

DEP SPECIFICATION

AREA CLASSIFICATION AND ELECTRICAL EQUIPMENT SPACING FOR NORTH AMERICAN APPLICATION

DEP 80.00.10.13-Gen.

February 2011

(DEP Circular 25/12 has been incorporated)

ECCN EAR99

DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the determination of hazardous (classified) areas in facilities handling flammable fluids and is used in conjunction with DEP 33.64.20.10-Gen. for the design of electrical installations in North America. It is based on API RP 505 and API RP 500.

For the classification of areas based on IP15, refer to DEP 80.00.10.10-Gen.

This DEP also provides requirements and recommends practices for electrical equipment spacing and location in petroleum facilities.

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 January 2010.

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 for permanent and temporary installations in oil refineries, chemical plants, oils sands facilities, gas plants, exploration and production facilities as well as distribution storage depots and installations. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process should 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.

1.3.2 Specific definitions

Authority Having Jurisdiction (AHJ)	organization, office, or individual responsible for enforcing the local regulatory requirements. Consult with the Shell Electrical Technical Authority for the applicable AHJs for the specific installation.
Electrical Technical Authority	discipline engineer appointed by the Principal and is responsible for all technical decisions associated with the work
Fire Area	A plant (surface) area where a sustained and intense fire is considered credible.
Manifold	Assembly of pipe flanges, valves, and miscellaneous fittings used to collect or distribute a common fluid or gas to or from a multiple of flowlines
Unprotected fired equipment	fired vessel that is not designed to eliminate the air intake, exhaust and hot surfaces as sources of ignition. NOTE: Protected fired equipment is normally provided with flame arresters, stack temperature shutdowns, forced draft burners with safety controls, spark arresters and insulation/cladding of external surfaces.

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 (4).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated January 2010.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be sent to the Administrator at standards@shell.com, using the DEP Feedback Form. The DEP Feedback Form can be found on the main page of "DEPs on the Web", available through the Global Technical Standards web portal <http://www.shell.com/standards> and on the main page of the DEPs DVD-ROM.

1.7 DUAL UNITS

Amended per

Circular 25/12

Dual units have been incorporated throughout this DEP.

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.

2. AREA CLASSIFICATION

2.1 INTRODUCTION

Area classification is the division of a plant or installation into hazardous (classified) areas and non-hazardous areas and the sub-division of hazardous (classified) areas into zones or divisions. This classification is based on the flammability of materials that may be present and the probability of a flammable atmosphere occurring. The classification provides a basis for the selection of electrical equipment appropriate for the defined areas and may be used as criteria for the safe positioning of other potential or continuous sources of ignition, e.g. fired heaters, internal combustion engines, etc. It can also be used as criteria in the planning and control of hot work, but should not be used as the sole criterion.

Area classification refers to normal operating conditions and does not apply to catastrophic situations such as well blowouts or the rupture of process vessels. These extreme conditions require emergency measures.

Area classification is an important factor in the design of electrical systems for hazardous (classified) locations. It has a major impact on safety, the cost of building and operating facilities and on the ability to maintain them.

Sound engineering judgment is required for the classification of areas. Under classifying areas can lead to equipment becoming ignition sources in flammable atmospheres. Over classifying areas can lead to installations that are costly and difficult to install and maintain which can also compromise the safety of the installations.

2.2 APPLICABILITY OF API RP 505/API RP 500

Facilities that handle flammable and combustible fluids SHALL [PS] be classified in accordance with API RP 505/API RP 500, as amended and supplemented by Section 2 of this DEP. In areas where national or local codes other than API RP 505/API RP 500 apply, these codes should be reviewed and supplemented with the requirements of this DEP.

For areas containing combustible dusts, refer to NFPA 499.

For chemical plants refer to NFPA 497 for additional information and requirements.

For additional information for classifying storage and handling areas associated with the transportation and distribution of Liquefied Petroleum Gas (LPG), refer to NFPA 58.

For additional information for classifying areas involving Liquefied Natural Gas (LNG), refer to NFPA 59A.

The choice between using the zone and division methods for classifying areas should include a review of the current practices at the Location and an evaluation of the economic benefits of both methods. The mixing of divisions and zones at the same site shall be avoided.

Installations which were operating at the date of issue of this DEP may be evaluated against this DEP, which provides current best practice. Any proposal for modification to an existing installation shall be assessed on the basis of whether the benefits from applying the DEP outweigh the implementation costs and risks. If it is intended to reclassify an existing installation on the basis of this DEP, reclassification should cover the entire installation. This is to avoid the application of multiple area classification standards within the same installation.

2.3 ADMINISTRATIVE ASPECTS

Area classification shall be undertaken only by a qualified Electrical Engineer, with sufficient background and experience to ensure that the resulting area classification accurately reflects the observed or anticipated hazardous (classified) location performance. The area classification process shall include the gathering of input from other groups and disciplines such as:

- Process engineering;

- Rotating equipment engineering;
- HVAC engineering;
- Operations and maintenance;
- HSSE and technical safety.

Any modification to the hazardous area classification or changes to process conditions or process related equipment that may impact the area classification of an existing installation SHALL [PS] be subject to a formal change procedure and the appropriate review.

Classification of locations should occur at an early stage of the project, such that equipment can be properly specified.

2.4 SUPPLEMENTAL REQUIREMENTS AND RECOMMENDED PRACTICES

2.4.1 Extent of hazardous (classified) areas

This section provides requirements and recommends practices that supplement or clarify API RP 505/API RP 500.

2.4.1.1 General

The area classification boundaries should be as uniform as possible. Avoid small pockets of unclassified areas within hazardous (classified) locations and excessive fluctuations in the boundary lines.

The area classification boundaries SHALL [PS] not extend beyond Shell property limits, fence lines, etc. and encroach into non-Shell properties.

The layout of process equipment should minimize the extent of hazardous locations classified as Group IIB (Group C) and Group IIC (Group A or B).

Conduit and cable sealing requirements should be included in the determination of area classification boundaries. Boundaries may be extended to avoid the installation of additional conduit and cable seals.

The following may increase the degree or extend the hazardous (classified) location boundaries:

- potential volume of gases or liquids that may be released as the result of an "abnormal situation";
- presence of highly volatile liquids such as propane, butane, propylene, etc.;
- for existing facilities, the past performance of the facility; and
- for new facilities, the observed performance of similar facilities as approved by the Electrical Technical Authority.

Equipment layout, building and ventilation design, and plot plan layout shall minimize Class 1, Zone 0 or Zone 1 (Division 1) locations. The intent is to minimize the requirement for explosion-proof and intrinsically safe equipment.

The maximum temperature, or T-Code, permissible SHALL [PS] be identified and based on the lowest material auto-ignition temperature present in the area. The maximum temperature may be identified per site, per unit, per building, etc.

Areas containing fuel gas facilities operating at or above 345 kPag (50 psig) SHALL [PS] be classified. Odorized fuel gas facilities operating less than 345 kPag (50 psig) are normally not classified.

NOTE: Municipal natural gas distribution systems normally operate at 207 kPa (30 psi) or less and are odorized with mercaptan to facilitate leak detection.

API RP 505/API RP 500 Annex D considers the volatility of material and predicted release rates to determine the extent of classification boundaries. Annex D may be used to verify/validate the classification of existing facilities for low volatility and low volume releases, but should not be used to classify new "grassroots" facilities.

Appendix A contains additional drawing details not available in API RP 505/API RP 500 that may be used for determining the extent of classified boundaries. Refer to the notes to verify the applicability of the drawing.

- Figure A1-1 Oil or Gas Wellhead
- Figure A1-2 Adequately Ventilated Process Building
- Figure A1-3 Inadequately Ventilated Process Building
- Figure A1-4 Adequately Ventilated Building Handling Produced Water or Building Subject to Similar Low-Volume Gas or Vapor Releases
- Figure A1-5 Manifold
- Figure A1-6 Air-Cooled Heat Exchanger With Open or Closed Side Louvers
- Figure A1-7 Control Valve

2.4.1.2 Offshore production facilities

For offshore production (EP) facilities, the area within 3 m (10 ft) surrounding any piping and tubing systems that contain flammable fluids (gases, vapors, liquids) and have leak sources such as valves, flanges, threads, taps, gauges and small bore appurtenances should be classified as Class I Zone 2 (Division 2) minimum.

For offshore floating production (EP) facilities with drilling rigs, the entire area comprising the drill floor is classified Class I, Zone 2 (Division 2) minimum.

For offshore production (EP) facilities, the interior space of turbine generator buildings and enclosures is classified Class I, Zone 2 (Division 2) regardless of ventilation and fuel gas pressure.

2.4.1.3 Onshore production facilities

For onshore production locations, a multiplying factor should be used to account for higher operating pressures except for lower risk hydrocarbon processes as described below. Higher pressures represent larger releases and possibly increased areas where a flammable mixture may exist after such a release is realized. Engineering judgment should be used whenever addressing high-pressure hydrocarbon streams. Table 1 indicates Pressure Adjustment Factors that should be used to determine the appropriate hazard radii or distance of all dimensions shown in the appropriate figure based on equipment operating within the indicated pressure range. To apply the factors, identify the type of equipment, determine the maximum operating pressure, use the appropriate figure in API RP 505/API RP 500 for the equipment type, select the adjustment factor from Table 1, and multiply the adjustment factor times the hazard distances from the figure to establish the area classification hazard distances. For example, the area around a separator operating at 10342 kPag (1500 psig) is classified in accordance with Figure 48 (API RP 500). The hazard radii of 3 m (10 ft) illustrated in Figure 48 (API RP 500) is increased by the correction factor in Table 1, resulting in a hazardous radius of 7.5 m (25 ft).

Certain applications do not represent higher release risks at higher pressures due to the reduced dispersion capacity; and therefore, the indicated pressure adjustment factors do not apply. These applications include:

- heavy oil production streams (14 API gravity or less);
- high-pressure/low volume applications (such as chemical injection systems);
- high water cut production streams;
- high hydrocarbon-carbon dioxide mixtures; or,
- other similar applications.

The multiplying factors identified in Table 1 were derived from anticipated leak sizes and dispersion modeling methods described in IP 15. Use of adjustment factors different from those in Table 1 requires a detailed engineering analysis approved by the Electrical Technical Authority.

Table 1 – Pressure Adjustment Factors for Onshore Production (EP) Installations

Description	Typical Services	Pressure Range	Adjustment Factor
Low Pressure	LP Separation, Free Water Knock Out , Bad Oil Tank , Vapor Recovery Unit , fuel system, etc.	0 kPag to 5102 kPag (0 psig to 740 psig) (Typical ANSI 300 Class flange and below rating at 37°C (100°F))	1.0
Medium Pressure	MP (Medium Pressure) Separation, gas compression, etc.	5109 kPag to 9928 kPag (741 psig to 1440 psig) (Typical ANSI 600 Class flange rating at 37°C (100°F))	1.5
High Pressure	HP Separation, manifold, Flow Line, , gas compression, dehydration, metering, export, etc.	> 9928 kPag > (1440 psig) (Typical ANSI 900 Class and above flange ratings at 37°C (100°F))	2.5

2.4.2 Area classification documentation

Area classification documentation SHALL [PS] be:

- kept up-to-date; and,
- available on site and as part of the location's permanent documentation record.

Area classification documentation SHALL [PS] take into account:

- new or modified process equipment or process related facilities;
- changes in process conditions;
- temporary equipment installed for more than 90 days (60 days for offshore locations); and,
- experience in operation of the installation.

Area classification drawings and supporting documentation shall be submitted to the Electrical Technical Authority for review and approval. Drawings shall be approved by Shell before purchase of electrical equipment.

NOTE: Some jurisdictions mandate the approval of area classification drawings by registered professional engineers and by the local authority (AHJ) and retained by Shell. (e.g., offshore locations under MMS and US Coast Guard jurisdiction).

Area classification documentation shall be in accordance with this DEP and local regulatory requirements and should include the following: