

DEP SPECIFICATION

PIPING CLASSES - REFINING AND CHEMICALS

DEP 31.38.01.12-Gen.

February 2012

DESIGN AND ENGINEERING PRACTICE

DEM1



PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of Shell Global Solutions International B.V. (Shell GSI) and, in some cases, of other Shell Companies.

These views are based on the experience acquired during involvement with the design, construction, operation and maintenance of processing units and facilities. Where deemed appropriate DEPs are based on, or reference international, regional, national and industry standards.

The objective is to set the standard for good design and engineering practice to be applied by Shell companies in oil and gas production, oil refining, gas handling, gasification, chemical processing, or any other such facility, and thereby to help achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to Shell companies for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual Operating Units to adapt the information set forth in DEPs to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use DEPs, they shall be solely responsible for such use, including the quality of their work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will typically expect them to follow those design and engineering practices that will achieve at least the same level of integrity as reflected in the DEPs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal.

The right to obtain and to use DEPs is restricted, and is typically granted by Shell GSI (and in some cases by other Shell Companies) under a Service Agreement or a License Agreement. This right is granted primarily to Shell companies and other companies receiving technical advice and services from Shell GSI or another Shell Company. Consequently, three categories of users of DEPs can be distinguished:

- 1) Operating Units having a Service Agreement with Shell GSI or another Shell Company. The use of DEPs by these Operating Units is subject in all respects to the terms and conditions of the relevant Service Agreement.
- 2) Other parties who are authorised to use DEPs subject to appropriate contractual arrangements (whether as part of a Service Agreement or otherwise).
- 3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) or 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, Shell GSI disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any DEP, combination of DEPs or any part thereof, even if it is wholly or partly caused by negligence on the part of Shell GSI or other Shell Company. The benefit of this disclaimer shall inure in all respects to Shell GSI and/or any Shell Company, or companies affiliated to these companies, that may issue DEPs or advise or require the use of DEPs.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, DEPs shall not, without the prior written consent of Shell GSI, be disclosed by users to any company or person whomsoever and the DEPs shall be used exclusively for the purpose for which they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of Shell GSI. The copyright of DEPs vests in Shell Group of companies. Users shall arrange for DEPs to be held in safe custody and Shell GSI may at any time require information satisfactory to them in order to ascertain how users implement this requirement.

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

TABLE OF CONTENTS

1.	INTRODUCTION	4
1.1	SCOPE.....	4
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	4
1.3	DEFINITIONS	4
1.4	CROSS-REFERENCES	5
1.5	SUMMARY OF MAIN CHANGES.....	5
1.6	COMMENTS ON THIS DEP	6
1.7	DUAL UNITS.....	6
2.	PIPING CLASSES – SERVICES AND MATERIALS SELECTION INDEX.....	7
3.	BALL VALVES	7
4.	LEVEL DISPLACER CHAMBERS.....	8
5.	PIPING CLASSES.....	9
6.	PIPING CLASSES FOR USE IN EUROPEAN SITES	9
7.	REFERENCES	10

APPENDICES

APPENDIX A	DETAILED CHANGES PER PIPING CLASS BETWEEN THE JANUARY 2009 EDITION AND THE DECEMBER 2010 EDITION	11
APPENDIX B	HISTORY OF DEP PIPING CLASSES INDEX.....	12
APPENDIX C	REQUEST FOR PIPING CLASS FORM.....	13

1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for piping classes which have been developed for use in refineries and chemical plants.

The basis of design of the piping classes is given in DEP 31.38.01.10-Gen.

The general requirements for piping systems are specified in DEP 31.38.01.11-Gen.

Piping classes developed primarily for exploration and production facilities are contained in DEP 31.38.01.15-Gen.

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 2011. For an overview of the changes to the piping Code and the individual piping classes since the previous edition, see (1.5)

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 refineries, chemical plants, gas plants and supply/distribution installations, and, where applicable, onshore exploration and production facilities (all within the property limits as defined in ASME B31.3:2008, Section 300.1). 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
Hydrogen service	service in which the process stream contains hydrogen at a partial pressure of 7 bar (abs) and higher.
Low temperature	metal temperature of 0°C and lower.
MESC	Materials and Equipment Standards and Codes
Piping class	assembly of piping components in a piping system, suitable for a defined service within design limits.
Post Weld Heat Treatment	heat treatment carried out after welding to reduce residual stresses and to temper hardened microstructures created by welding.
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 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.

1.5.1 Introduction

Shell GSI organized a series of alignment meetings with refining and chemicals operating company specialists from Manufacturing and EP in the USA and Canada in order to capture experience on selection and application of piping components and align the definition of piping systems for the future. From the learnings of these sessions, the following items were incorporated:

- DN 15-40 (NPS ½ -1 ½) socket welded fittings in certain piping classes with class 150-600 flange rating
- Extension of piping classes with lowest design temperature of -20°C (-4°F) to -29°C (-20°F).

The development of piping classes for services, not available in the February 2011 issue of the service index, has not been incorporated.

Additionally, the piping class portfolio was adapted in line with business development requirements, new and updated international standards, and feedback from third party clients and manufacturers. A number of cost saving developments were introduced.

The most substantial changes are explained below.

For a detailed overview of the changes in each piping class reference is made to (Appendix A). The piping class revision history is indicated in (Appendix B). For both documents reference is made to separate excel files.

This DEP has reference to MESC 13^A onwards. MESC numbers referred to in the piping classes contained in this DEP shall be extracted from MESC version 13^A and above.

1.5.2 Design code update

A new revision of ASME B31.3 was issued in 2010. Piping classes have been updated in line with the latest code requirements for welded components at elevated temperatures.

1.5.3 New piping classes

New piping classes have been introduced with a lowest design temperature of -29°C (-20°F) to replace piping classes formerly issued with a lowest design temperature of -20°C (-4°F).

1.5.4 Fittings

In piping classes with class 150-600 flange rating, socket-welded fittings have been introduced in line with the philosophy depicted in DEP 31.38.01.10-Gen.

1.5.5 Valves

In order to align valve design and type approval testing procedures with the new range of lowest design temperature of -29°C (-20°F) valve buying descriptions have been updated. Where required elastomeric seals have been replaced with grades of the same elastomers suitable for the lower design temperature.

1.5.6 Branch table

Branch tables have not been updated. Where socket-welded fittings are introduced, for standard branch connections reference to plain (and flanged) branch nipples is maintained.

1.5.7 Assemblies

For socket-welded hydrotest vents and drains, reference is made to standard drawing S 38.154.

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://swww.shell.com/standards> and on the main page of the DEPs DVD-ROM.

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.

2. PIPING CLASSES – SERVICES AND MATERIALS SELECTION INDEX

This index is presented as a spreadsheet on Standard Form DEP 31.38.01.84-Gen.

3. BALL VALVES

The use of soft-seated trunnion-mounted ball valves in listed services were reviewed in 2010. In cases where commonly used elastomers were not compatible with the fluid service, the service was reassigned to a piping class without elastomers. Formic acid service was deleted from the service index, pending the development of a new piping class.

For users wanting to include trunnion mounted ball valves in affected services, the table below shows the applicable MESC number range for suitable soft-seated ball valves that are available in MESC as of version 13.

It is intended that a later edition of this DEP will include new ball valve piping classes for these services.

Piping class	Service	MESC number range	
11001	Acetone	770025	003.1 to 012.1
	Acetonitrile	770025	044.1 to 046.1
	Methanol		
	Butanone (Methyl ethyl ketone)		
13032	Carbon dioxide	770322	003.1 to 012.1
		770322	044.1 to 046.1
13033	Formic acid	770319	003.1 to 012.1
		770319	044.1 to 046.1
31001	Acetone	770025	053.1 to 062.1
	Acetonitrile	770253	064.1 to 066.1
	Methanol		
	Butanone (Methyl ethyl ketone)		
33032	Carbon dioxide	770322	053.1 to 062.1
		770363	064.1 to 066.1
33033	Formic acid	770319	053.1 to 062.1
		770359	064.1 to 066.1

4. LEVEL DISPLACER CHAMBERS

The table below shows level displacer chambers related to piping class material which are available in the MESC catalogue. The related standard drawing is S 38.056.

Piping class material description	Level displacer chamber material description	MESC number range
Alloy steel 0.5Mo	ASTM A 335 grade P1	768060 702.1 to 738.1
Alloy steel 1.25Cr-0.5Mo	ASTM A 335 grade P11	768060 802.1 to 978.1
Alloy steel 1.25Cr-0.5Mo PWHT	ASTM A 335 grade P11	768064 022.1 to 078.1
Alloy steel 5Cr-0.5Mo PWHT	ASTM A 335 grade P5	768060 742.1 to 938.1
Alloy steel 9Cr-1Mo PWHT	ASTM A 335 grade P9	768059 702.1 to 798.1
Carbon steel	ASTM A 106 grade B	768060 042.1 to 138.1
Carbon steel H-Sour	ASTM A 106 grade B	768060 402.1 to 498.1
Carbon steel PWHT	ASTM A 106 grade B	768059 042.1 to 118.1
Carbon steel H-Sour PWHT	ASTM A 106 grade B	768059 442.1 to 478.1
Carbon steel LT	ASTM A 333 grade 6	768060 242.1 to 338.1
Carbon steel LT H-Sour	ASTM A 333 grade 6	768060 582.1 to 678.1
Carbon steel LT PWHT	ASTM A 333 grade 6	768059 242.1 to 298.1
Stainless steel 304	AISI 304	768061 042.1 to 118.1
Stainless steel 316	AISI 316	768061 442.1 to 538.1
Stainless steel 316L	AISI 316L	768062 002.1 to 038.1
Stainless steel 321/347	AISI 321/347	768061 842.1 to 938.1
Stainless steel 321 stab HT	AISI 321 stab HT	768061 562.1 to 678.1
Duplex stainless steel	ASTM A 790 UNS S31803	768062 402.1 to 498.1
Super duplex stainless steel	ASTM A 790 UNS S32750	768062 502.1 to 538.1

5. PIPING CLASSES

The piping classes for ASME class ratings 150, 300, 600, 900, 1500 and 2500 are contained in separate files for each ASME class rating.

These piping classes SHALL [PS] be used for services as specified in the Services and Materials Selection Index DEP 31.38.01.84-Gen. (e.g. fluid service, ASME pressure rating, temperatures, sizes, materials, valves, etc.).

For services not covered in DEP 31.38.01.84-Gen., piping classes shall be developed based on the philosophies outlined in DEP 31.38.01.10-Gen. and DEP 31.38.01.11-Gen. Guidance on the development of project-specific piping classes is given in DEP 31.38.01.21-Gen.

Requests for new piping classes can be made through the Request for Piping Class Form in (Appendix C). Project-specific requests shall be sent to SGSI - EPT-EMMI Piping Systems Team.

For updates in the framework of the DEP, the Request for Piping Class Form should be attached to the DEP Feedback System form.

6. PIPING CLASSES FOR USE IN EUROPEAN SITES

Piping classes contained in this DEP have been certified by Lloyds Register Netherlands B.V. acting as Notified Body in the framework of the European Pressure Equipment Directive (PED) to be compliant with Module B1 of the PED.

For Refining and Chemicals (R&C) piping classes (DEP 31.38.01.12-Gen.) the relevant design appraisal dossier number is: PED/B1/9004357 issue 1.

All applicable Particular Material Appraisals (PMAs) will be made available through the Global Technical Standards web portal <http://www.shell.com/standards>.

Piping classes contained in this DEP may be used in member states of the European Union (EU) where the Pressure Equipment Directive (PED) applies, without restrictions.

7. REFERENCES

In this DEP, reference is made to the following publications:

- NOTES:
1. Unless specifically designated by date, the latest edition of each publication shall be used, together with any amendments/supplements/revisions thereto.
 2. The DEPs and most referenced external standards are available to Shell staff on the SWW (Shell Wide Web) at <http://sww.shell.com/standards/>.
 3. Excluded from this list are the standards referenced in the piping classes themselves, a list of which would be too extensive.

SHELL STANDARDS

Definition of temperature, pressure and toxicity levels	DEP 01.00.01.30-Gen.
Piping classes – Basis of design	DEP 31.38.01.10-Gen.
Piping – General requirements	DEP 31.38.01.11-Gen.
Piping classes – Exploration and production	DEP 31.38.01.15-Gen.
Compilation of a specification for piping systems	DEP 31.38.01.21-Gen.
Standard Form: Piping classes – Services and material selection index	DEP 31.38.01.84-Gen.
Standard Drawing: Displacer chambers	S 38.056
Socket-welded hydrotest vents and drains	S 38.154

AMERICAN STANDARDS

Large Diameter Steel Flanges NPS 26 Through NPS 60 Metric/Inch Standard	ASME B16.47
Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard	ASME B16.5
Process piping	ASME B31.3:2008
Standard specification for seamless carbon steel pipe for high-temperature service	ASTM A 106
Standard specification for seamless and welded steel pipe for low-temperature service	ASTM A 333
Standard specification for seamless ferritic alloy-steel pipe for high-temperature service	ASTM A 335
Standard specification for seamless and welded ferritic/austenitic stainless steel pipe	ASTM A 790

EUROPEAN STANDARDS

Directive of the European Parliament and of the Council on the Approximation of the Laws of the Member States Concerning Pressure Equipment	97/23/EC
---	----------

NOTE: Commonly known as the European Pressure Equipment Directive (PED)

Issued by:
EU/EC - European Union/Commission Legislative Documents
175 Rue De La Loire
Brussels, Belgium

**APPENDIX A DETAILED CHANGES PER PIPING CLASS BETWEEN THE JANUARY 2009
EDITION AND THE DECEMBER 2010 EDITION**

This index is presented as a separate spreadsheet, with the number DEP 31.38.01.12-Gen.
and title:

“Refining and chemicals (R&C) - Appendix A: Detailed changes per piping class”.

APPENDIX B HISTORY OF DEP PIPING CLASSES INDEX

This index is presented as a separate spreadsheet, with the number DEP 31.38.01.12-Gen. and title:

“Refining and chemicals (R&C) - Appendix B: History of DEP piping classes index”.

APPENDIX C REQUEST FOR PIPING CLASS FORM

Originator Information									Activity Code:					Piping Class Number		
Originator ^(M)																
Reference Indicator ^(M)																
Company Name ^(M)																
Location ^(M)																
Market Sector ^(M)				Upstream				Downstream	X							
Plant																
Project ^(M)																
Revision ^(M)		0														
Revision Date ^(M)																
Service Information																
Medium ^(M)																
Properties ^(M)																
Chemical Formula																
Chemical Abstracts Service																
Registry Number (CAS No.)																
Material Safety Data Sheet ^(M)			Attached													
Liquid and/or Gas ^(M)		Liquid	X		Gas	X		Both	X							
Rich or Lean		Rich			Lean											
Sour Service ^(M)								(Refer to DEP 31.38.01.11-Gen App. 10)								
Upstream		Yes			No	X										
Downstream		High			Moderate			Low								
Hydrogen Partial Pressure > 7bara/101psia ^(M)		Yes	X		No			(Applicable only if Hydrogen is present)								
Operating Condition 1		min T			max T			mech design		max T						
Temperature (T) ^(M)	[°C]				[°F]											
Pressure (P) ^(M)	[barg]				[psig]											

<i>Operating Condition 2</i>		min T		max T		(Applicable in case of more than one operating condition)										
Temperature (T)	[°C]			[°F]												
Pressure (P)	[barg]			[psig]												
ASME Class Rating				(Based on ASME B16.5 and B16.47)												
LODMAT ^(M)	[°C]			[°F]	(Lowest One Day Mean Ambient Temperature)											
Full Vacuum ^(M)		Yes	X	No												
Additional Information																
Material Information																
Base Material ^(M)																
Corrosion Allowance ^(M)	[mm]			[in]												
Design Life	[years]															
Corrosion Rate	[mm/yr]			[in/yr]												
Material Specification																
Pipe Seamless																
Pipe Welded																
Bolting																
Casting																
Fitting																
Forging																
Gasket																
Plate																
Valve Internals/Trim																
....																
....																
Piping Component Information												Minimum			Maximum	
Diameter Range ^(M)											[DN]		[NPS]			
Valves		Valve Type										Minimum		Maximum		

Type 1		Gate																	
Type 2		Globe								[DN]									
Type 3		Check								[DN]									
Type 4										[DN]									
Type 5										[DN]									
Type 6										[DN]									
Type 7										[DN]									
Valve End Type																			
Remarks																			
Comments																			
<i>EPT-EMMI-Piping Systems</i>																			
Proposed DEP Piping Class				DEP Piping Class No.															
<i>EPT-EMMI-Materials</i>		(If DEP Piping Class has been proposed)																	
Remarks																			
Completion Instructions																			
Customer shall where possible fill in the shaded areas.																			
Items marked with ^(M) indicate that the information must be provided and/or endorsed by the Customer.																			
Project-specific Request for Piping Class Forms shall be sent to SGSI - EPT-EMMI Piping Systems Team																			
For updates in the framework of the DEP, the form should be attached to the DEP Feedback System form.																			