

DEP SPECIFICATION

PASSIVE FIRE PROTECTION FOR ONSHORE FACILITIES

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DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design and application/installation of passive fire protection (PFP) of steel in Fire Protection Zones (FPZs).

This DEP applies to steel supporting structures and piping and equipment in process areas and processing plants as well as to storage facilities, jetties and pipe bridges (including those outside the battery limits) in oil/gas/petrochemical installations.

This DEP is intended to ensure that the extent of PFP applied is effective and practical in terms of maintainability and reduction of risks.

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 2015; 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 and distribution. 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 Abbreviations

Term	Definition
FPZ	Fireproofing Zone
HCM	Hazard Consequence Modelling
ITP	Inspection and Test Plan
PFP	Passive Fire Protection
TSA	Thermally Sprayed Aluminium

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 (7).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a full revision of the DEP of the same number dated February 2015. The following are the main non-editorial changes to align DEM1 requirements with DEP 80.47.10.30-Gen:

Section/Clause	Change
All	Restructured and clarified requirements, enforced use of shall/should/may for normative statements.
3.3	Added notes from Appendix B.
3.1	Added notes from Appendix C.
6.2	Included notes from Appendix D.

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.
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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 PROJECT DOCUMENTATION REQUIREMENTS

In order for a project to comply with this DEP, documentation, as specified in (Appendix A), shall be provided to Principal in the Definition and Execution phases of the project.

2. GENERAL

2.1 OBJECTIVES

Passive fire protection (PFP) is intended to improve the fire resistance of structures that support pressure vessels, piping and other equipment located in FPZs. PFP is provided by the application of concrete or other approved protection materials to structural steel supports. PFP offers protection against the adverse thermal effects of fire for a defined period and a defined degree of exposure.

1. PFP should not be considered as a replacement for active firefighting or lead to relaxation of normal design requirements (spacing and layout considerations) or precautions in operation and maintenance.

2.2 GENERAL REQUIREMENTS

1. The extent of PFP SHALL [PS] be established on the basis of a fire safety assessment executed for the particular plant or unit, with reference to DEP 80.47.10.30-Gen.

The zones where PFP is required are called Fire Protection Zones (FPZs). For designs inside the USA the concept of Potential Fire Source is used.

2. The extent (area of coverage) of PFP applied to equipment and structures shall be indicated on layout and construction drawings.
3. As there is a wide variation in the design requirements for structures, this DEP shall be used when specifying PFP for structures not specifically mentioned in (3).

2.3 FIRE SEVERITY

1. The severity of the fire shall be based on hydrocarbon pool fires using the fire temperature profile per UL 1709.

The hydrocarbon fire test as defined in UL 1709 is applicable to all PFP systems applied on steel supports and structures.

2. Refer to ISO 22899-1 to determine the performance of PFP material selected for the protection of structures against credible jet fire scenarios.

The PFP performance test specified in ISO 22899-1 is complementary to other hydrocarbon fire resistance tests of PFP materials, as specified in UL 1709, BS 476 and ISO TR 834-3.

2.4 FIRE RESISTANCE DURATION

1. Refer to DEP 80.47.10.30-Gen. for the required protection time to be provided by PFP.

For steel structures and equipment requiring passive fire protection, a typical minimum of 30 minutes protection time against a hydrocarbon fire is provided.

The need for protection times is provided in the FSA, which takes into account fire size, duration, extent of flame impingement and availability of fixed/mobile firefighting system. The FSA uses HCM methods, which are mathematical models to estimate the effect of explosions, fires and dispersion.

3. PASSIVE FIRE PROTECTION OF EQUIPMENT AND STRUCTURES

3.1 STRUCTURES SUPPORTING EQUIPMENT AND PIPING

1. For PFP on pressure equipment legs or lugs, a minimum gap of 25 mm-50 mm (1 in-2in) shall be maintained between the PFP and pressure retaining parts.
2. Bolted moment connections of shop-applied, fireproofed, main pipe racks blockouts should be fireproofed in the field subsequent to erection.

Block outs are typically fireproofed subsequent to erection; however, moment connection block outs in pipe racks can be ignored with consultation with the Principal.

3. Structural bracing shall only be fireproofed when required for load cases that are included with the base fire case and for primary stability of the structure.
4. Where concrete fire proofing is applied to primary or secondary structural members, refer to Appendix C, and the following notes shall apply:
 - a. structural sections with a depth less than 300mm (12") shall be box section;
 - b. structural sections with a depth greater than 300mm (12") may be contoured in shape;
 - c. reinforcing mesh anchors should be spaced on 500mm (19.5") centers;
 - d. anchor clips should be attached to the structural anchor using epoxy mastic;
 - e. when using hollow box sections of less than 300mm (12"), fire stops shall be installed every 1.5m (5ft);
 - f. where proprietary materials are used for reinforcing mesh installations, Manufacturer/Supplier recommendations should be followed;
 - g. where economically beneficial, cylindrical forms may be used for columns.

3.2 COLUMN AND VESSEL SKIRTS

1. PFP shall be directly applied on skirts and vessel supports as indicated in S 20.002-001 and S 20.003-001, if they meet the criteria stated in 3.3.2 Item 1 of DEP 80.47.10.30-Gen.
 - a. The skirt PFP shall stop well below the vessel insulation tangent line for hot or cold insulated vessels.
 - i. The separation distance between the ring angle and the vessel insulation tangent line shall either conform to S 20.003-001, or be determined using heat transfer and stress calculations.
 - 1). Heat transfer and thermal stress calculations shall determine the type and amount of reinforcement required.
 - b. The inside of the skirt SHALL [PS] be protected with:
 - i. PFP if there are flanged pipe connections inside the skirt;
 - ii. fire resistant insulation material if insulation is required inside the skirt and there are no flanged pipe connections inside the skirt.
2. PFP shall be applied to steel saddles as required by DEP 80.47.10.30-Gen. Section 3.3.3.

For details of column and vessel skirt fire proofing and sphere support leg fire proofing, refer to Standard Drawings S 20.002 and S 20.003.