

DEP SPECIFICATION

DEFINITION OF TEMPERATURE, PRESSURE AND TOXICITY LEVELS

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DESIGN AND ENGINEERING PRACTICE

DEM1



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PART I INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for determining temperatures and pressures in design and operation (Part II). It also defines substances with regard to their toxicity, for which other DEPs may specify additional design and engineering requirements (Part III).

The custodianship and accountability for this DEP resides with the Process Engineering discipline. However, the definition of toxicity is a technical competency that is maintained in the Health discipline in Shell. As such, the relevant subject matter experts and the custodianship for (Part III) of this DEP are with the Health discipline.

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 2012; 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.

1.3.2 Specific definitions

Term	Definition
Intended operation	Operation in which process conditions, i.e., temperature, pressure, flow, fluid compositions, etc., are stable and in accordance with the process design.
Incidental operation	Infrequent transient conditions for short durations associated with pipeline operation as the result of surge, failure of a control valve, accumulation of pressure during activation of an overpressure protection device.
MSDS	Materials Safety Data Sheet
Pressure relief valve	Generic term for relief valves, safety valves or safety/relief valves.
Pressure relief device	Generic term for pressure relief valves, bursting disks, or other mechanical emergency relief appliances.
ppm-volume	Molar concentration of a substance in parts per million. For gas, the ppm-volume in SI-units is calculated as: $ppmv = (mg/m^3) \times (molar\ gas\ volume) / (MW\ of\ substance)$ where - mg/m^3 is the substance concentration in milligrams per Normal cubic metre (Nm^3); - 22.42 is the molar gas volume at normal temperature and pressure conditions (0 °C and 101.325 kPa) (32 °F and 14.7 psi) - 23.64 is the molar gas volume at standard temperature and pressure conditions (15 °C and 101.325 kPa) (60 °F and 14.7 psi) - MW is the relative molecular mass of the substance Or, when using US Customary units: $ppmv = (lb/ft^3) / 1000000 \times (molar\ gas\ volume) / (MW\ of\ substance)$ - lb/ft^3 is the substance concentration in pounds per cubic foot; - 359 is the molar gas volume at normal temperature and pressure conditions (32 °F and 14.7 psi) - 379 is the molar gas volume at standard temperature and pressure conditions (60 °F and 14.7 psi) - MW is the relative molecular mass of the substance
Very toxic (substances)	Substances that are very hazardous for the environment or human health. NOTES: 1. "Toxic" substances are classified as such in databases such as the European Chemical Substances Information System (ESIS) and the Globally Harmonised System of Classification and Labelling (GHS). This DEP (see (Part III, 3)) further classifies some of these substances as "very toxic". 2. This DEP further classifies very toxic substances as "very toxic - acute", "very toxic - chronic" and "very toxic - environment". 3. Where a substance has been deemed "very toxic acute" on the basis of the definitions in (4) of this document, there may be over conservativeness in specifying equipment if the classification has been reached as a result of R34, R35 (causes (severe) burns) or H314/H318 (causes severe skin burns and eye damage). Risk should be evaluated before determining the degree of equipment needed (i.e., double pump seals or double block and bleed). This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual (DEM) 1 – Application of Technical Standards. In some instances, derogation may be appropriate.

1.3.3 Abbreviations

Term	Definition
ABP	Atmospheric Boiling Point
AFT	Adiabatic Flash Temperature
CMR	Carcinogen, Mutagen, Reprotoxicant
DP	Design Pressure
DSD	Dangerous Substances Directive
DT	Design Temperature
EDT	Emergency Design Temperature
GHS	Globally harmonized system of classification and labelling
HPD	Hydrostatic Pressure Differential (liquid head at pump discharge due to delivery height change)
HPO	Highest Pressure Operating (shutoff pump differential)
HPS	Hydrostatic Pressure System
LAT	Lowest Ambient Temperature
LDP	Lower Design Pressure
LDT	Lower Design Temperature
MAIP	Maximum allowable incidental pressure
MAOP	Maximum allowable operating pressure
MAT	Minimum Allowable Temperature
MAWP	Maximum allowable working pressure
MDMT	Minimum Design Metal Temperature
MDT	Mechanical Design Temperature
MMT	Minimum Metal Temperature
MOP	Maximum Operating Pressure
MOT	Maximum Operating Temperature
OP	Operating Pressure
OT	Operating Temperature
SOP	Standard Operating Pressure
UDT	Upper Design Temperature

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 (Part IV).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a full revision of the DEP of the same number dated February 2012. The following are the main, non-editorial changes.

Section/Clause	Change
General	The DEP has been split into multiple parts. Part II covers definition of pressure and temperature. Part III covers definition of very toxic substances.
Part I, 1.3.2	Added the term “incidental operation” with definition. Modified definition of Very toxic. Modified definition of ppm volume.
Part I, 1.8	Added this section.
Part II, 3.1.3	Added items 5, 6 and 7.
Part II, 3.1.4	Added last sentence under item 2. Added last sentence under item 3.
Part II, 3.1.6	Added item 6. Demoted SHALL [PS] statement to lowercase shall statement in item 8.
Part II, 3.2.1.2	Added item 6.
Part II, 3.2.1.3.1	Added item 5.
Part II, 3.2.1.3.2	Added item 12.
Part II, 3.2.1.3.6	New Section added on Pipeline systems
Part II, 3.2.1.4	Item 1 reworded to remove SHALL [PS] statement.
Part II, 3.2.1.6	New Section added on MAIP.
Part III, 5.2 and 6.1.1	Deleted the ‘ppm volume’ section.
Part III (general)	Changed wording from “classification” to “definition” throughout Part III. Modified Table 2 with added definitions.

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 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.

PART II DEFINITION OF PRESSURE AND TEMPERATURE

1. TECHNICAL ASSURANCE

During project development, the operating and design pressure/temperature requirements are specified by the process engineer.

2. PRESSURE SYSTEM

A pressure system is an individual equipment item or a group of equipment including associated piping that within its boundaries remains open under all conditions, and it can be demonstrated that blockage due to freezing, solidification, fouling, sublimation, damage of internals, scale, debris, foreign objects, etc., cannot occur.

1. If block valves are included in the system, the requirements of ASME VIII Division 1 Appendix M shall be met.
2. The system design pressure SHALL [PS] not be higher than the pressure rating of any system component.
3. The effects of static head shall be taken into account.
4. When a system approach is taken, the hydraulics shall be evaluated to ensure that no equipment exceeds its design pressure before a pressure relief device activates, and during relieving conditions, no equipment exceeds its code allowable accumulation.

3. TEMPERATURE AND PRESSURE LEVELS

3.1 TEMPERATURE

3.1.1 Operating temperature (OT)

The OT is the temperature that prevails inside equipment and piping during the predominant intended operation.

1. The process engineer shall determine the OT.
2. Where temperatures different than the intended operation are to be specified and taken as the operating temperature, the maximum operating temperature (Part II, 3.1.2) or the emergency design temperature (Part II, 3.1.4) SHALL [PS] be considered individually.

In many cases, temperatures different from those required for the intended operation can occur, e.g., during start up, shut down, drying, regeneration, steam-air decoking, heating up to maximum ambient temperature, including solar radiation, fouling of heat exchangers, failure of cooling medium and heat exchanger by-passing, etc.

3. The reason for the specification shall be stated in the relevant documents (see DEP 01.00.02.12-Gen. for preparation of safeguarding memoranda).

3.1.2 Maximum operating temperature (MOT)

1. If operational flexibility is needed, the MOT shall be established higher than the OT. Otherwise, the MOT should be greater than or equal to the OT but shall not be below the OT.
2. The MOT shall be determined by the process engineer in consultation with the process control engineer.
3. The MOT is normally used as the basis for materials selection with respect to long term corrosion and/or material degradation. Therefore, any subsequent proposed change in MOT shall be scrutinised to confirm the continued suitability of the material.