific equipment and materials ("products") meet consensus-based standards of safety to provide the assurance, required by OSHA, that these products are safe for use in the U.S. workplace. See DEP 33.64.20.10-Gen., Appendix E for additional information on NRTLs.
Process Safety	Management of hazards that can give rise to major accidents involving the release of potentially dangerous materials, release of energy, such as fire or explosion, or both.

1.3.3 Abbreviations

Term	Definition
AHJ	Authority Having Jurisdiction
ASD	Adjustable Speed Drive
CEC	Canadian Electric Code
CT	Current Transformer
EMT	Electrical Metallic Tubing
LV	Low Voltage
MCC	Motor Control Centre
MCT	Multi Cable Transit
MMS	Minerals Management Service
MV	Medium Voltage
NEC	National Electrical Code
NRTL	Nationally recognized testing laboratory

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets (). Other documents referenced by this DEP are listed in (10).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated September 2011, amended February 2013. The changes followed a requirements quality review and were not a full technical update. The following are the main, non-editorial changes.

Section/Clause	Change
All	Restructured and clarified requirements, enforced use of shall/should/may for normative statements.

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://swwww.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.

2. GENERAL INSTALLATION REQUIREMENTS

2.1 GENERAL

1. Electrical facilities shall be designed for the application and installed in accordance with the Manufacturer/Supplier's ratings, approvals, recommendations, and instructions.
2. Where applicable, electrical facilities shall be suitable for seismic conditions.
3. Protective finishes that sustained damage prior to, or during, installation shall be properly repaired.
4. The material used and method of application shall be compatible with the original equipment Manufacturer/Supplier's finish.
5. If dissimilar metals are in electrical contact, a suitable corrosion inhibitor shall be applied.
6. Protective covers shall be placed over open termination points.

2.2 STANDARDS, CODES, AND REGULATIONS

1. Refer to the National Electrical Code (NEC) for the requirements for US electrical installations.
2. Refer to CSA C22.1 Canadian Electrical Code Part I, or approved variances for the requirements for Canadian electrical installations.
3. Refer to the requirements of the Authority Having Jurisdiction (AHJ) for the local regulatory requirements.

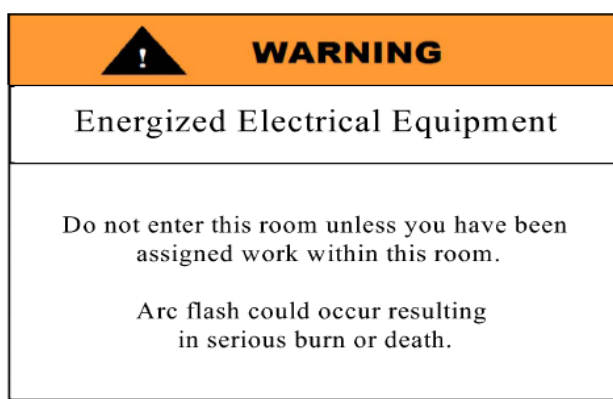
Examples of AHJs are as follows:

- *OSHA Jurisdiction - NEC and Occupational Safety and Health Administration (OSHA) standards 29 CFR 1910 for all facilities in the US (including state waters).*
 - *Bureau of Ocean Energy Management (BOEM) Jurisdiction (primarily fixed facilities in US federal waters) - United States Code of Federal Regulations (CFR) Title 30 Part 250. The BOEM also references API RP 14F/ API RP 14FZ and API RP 500/505 for all fixed facilities in US federal waters.*
 - *USCG Jurisdiction (primarily floating facilities in US federal waters) – API RP 14F/FZ and the United States Code of Federal Regulations (CFR) Title 46 Subchapter for all floating facilities in US federal waters and any other facilities under the jurisdiction of the USCG.*
4. The applicable provisions of the latest published version of referenced codes and standards listed in the References section.

2.3 SAFETY

1. The Principal's electrical safety rules shall be followed.
2. All electrical distribution equipment (e.g., switchgear, motor control centers, and panel boards) shall be labeled with regards to electrical incident energy and appropriate PPE as recommended by the following:
 - a. CSA Z462;
 - b. NFPA 70E; and
 - c. NFPA 70 (NEC).
3. A safety sign as shown in Figure 1 or one with similar intent shall be posted on the exterior door to rooms with electrical equipment.

Figure 1 Safety sign



4. Refer to HSE0038-PR01 for the requirements for US Upstream facilities installation practices.
5. Refer to NFPA 70E and the NEC for the requirements for US Downstream facilities installation practices.
6. Refer to Z462 and CEC for the requirements for Canadian facilities installation practices.

2.4 PROTECTION AGAINST EXPLOSION AND FIRE HAZARDS

1. Refer to DEP 80.00.10.13-Gen. for the requirements for electrical facilities in hazardous (classified) areas.

2.5 STANDARDIZATION OF EQUIPMENT AND MATERIALS

1. Equipment of similar nature and incorporating similar or identical components and of similar or identical construction should be from the same Manufacturer/Supplier.
 - a. This should apply to power and convenience outlets, to luminaries, and bulk materials.

This is for standardization of site materials and equipment.
2. If the project work is at an existing facility, the materials should be compatible with the equipment of that location.

2.6 CERTIFICATES, DECLARATIONS, AND TEST REPORTS

1. The Contractor shall obtain the Manufacturer/Supplier's test reports and certificates in accordance with the equipment specifications.
2. Equipment shall be approved, listed, labeled, certified or otherwise determined to be safe by a NRTL in accordance with nationally recognized product safety standards for the application and the environment in which the equipment is installed (e.g., hazardous locations, wet locations).
 - a. Equipment of a type that no NRTL (US), Certification Body (Canada) or Inspection Body (Canada) approves, certifies, lists, labels, or determines to be safe shall be approved by the AHJ or Electrical Technical Authority.
3. The Electrical Technical Authority may require additional inspection, testing and documentation from the Manufacturer/Supplier or testing laboratories to verify the equipment is safe for its intended use and is acceptable for the area in which it is installed.

2.7 QUALITY ASSURANCE AND CONTROL

1. Contractors and Manufacturers/Suppliers shall implement quality control and assurance systems that conform to the ISO 9000 series.

2.8 TESTING

1. Electrical systems and equipment shall be inspected and tested in accordance with the Project Inspection and Testing Plan.
2. All electrical facilities shall be subject to inspection and tests by the Principal prior to acceptance.

2.9 EQUIPMENT MAINTENANCE DURING STORAGE AND CONSTRUCTION

1. The Contractor shall protect equipment from damage caused by the following:

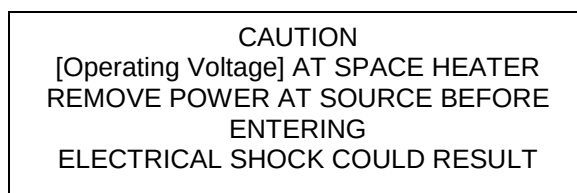
- a. weather;
- b. corrosion;
- c. water;
- d. dirt;
- e. heat;
- f. physical abuse; or
- g. other detrimental conditions.

The kind of damage that can occur during storage or construction.

2. The Manufacturer/Supplier's storage recommendations shall be adhered to the following:

- a. Space heaters furnished with equipment such as generators, motors, and control panels shall be energized during the storage and construction phases of a project.
 - i. Once equipment is energized, the Principal's Lockout and Tagout Procedures shall be followed.
 - ii. A temporary yellow warning sign with black lettering indicating that space heater voltage is present shall be provided on the space heater terminal box cover as shown in Figure 2.

Figure 2 Temporary yellow warning sign



Substitute nominal voltage (120 VAC) for [Operating Voltage] on tag.

3. All outdoor enclosures should have desiccant bags to prevent damage from moisture.

3. EQUIPMENT INSTALLATION

3.1 GENERAL

1. Electrical equipment, such as switchgear, motor control centers, transformers, main generators, motors, and ASDs, shall be installed in accordance with the project contract documents and drawings, and the equipment Manufacturer/Supplier's recommendations.
2. If necessary, a Manufacturer/Supplier's representative shall be present to advise on installation and commissioning.
3. Prior to installation, the physical and mechanical condition of all equipment shall be inspected.
 - a. The nameplate data shall be compared to the project drawings and specifications.
 - b. The Electrical Technical Authority shall be notified immediately upon discovery of damage or a discrepancy.
4. Equipment shall be installed level and plumb.
5. Equipment shall be properly grounded utilizing one of the methods specified in (6).
6. For offshore facilities, equipment installed outdoors shall be secured in place with stainless steel hardware.
7. Once installation is complete, all shipping brackets, braces, straps, and other aids shall be removed.

3.2 TRANSFORMERS

1. Transformer frame and enclosure grounding shall be verified.
2. All bolted electrical field connections shall be tightened to the proper torque using a calibrated torque wrench in accordance with Manufacturer/Supplier's recommendations.
3. For offshore facilities, torque paint shall be applied in the presence of the designated Principal's Responsible Person.
4. Transformer tap setting shall be as specified in the contract documents.

3.3 SWITCHGEAR AND MOTOR CONTROL CENTERS

1. If switchgear or MCCs are installed in field fabricated buildings or rooms, the following shall apply:
 - a. switchgear or MCCs installed after the switchroom is completed, so as to minimize the ingress of dust and dirt during or after erection;
 - b. after assembly and alignment, switchgear busbar joints tightened to the Manufacturer/Supplier's recommended torque settings using a calibrated torque wrench;
 - i. for offshore facilities, torque paint applied in the presence of the Principal.
 - c. after installation, busbar joints insulated in accordance with the Manufacturer/Supplier's instructions;
 - d. all withdrawable switching devices checked for free movement and correct alignment;
 - e. after installation, area clearances, alignment, operation of doors, mechanisms, and removable components verified.

3.4 LIGHTING PANELS

1. Refer to NEC or CEC for the maximum mounting height and location requirements for the panel board mounting height.
2. All circuits shall be legibly identified as to purpose or use on a circuit directory located on the face or inside of the panel door.

3.5 BATTERY SYSTEMS

1. All bolted electrical connections shall be verified for tightness using a calibrated torque wrench, to the values required by the Manufacturer/Supplier.
2. The Manufacturer/Supplier's approved corrosion-inhibiting grease shall be applied on the contact surfaces of all cell-to-cell and terminal connection points.

3.6 ENCLOSURES

1. All explosion-proof enclosures shall be provided with NRTL listed breather and drain fittings to prevent the accumulation of moisture inside the enclosure.
2. All non-explosion proof enclosures shall be provided with one of the following two methods to prevent accumulation of moisture inside the enclosure:
 - a. two 4.7 mm (0.1875 in) diameter holes drilled in opposite bottom corners of the enclosure;
This is the preferred method for offshore facilities. This method requires approval for offshore facilities.
 - b. a drain fitting;
 - i. the drain shall be designed to avoid an accumulation of water in the bottom of the enclosure.
3. Unless otherwise specified, all penetrations shall be located on the bottom or sides of an enclosure.
4. Outdoor enclosures shall not be provided with top entry penetrations.
5. Top entry penetrations are acceptable on indoor enclosures.
6. If top entry penetrations on an outdoor enclosure are unavoidable:
 - a. a top entry penetration shall not be provided above energized parts;
 - b. a hot or cold shrink tubing, with an adhesive coating, shall be installed over the hub;
 - c. for offshore facilities only, a UV-resistant silicone shall be applied to the hub and cable terminator or conduit before the hot or cold shrink tubing.
7. All enclosures shall be grounded in accordance with the drawings.

8. The following shall apply to enclosures for offshore facilities:
 - a. isolate aluminum plates, boxes, and enclosures from steel with 3 mm (0.125 in) thick fiberglass isolators and secured using 316 stainless steel hardware;
 - b. in areas of high humidity, include a corrosion inhibitor (corrosion-inhibiting desiccant device) with a maintenance program to replace the emitter at intervals no greater than one year;
 - c. remove all plastic plugs from the cable penetration hubs provided for shipping;
 - d. all cable penetration hubs be occupied with cable terminations or properly sized NRTL-approved, stainless steel plugs before being put into service;
 - e. cable or conduit entrances into enclosures made with stainless steel hubs that include integral grounding lugs (for non-metallic enclosures) or welded stainless steel half-couplings.

3.7 LABELING AND NAMEPLATES

3.7.1 General

1. All electrical equipment (including enclosures, panels, and junction boxes) shall be provided with a nameplate that displays a text name, a description, and an identifying number.
2. Refer to (Appendix 1) for the labelling requirements for Offshore installations.
3. All gauges, controls and lights, on a panel, box, or other enclosure shall be labeled.
4. Refer to (Appendix 1) and (Appendix 2) for the nameplate color-coded requirements for offshore facilities.
5. Refer to ANSI Z535.4, Section 7, for the nameplate color-coded requirements for onshore facilities.

3.7.2 Label plates

1. All panel-mounted label plates shall be 3-ply phenolic or 2-plex labels with engraved lettering.
 - a. Unless otherwise specified, label plates shall be attached with stainless steel screws.
 - b. For offshore and downstream facilities, label plates for explosion-proof enclosures shall be attached using silicone or other UV-resistant adhesives that provide permanent adhesion.
 - c. For Canadian facilities, label plates shall be attached to the mounting of the panel or be attached to the support or the wall next the enclosure.
 - i. Silicone adhesive shall not be used.

3.7.3 Equipment and cable tags

1. Equipment and cable shall be labeled with stainless steel tags with embossed or debossed lettering.
2. Tags shall be secured to the equipment with black UV-resistant nylon or stainless steel cable ties.

3.7.4 Indoor tags

1. Labeling for items installed indoors, not subject to dirt or abuse, may be the vinyl "peel-and-stick" type.
2. The color and size shall meet the requirements specified in (3.7.1).

4. CABLE AND WIRE INSTALLATION

4.1 GENERAL

1. Cable and wire materials and sizes shall be in accordance with the drawings and cable schedules.
2. Cable splices shall be recorded and their locations marked accurately on 'as-built' drawings.
3. Refer to NEC and CEC for the requirements for the installation of type MC-HL, TECK, and TC cables.
 - a. Refer to API RP 14F or API RP 14FZ, as applicable, for the requirements for the installation of cables for offshore facilities.
4. Refer to IEEE 45 for the requirements for the installation of shipboard.
5. Refer to 46 CFR, Subchapter J, for the requirements for the installation of cables at facilities under the jurisdiction of the USCG.
6. Cables, cable supports, and cable tray shall not be fixed directly or indirectly to equipment or process pipes.
7. All cables shall be installed and supported to avoid the following:
 - a. damage to the exterior jacket;
 - b. bends with radii less than recommended by the Manufacturer/Supplier and applicable codes or regulations, whichever are most stringent;
 - c. flattening of cable;
 - d. tensile stresses in excess of the Manufacturer/Supplier's recommendations;
 - e. cable splices, unless approved in writing by the Electrical Technical Authority;
 - f. penetration of floors or decks without protection by sleeves or kick plates for cables extending into walkway areas;
 - g. untwisting of cable pairs and triads.
8. Cable attachments for pulling shall be pulling eyes or patent grips with a swivel between the eye or grip and the pulling rope.
 - a. The maximum permissible tension when using an eye shall be 0.036 kg (.008 lb) per 5.057 mm² (circular mil) of copper conductor cross section or meet Manufacturer/Supplier recommendations.
 - b. The maximum permissible tension when using a patent grip shall be 0.036 kg (.008 lb) per 5.057 mm² (circular mil) of copper conductor cross section for an eye, but shall not exceed 455 kg (1,000 lb) or meet Manufacturer/Supplier recommendations.
 - c. Tension shall be measured using a dynamometer when pulling main 480/600 volt feeders and medium voltage cables.
9. The following shall be avoided while pulling:
 - a. sharp bending;
 - b. kinking cables;
 - c. damaging insulation;
 - d. overstressing conductors.
10. Care shall be taken with the installation of bi-metallic terminations.

4.2 UNDERGROUND CABLE AND CONDUIT SYSTEMS

1. Direct buried main feeder or critical conduit shall comply with the following:
 - a. locate yellow marker warning tape 30 cm (1 ft) below grade;
 - b. locate red concrete 60 cm (2 ft) below grade;
 - c. bury conduit or cable a minimum of 90 cm (3 ft) below grade.
2. Direct buried non-critical conduit or cable shall comply with the following:
 - a. locate yellow marker warning tape 30 cm (1 ft) below grade;
 - b. bury conduit or cable a minimum of 90 cm (3 ft) below grade.
3. For direct buried conduit or cable, a separation of at least 90 cm (3 ft) shall be maintained between conduit or cable and underground pipelines.
4. PVC conduit and cable tray may be placed underground in concrete duct banks.
5. All underground conduits and cable shall be identified at the transition from underground to above grade.

4.3 ABOVE GROUND CABLE

4.3.1 General

1. Unless otherwise specified, cables shall be installed in cable tray systems.
2. Unless otherwise specified, cables shall not be installed in rigid metal conduit.
3. For offshore facilities, the following apply:
 - a. the use of conduit shall be subject to approval by the Electrical Technical Authority;
 - b. the use of conduit shall be limited to the inside of buildings, enclosures, or on skid packages;
 - c. miscellaneous hardware shall be stainless steel.