

DEP SPECIFICATION

METALLIC MATERIALS - PREVENTION OF BRITTLE FRACTURE IN NEW ASSETS

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DESIGN AND ENGINEERING PRACTICE

DEM1



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

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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the selection and application of steels in order to prevent brittle fracture at low temperature, and is applicable to new assets. This DEP applies irrespective of the contained fluids and covers low temperatures caused both by climate and by the process operating envelope. In addition, specific requirements are given for equipment containing liquefied gas.

Guidelines are given for steel selection on the basis of the Lower Design Temperature for:

- unfired pressure vessels;
- piping, piping components and valves (including control valves);
- rotating equipment;
- subsea equipment subjected to Joule Thompson cooling.

This DEP shall only be used within the context of the relevant design and construction codes and the corresponding DEPs. See (3).

This DEP is not applicable to:

- fired heaters;
- transmission pipelines;
- vertical atmospheric storage tanks;
- steel structures.

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 number dated February 2011; 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.

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

Term	Definition
Adiabatic Flash Temperature (AFT)	The lowest temperature a liquid reaches, when a given quantity of a mixture is adiabatically depressurised to atmospheric pressure.
Atmospheric Boiling Point (ABP)	The temperature at which the vapour pressure throughout the bulk of the liquid exceeds the atmospheric pressure.
Equipment	In the context of this DEP, any unfired vessel, column, reactor, heat exchanger, pump, compressor, piping or part thereof under internal or external pressure. Fired heaters, vertical atmospheric storage tanks, steel structures and transmission pipelines are excluded from this definition.
General Membrane Stress	The tensile component of the general primary stress resulting from sustained loadings, such as internal and external pressures, static head, own weight and wind loading. The general membrane stress is averaged over the thickness of the structure and it determines the elastic stored energy in the wall of the equipment. In design or assessment of piping systems, stresses due to thermal constraints contribute to the general membrane stress.
Liquefied Gas	A product which is gaseous at ambient temperature and atmospheric pressure, but is maintained in a liquid state by means of pressure or refrigeration, or a combination of the two.
Lowest Ambient Temperature (LAT)	The lowest one day mean ambient temperature on the basis of meteorological data of hourly measurements over the last 20 years, or longer. The LAT shall not be warmer than the lowest ambient temperature to be used for design under the local regulations.
Lower Design Temperature (LDT)	The lowest temperature at which equipment may be subjected to its design pressure; LDT is further described in (4.2).
Minimum Metal Temperature (MMT)	The lowest temperature that equipment may possibly attain; MMT is further described in (4.1).

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 (7).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated February 2011. The following are the main, non-editorial changes.

Section	Change
3	updated reference to design codes and pressure vessel DEPs
4.4	added new section "Specific conditions for subsea equipment"

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.