

DEP SPECIFICATION

PIPING CLASSES – BASIS OF DESIGN

DEP 31.38.01.10-Gen.

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DESIGN AND ENGINEERING PRACTICE

DEM1



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PART I INTRODUCTION

1 INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for piping classes and explains the design basis of the piping classes in DEP 31.38.01.12-Gen. and DEP 31.38.01.15-Gen. (Part II) explains the design basis of the piping classes in DEP 31.38.01.23-Gen., which conforms to CSA Z662. (Part II) is written as amendments to (Part I).

Guidance on the application of piping classes for projects is given in DEP 31.38.01.21-Gen.

Line pipe and fittings for oil and gas transmission pipeline systems are outside the scope of this DEP.

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 2016; 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.

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

1.3.2 Specific definitions

Term	Definition
assembly	Pre-designed standard configuration for vents, drains, orifice meter runs, thermowells and pressure points within a piping class.
flashing fluid	Fluids listed in Energy Institute IP 15: 2005 as Class 0, I, II(2) and III(2). Also includes fluids listed as Class II(1) and III(1) where warm/hot surfaces are within the distances defined in API RP 505:1997, section 14.3
piping class	Collection of piping components, suitable for a defined service and design limits, in a piping system.
surface facilities (piping classes)	Surface facility type in the Piping Classes refers to all components not covered by pipelines (Piping Classes) under the jurisdiction of the provincial pipeline regulatory agency.
very toxic (substances)	Substances that are very hazardous for the environment or human health, as specified in DEP 01.00.01.30-Gen. (which also identifies "toxic" substances by reference to chemical substances databases).

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 III).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated February 2016. The following are the main, non-editorial changes.

Section/Clause	Change
3.2	Expanded wall thickness range used
3.9	Updated the reference to the European Pressure Equipment Directive
3.17	Added new section in (Part I, 3.17) on forged /cast valves.
	In Part II, (3.17) was renumbered to (3.18), and so on.

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.

2 GENERAL

2.1 SERVICES NOT COVERED IN DEPS

1. For services not covered in DEP 31.38.01.12-Gen., DEP 31.38.01.15-Gen. or DEP 31.38.01.84-Gen. (e.g., fluid service, ASME pressure rating, temperatures, sizes, materials, valves), piping classes SHALL [PS] be developed in accordance with the design basis specified in this DEP.

2.2 DEFINITION OF A PIPING CLASS

A piping class consists of a collection of standardised piping components that are compatible and are suitable for a defined service at stated pressure and temperature limits. All components applied in piping classes are covered by a 'Material and Equipment Standards and Codes' (MESC) buying description.

The MESC catalogue is available to Shell users and licensees on the Customer Wide Web of Shell Global Solutions: <http://www.shell.com/cww>.

2.3 BENEFITS OF PIPING CLASSES

The benefits of designing and purchasing piping in accordance with piping classes are summarised as follows:

- *Large reduction in piping system engineering and procurement effort;*
- *Group-wide standardisation of piping material and piping systems design;*
- *Variety control, leading to reduced costs of stocking material;*
- *Integrity control in relation to applied standards;*
- *Increased leverage for centralised purchasing;*
- *Reduced risk of wrong material selection.*

2.4 APPLICATION OF PIPING CLASSES

1. For the application of piping classes reference is made to the following DEPs and MESCOs:
 - a. DEP 31.38.01.11-Gen.
 - b. DEP 31.38.01.12-Gen.
 - c. DEP 31.38.01.15-Gen.
 - d. Standard form DEP 31.38.01.84-Gen.
 - e. MESC Group 74 (pipe)
 - f. MESC Group 76 (fittings and flanges)
 - g. MESC Group 77 (valves)
 - h. MESC Group 81 (bolting)
 - i. MESC Group 85 (gaskets and packing).

2.5 PIPING CLASS NUMBERING

1. The piping class number shall be comprised of three parts as follows:

Part 1		Part 2				Part 3

- a. Part 1 is made up of one or two digits that indicate the ASME rating class as follows:

- 1** for ASME rating class 150
- 3** for ASME rating class 300
- 6** for ASME rating class 600
- 9** for ASME rating class 900
- 15** for ASME rating class 1500
- 25** for ASME rating class 2500

- b. Part 2 is made up of four digits as follows:

- i. The first digit indicates the general group of materials as follows:

- 1** Carbon steels
- 2** Low and intermediate alloy steels
- 3** Stainless steels
- 4** Aluminium and aluminium alloys
- 5** Copper and copper alloys
- 6** Nickel and nickel base alloys
- 7** Non-metallic materials
- 8** Carbon steel, lined or galvanised

- ii. The last three digits are for identification and have no specific meaning.

*An example of Parts 1 and 2 is: **15 3050** for ASME rating class 1500, stainless steel.*

- c. Part 3 indicates a process service related selection of impact tested and non-impact tested material in carbon steel piping classes.

–KS *Impact tested material selection for application down to -29 °C (-20 °F). These piping classes have been developed for liquid butane, LPG and compressed light and flammable gases such as hydrogen, methane, ethane, propane and ethylene.*

–29 *Piping class material selection in line with ASME B31.3 Figure 323.2.2A curve B for application down to -29 °C (-20 °F) for services not mentioned for –KS above.*

2.6 CONTENT OF PIPING CLASSES

A piping class document is made up of five or six pages, the contents of which are specified as follows:

Page 1

Summary block giving class details and revision status.

Mechanical design limits, indicating the pressure ratings at coincident temperatures.

Notes, giving additional design background and application guidelines/restrictions.

Branch table, giving construction details for 90° branch connections, suitable within the design limits.

Table of schedules, giving the selected pipe (schedule number or actual thickness) for each nominal pipe diameter in the piping class concerned.

Page 2 (and 3):

Short materials descriptions for piping components used in the piping class, referring to external standards.

Pages 3, 4 (and 5):

Components and their MESC numbers.

Page 5 (or 6):

Ranges of bolt sets for various types of flanged joints.

Assemblies for vents, drains and instrument connections.

1. Assemblies for instrument connections shall be in accordance with DEP 32.31.00.32-Gen. and DEP 32.37.10.11-Gen.

Figure numbers shown in the assemblies refer to those given in (Appendix A) of this DEP.

2.7 SELECTION OF PIPING CLASSES

The "services and materials selection index" (Standard Form DEP 31.38.01.84-Gen.) identifies the main characteristics (e.g., materials, valves, gaskets and bolting) of all piping classes.

1. Piping classes SHALL [PS] be:
 - a. selected according to the "services and materials selection index" (Standard Form DEP 31.38.01.84-Gen.) and as follows:
 - i. The appropriate ASME rating class is identified by matching the required operating pressure and temperature with the design limits given in the piping classes.
 - ii. For final selection, the responsible materials and corrosion engineer are consulted;
 - b. developed following the process for project specific piping classes as per DEP 31.38.01.21-Gen. in case the service is not listed in the service index list (DEP 31.38.01.84-Gen.).

3 DESIGN PRINCIPLES

3.1 SELECTION OF BASIC MATERIAL

1. The composition and properties of the medium SHALL [PS] be specified by the process engineer.
2. In consultation with the process engineer, the materials and corrosion engineer SHALL [PS] establish the required metallic and non-metallic materials selection based on the process requirements such as medium, pressure, vacuum conditions, minimum/maximum temperature, flow and the environment of the process facility.
3. Design life and cost considerations shall also be taken in account when optimising the material selection.
4. After selection of the basic material for the specified service, a suitable piping class SHALL [PS] be selected (2.7) for the design pressure and temperature.
5. The primary selection of the piping classes will be governed by the characteristics of individual process streams. However, the total number of selected piping classes should be assessed for possible standardization, limitation of component varieties, spare part and stock holding optimisation, and the risk of mixing similar materials.
6. For additional information, the following DEPs should be consulted:
 - a. DEP 30.10.02.11-Gen.
 - b. DEP 30.10.02.13-Gen.
 - c. DEP 30.10.02.31-Gen.
 - d. DEP 39.01.10.11-Gen.

3.2 DESIGN CODES

Metallic piping classes have been designed in accordance with ASME B31.3.

The design limits specified in the piping classes have been derived from the pressure/temperature (P/T) ratings for flanges given in ASME B16.5 for sizes, up to and including DN 600 (NPS 24) and ASME B16.47 for sizes DN 750-1200 (NPS 30-48), unless otherwise stated in the piping class notes.

There are no piping classes for pressures higher than those allowed by the ASME B16.5 rating class 2500 for the specified design temperature and material.

For listed materials the relevant values from Table 2 of ASME B16.5/B16.47 apply. For comparable materials not listed, the Pressure / Temperature rating is established in accordance with Annex B of ASME B16.5.

Where specified by ASME B31.3, bolting calculations have been performed to verify the ability to seat the selected gasket and to maintain a sealed joint under the given pressure/temperature (P/T) rating; ASME PCC-1 has been followed for this.

Allowable internal pressures for pipe and fittings have been verified in accordance with ASME B31.3 paragraph 304.1.2 equation (3a) in order to meet the design limits of piping classes.

For sizes DN 15 (NPS ½) to DN 600 (NPS 24), a manufacturing tolerance of 12.5 % has been applied.

For sizes larger than DN 600 (NPS 24), all components have been specified so that a negative manufacturing tolerance of 0.3 mm (0.01 in) is used as the base for the mechanical design.

For manufacturing tolerances of fittings larger than DN 600 (NPS 24), reference is made to MSS-SP-75 Chapter 13 (instead of Chapter 11 of ASME B16.9).