

DEP SPECIFICATION

STATIC ELECTRICITY

DEP 80.64.10.11-Gen.

February 2017

DESIGN AND ENGINEERING PRACTICE

DEM1



© 2017 Shell Group of companies

All rights reserved. No part of this document may be reproduced, stored in a retrieval system, published or transmitted, in any form or by any means, without the prior written permission of the copyright owner or Shell Global Solutions International BV.

This document has been supplied under license by Shell to:
UOP Honeywell ted.fuger@honeywell.com 19/01/2018 10:46:23

AVA Documents
Document Sharing Hub

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of Shell Global Solutions International B.V. (Shell GSI) and, in some cases, of other Shell Companies.

These views are based on the experience acquired during involvement with the design, construction, operation and maintenance of processing units and facilities. Where deemed appropriate DEPs are based on, or reference international, regional, national and industry standards.

The objective is to set the standard for good design and engineering practice to be applied by Shell companies in oil and gas production, oil refining, gas handling, gasification, chemical processing, or any other such facility, and thereby to help achieve maximum technical and economic benefit from standardization.

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.

When Contractors or Manufacturers/Suppliers use DEPs, they shall be solely responsible for such use, including the quality of their work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will typically expect them to follow those design and engineering practices that will achieve at least the same level of integrity as reflected in the DEPs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal.

The right to obtain and to use DEPs is restricted, and is typically granted by Shell GSI (and in some cases by other Shell Companies) under a Service Agreement or a License Agreement. This right is granted primarily to Shell companies and other companies receiving technical advice and services from Shell GSI or another Shell Company. Consequently, three categories of users of DEPs can be distinguished:

- 1) Operating Units having a Service Agreement with Shell GSI or another Shell Company. The use of DEPs by these Operating Units is subject in all respects to the terms and conditions of the relevant Service Agreement.
- 2) Other parties who are authorised to use DEPs subject to appropriate contractual arrangements (whether as part of a Service Agreement or otherwise).
- 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.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, Shell GSI disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any DEP, combination of DEPs or any part thereof, even if it is wholly or partly caused by negligence on the part of Shell GSI or other Shell Company. The benefit of this disclaimer shall inure in all respects to Shell GSI and/or any Shell Company, or companies affiliated to these companies, that may issue DEPs or advise or require the use of DEPs.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, DEPs shall not, without the prior written consent of Shell GSI, be disclosed by users to any company or person whomsoever and the DEPs shall be used exclusively for the purpose for which they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of Shell GSI. The copyright of DEPs vests in Shell Group of companies. Users shall arrange for DEPs to be held in safe custody and Shell GSI may at any time require information satisfactory to them in order to ascertain how users implement this requirement.

All administrative queries should be directed to the DEP Administrator in Shell GSI.

TABLE OF CONTENTS

1.	INTRODUCTION	5
1.1	SCOPE	5
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	5
1.3	DEFINITIONS	6
1.4	CROSS-REFERENCES	9
1.5	SUMMARY OF MAIN CHANGES.....	9
1.6	COMMENTS ON THIS DEP	10
1.7	DUAL UNITS.....	10
1.8	NON NORMATIVE TEXT (COMMENTARY).....	10
2.	GENERAL	11
2.1	RISK OF IGNITION DUE TO STATIC ELECTRICITY	11
2.2	IGNITION BY ELECTROSTATIC DISCHARGES	12
2.3	ELECTRIC SHOCK	12
3.	CONTROL OF ELECTROSTATIC CHARGE GENERATION AND ACCUMULATION.....	12
3.1	EARTHING/GROUNDING AND BONDING	12
3.2	USE OF NON-CONDUCTIVE SOLID MATERIALS	13
3.3	USE OF DISSIPATIVE SOLID MATERIALS	13
3.4	FLOORS	14
3.5	IGNITIONS FROM PEOPLE	14
4.	MANAGING RISK OF ELECTROSTATIC IGNITION IN LIQUIDS	14
4.1	GENERAL	14
4.2	LARGE METAL STORAGE TANKS	15
4.3	MEDIUM METAL STORAGE TANKS.....	16
4.4	NON-METAL STORAGE TANKS	18
4.5	SMALL STORAGE TANKS AND CONTAINERS	18
4.6	ROAD TANKER (TANK TRUCK) LOADING	19
4.7	RAIL TANKER (TANK CAR) LOADING	19
4.8	SHIPS AND BARGES	21
4.9	AIRCRAFT FUELLING	21
4.10	ROAD TANKER DELIVERIES.....	21
4.11	MOTOR VEHICLE FUELLING	22
4.12	PLANT PROCESSES (BLENDING, STIRRING, MIXING).....	22
4.13	FILTERS	24
4.14	PIPING SYSTEMS.....	24
4.15	HOSES	25
4.16	VACUUM TRUCKS.....	25
4.17	INERTING SYSTEMS	25
4.18	TRANSMISSION BELTS	25
4.19	GLASS SYSTEMS.....	25
5.	MANAGING RISK OF ELECTROSTATIC IGNITION IN POWDERS AND DUSTS	26
5.1	GENERAL	26
5.2	HANDLING POWDERS OR DUSTS WITHOUT FLAMMABLE GASES OR VAPOURS	26
5.3	HANDLING POWDERS OR DUSTS WITH FLAMMABLE GASES OR VAPOURS	27
5.4	FLEXIBLE INTERMEDIATE BULK CONTAINERS (FIBC)	27
5.5	DESIGN AND ENGINEERING OF PNEUMATIC CONVEYING SYSTEMS	28
5.6	CONVEYOR BELTS AND TRANSMISSION BELTS	28
6.	REFERENCES	29

APPENDICES

APPENDIX A	IGNITION PROPERTIES OF MATERIALS AND INERTING	32
APPENDIX B	HOSES	33

1. INTRODUCTION

1.1 SCOPE

This DEP specifies design and gives recommendations for engineering requirements necessary to avoid ignition due to electrostatic hazards. It supercedes the design and engineering aspects of the 1988 Shell Safety Committee publication "Static Electricity Technical and Safety Aspects" and the 2002 report OG.02.42373.

Operation and maintenance aspects are covered elsewhere (refer to the business operating frameworks).

This DEP is not applicable to the hazard of lightning - refer to DEP 33.64.10.10-Gen. and DEP 33.64.20.10-Gen., as applicable; or for damage of electronic components due to static electricity - refer to DEP 33.64.10.33-Gen.

Electrostatic phenomena are widespread and this DEP is not intended to be an exhaustive list of all such phenomena. For specific cases not covered within the DEP, further guidance should be sought from the relevant subject matter expert.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual DEM 1 – Application of Technical Standards.

This is a revision of the DEP of the same number dated February 2013; 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 capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

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

1.3.2 Specific definitions

Term	Definition
Anti-static	See Dissipative.
Brush Discharge	Brush discharges are produced between blunt conducting electrodes and insulating material (solid, liquid or particles in gaseous suspension). They are considered the second most incendive form of discharge.
Class I Division 1	Hazardous area classification NFPA publication 70, NEC & CEC, also API 500. In which ignitable concentrations of hazards exists under normal operation conditions and/or where hazard is caused by frequent maintenance or repair work or frequent equipment failure.
Class I Division 2	Hazardous area classification NFPA publication 70, NEC & CEC, also API 500. In which ignitable concentrations of hazards are handled, processed or used, but which are normally in closed containers or closed systems from which they can only escape through accidental rupture or breakdown of such containers or systems.
Class II Division 1	Hazardous area classification NFPA publication 70, NEC & CEC. Locations are those in which combustible dust may be found under normal conditions
Clean Liquid	Liquids not characterized as Contaminated Liquid are considered clean in the context of this DEP.
Conductive	An adjective describing a material incapable of retaining a significant electrostatic charge when in contact with earth/ground and having a volume resistivity equal to or lower than 10 kΩm (33 kΩft).
Conductive Hose	A hose with a resistance less than 1 kΩ/m (0.3 kΩ/ft).
Contaminated Liquid	Liquid containing more than 0.5 % by volume of free water or other immiscible liquid or more than 10 mg/l (10 ppm) of suspended solids is considered contaminated in the context of this DEP.

Term	Definition
Discharge	Electrostatic discharges are generated when insulating media (e.g., air) temporarily breaks down due to a high electric field, leading to a spark or other type of discharge.
Dissipative	An adjective describing a material incapable of retaining a significant amount of electrostatic charge when in contact with earth/ground. These materials have a volume resistivity higher than 10 kΩm (33 kΩft) but equal to or lower than 10 ⁹ Ωm (33 x 10 ⁹ Ωft), or a surface resistivity less than 10 ¹⁰ Ω measured at ambient temperature and 50 % relative humidity.
Dissipative hose	A hose with a resistance per unit length between 1 kΩ/m (0.3 kΩ/ft) and 1 MΩ/m (0.3 MΩ/ft). Note that API RP 2003 refers to this type of hose as "Type C conductive", ISO 8031 refers to this type of hose as "Type Ω Semi-conductive" or "Type Ω antistatic".
Earth/Ground	The general mass of earth. In IEC standards, the word Earth is used, whereas in North American standards the word Ground is used. In this Global DEP both are used.
High conductivity liquid	A liquid with a conductivity of 10000 pS/m or greater. (e.g., crude oil, alcohol, water)
High resistivity powders	Powders with volume resistivities > 10 GΩm (10 ¹⁰ Ωm) (330 GΩm) (e.g., polymers).
Insulating	See non-conductive.
Insulating hose	See non-conductive hose.
Low conductivity liquid	A liquid with a conductivity of 50 pS/m or lower. (e.g., gasoline, kerosene, white oils, lubricating oils, NGLs)
Low resistivity powders	Powders with volume resistivities < 1 MΩm (3.3 MΩft) (e.g., metals) In practice, low resistivity powders are rare. Even metal powders do not remain conductive for very long because oxide films form on the surface and increase their resistivity.
Medium conductivity liquid	A liquid with a conductivity between 50 pS/m and 10000 pS/m (e.g., black oils)
Medium resistivity powders	Powders with volume resistivities between 1 MΩm (3.3 MΩft) and 10 GΩm (10 ¹⁰ Ωm) (330 GΩm) (e.g., organic powders)
Minimum ignition energy (MIE)	The minimum spark energy needed to ignite an optimum concentration of flammable material in air using a capacitive spark under ideal conditions.

Term	Definition
Non-conductive	An adjective describing a material that is neither conductive nor dissipative and on which electrostatic charges can accumulate and not readily dissipate even when in contact with earth/ground (e.g., most common plastics). As a guide, solids can be classed as insulating when they have a volume resistivity greater than 100 MΩm (330 MΩft) or a surface resistivity greater than 10^{10} Ω per square.
Non-conductive hose	A hose with a resistance per unit length above 1 MΩ/m (0.3 MΩ/ft).
Relaxation time	The time during which the electrostatic charge on a solid surface, in the bulk of a liquid or powder, or in a cloud of mist or powder, decays exponentially to 1/e (i.e., about 37 %) of its original value.
Semi-conductive	See Dissipative.
Spark	Sparks occur between conductors at different potentials when the electric field in the gap exceeds a breakdown threshold. During the breakdown, a hot conducting plasma channel forms between the conductors and charge flows rapidly, converting potential energy to heat via the plasma channel. Sparks are also readily produced when large current flows are interrupted. Typically, sparks are considered the most incendive form of discharge.
Ultra-low conductivity, high viscosity	< 2 pS/m, > 30 mm ² /s (1.2 in/s) (e.g., highly purified paraffins)
Zone 0	Hazardous area classification per EI 15
Zone 1	Hazardous area classification per EI 15
Zone 20	Hazardous area classification per IEC 60079-10.2
Zone 21	Hazardous area classification per IEC 60079-10.2

1.3.3 Abbreviations

Term	Definition
FIBC	Flexible Intermediate Bulk Containers
MIE	Minimum ignition energy

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 (6).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a full revision of the DEP of the same number dated February 2013. The following are the main, non-editorial changes.

Section/Clause	Change
1.5	Added section renumbered subsequent sections as needed.
1.8	Added section.
2 - 5	Restructured and clarified requirements.
2.2	Deleted sections and renumbered subsequent sections accordingly.
4.1.2	DEM1 Statement referencing (4.2) to (4.11) has been deleted in favor of specific DEM1 Statements applied across these sections.
4.2.2.1 Item 1	DEM1 statement previously 4.1.2 Item 1 applied specifically
4.2.2.1 Item 2	DEM1 statement previously 4.1.2 Item 1 applied specifically
4.2.2.1 Item 3	DEM1 statement previously 4.1.2 Item 1 applied specifically
4.2.2.2 Item 1	DEM1 statement previously 4.1.2 Item 1 applied specifically
4.3.2.2 Item 1	DEM1 statement previously 4.1.2 Item 1 applied specifically
4.3.2.2 Item 2	DEM1 statement previously 4.1.2 Item 1 applied specifically
4.3.2.3 Item 1	DEM1 statement previously 4.1.2 Item 1 applied specifically
4.3.2.4 Item 1	DEM1 statement previously 4.1.2 Item 1 applied specifically
4.7.2 Item 2	DEM1 statement previously 4.1.2 Item 1 applied specifically
4.7.2 Item 3	DEM1 statement previously 4.1.2 Item 1 applied specifically
4.8.2 Item 1	DEM1 statement previously 4.1.2 Item 1 applied specifically
4.9.2 Item 1	DEM1 statement previously 4.1.2 Item 1 applied specifically

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.