

PETRONAS TECHNICAL STANDARDS

DESIGN AND ENGINEERING PRACTICE

MANUAL

PIPING CLASSES - EXPLORATION AND PRODUCTION

PTS 31.38.01.15

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For PTS Updates/Review>

This revision of PTS **31.38.01.15 – Piping Classes – Exploration and Production (February 2010)** has been updated to incorporate PETRONAS Lessons Learnt, Best Practice and new information issued by relevant industry code and standards.

The previous version of this PTS (**DECEMBER 1999**) will be removed from PTS binder / e-repository from herein onwards.

Document Approval

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Revision History

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PREFACE

PETRONAS Technical Standards (PTS) publications reflect the views, at the time of publication, of PETRONAS OPU/Divisions.

They are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PETRONAS' OPU in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardisation.

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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	4
1.5 SUMMARY OF CHANGES SINCE THE LAST REVISION	4
1.5.1 Introduction	4
1.5.2 Pressure/temperature rating	4
1.5.3 Piping classes	5
1.5.4 Valves	5
1.5.5 Stud bolts	5
1.5.6 Spectacle blinds/spades	5
1.5.7 Gaskets	5
1.5.8 Miscellaneous	5
1.5.9 Impact testing of austenitic stainless steel	6
2. PIPING CLASSES – SERVICES AND MATERIALS SELECTION INDEX	7
3. PIPING CLASSES	8
4. REFERENCES	9

APPENDICES

APPENDIX A	DETAILED CHANGES PER PIPING CLASS	10
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1. INTRODUCTION

1.1 SCOPE

This PTS contains the piping classes for exploration and production facilities. The basis of design of the piping classes is given in PTS 31.38.01.10

This is a revision of the PTS of the same number dated December 1999; a summary of the changes since the last revision is included in (1.5).

The general requirements for piping systems are specified in PTS 31.38.01.11.

Excluded from the scope of this PTS are:

- oil and gas transmission pipeline systems;
- piping classes for refineries and chemical plants, which are included in PTS 31.38.01.12.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by PETRONAS, the distribution of this PTS is confined to companies forming part of PETRONAS Group, and to Contractors nominated by them.

This PTS is intended for use in exploration and production facilities, within the property limits as defined in ASME B31.3 par. 300.1.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this PTS the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable as regards safety, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this PTS 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 with the object of obtaining agreement to follow this PTS as closely as possible.

1.3 DEFINITIONS

The **Contractor** is the party which 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 **Principal** is the party which initiates, and ultimately pays for, the project. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant, authorised to act for the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.4 CROSS REFERENCES

Where cross-references to other parts of this PTS are made, the referenced section number is shown in brackets. Other documents referenced by this PTS are listed in (4).

1.5 SUMMARY OF CHANGES SINCE THE LAST REVISION

1.5.1 Introduction

This revision is mainly an update of the existing piping classes to align with the latest developments. The main changes are listed below.

An overview of the changes per piping class is given in Appendix A.

1.5.2 Pressure/temperature rating

Revisions of ASME B31.3 and ASME B16.5 were issued in January 2004 and November 2003, respectively. The pressure/temperature rating of the piping classes have been recalculated in line with the latest issues of the above codes and standards.

1.5.3 Piping classes

Alloy 625, Alloy 825 and 6Mo piping classes with solid and clad material have been developed for the need of recent projects.

Piping classes with soft seated ball valves have been replaced due to change from BS 5351 to ISO 17292, which includes a change in pressure/temperature rating.

Piping classes with carbon steel galvanised piping are only applicable for fire fighting service and have therefore been removed from this PTS.

Piping classes with pipe clamp connectors have not been issued with this revision due to a review on the design verification of the various manufacturer specific clamp connectors.

Due to the medium (sodium hypochlorite), titanium piping class 16041 has been subject to fugitive emission tightness class A.

1.5.4 Valves

PETRONAS International is working on enhanced group philosophies regarding fugitive emissions on a toxicological and environmental base. This have been applied on the selection of valves and reflect piping classes which are suitable for fugitive emission tightness class A. See PTS 31.38.01.10-Gen, para 3.10.

ASTM A216 grade LCB material have been deleted from group piping classes, to be replaced with the now widely available ASTM A216 grade LCC material. This change has allowed higher class ratings for new piping classes.

Flanged short pattern triple eccentric butterfly valves have been introduced for DN 200 and larger as an economic alternative for gate valves. Due to a higher performance, these valves have also replaced wafer type butterfly valves class 150 and 300.

Dual plate check valves have been introduced for DN 300 and larger sizes, as an economic alternative for swing type check valves.

BS 5351 ball valves have been withdrawn and replaced by ISO 17292. Due to a deviation in pressure/temperature rating between both specifications, new piping classes have been developed (see 1.6.3).

The maximum temperature of soft seated ball valves have been increased from 120 to 150 °C, which is the maximum allowable temperature for PTFE and Devlon V seats.

Ball valves with electroless nickel plated (ENP) balls have been removed from the piping classes and replaced by valves with stainless steel balls. See PTS 39.01.10.11-Gen.

1.5.5 Stud bolts

Bolt lengths have been reviewed and verified.

1.5.6 Spectacle blinds/spades

Spectacle blinds have been reviewed for ergonomics and limited to the maximum allowable size in accordance with PTS 31.38.01.11-Gen.

Spades have been added for all sizes.

1.5.7 Gaskets

For pressure classes and sizes up to/incl. DN 600, stainless steel spiral wound graphite gaskets with a stainless steel inner ring and a carbon steel outer ring have been specified.

The manufacturing standard for spiral wound gaskets has changed from BS 3381 to ASME B16.20.

New gaskets have been introduced for duplex stainless steel and titanium piping classes.

1.5.8 Miscellaneous

The maximum size of vents and drains has been increased, relative to the header size.

Non-piping items such as level gauges and level displacer have been removed from the piping classes.

Thermowells have been replaced in accordance with new design. See PTS 31.38.01.11-Gen.



1.5.9 Impact testing of austenitic stainless steel

For application at temperatures below $-101\text{ }^{\circ}\text{C}$, ASME B31.3 para 3.2.3.2.2 requires impact testing at the lower design temperature. This requirement has been reflected in the applicable austenitic stainless steel grade 304 cryogenic piping classes, through impact testing at $-196\text{ }^{\circ}\text{C}$.

2. PIPING CLASSES – SERVICES AND MATERIALS SELECTION INDEX

This index is presented as an excel spreadsheet which is attached in the attachment.



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[illegible]

General

- 1 Selection between 1 and 3 mm corrosion allowance depending on the corrosivity of the medium has to be selected by the corrosion engineer.
- 2 For the definition of "High Sour" and "Moderate Sour", see PTS 31.38.01.11, Appendix 10.

Notes for R&C piping classesSpecific

- 3 Piping classes 31011 and 31012 are interchangeable.
- 4 See PTS 30.10.02.31 for low temperature service.
- 5 Chemical Abstracts Service Registry Number
- 6 Consult a corrosion engineer for a check on the high temperature sulphidation corrosion rate and select materials accordingly.
- 7 Amine includes ADIP, MEA, DEA, AD, TEA and Sulfinol:
 - H₂S case = H₂S/CO₂ > 0.01 for gas phase, > 0.02 for liquid phase;
 - CO₂ case = H₂S/CO₂ < 0.01 for gas phase, > 0.02 for liquid phase.
- 8 Selection shall be carried out by materials engineer on the basis of the specific process conditions.
- 9 Hydrocarbon service includes aviation alkylate, LPG, C1-C4, paraffins and olefins, fuel gas, fuel oil, gasoil, gasoline, isopentane, luboil, naphtha, pentane, toluene and xylene.
- 10 See PTS 31.40.10.19 for the use of GRP piping.
- 11 See PTS 80.47.10.31 for fire fighting installations.
- 12 H₂ pp < 7 bar; wet H₂S < 50 mg/kg; wet HCN < 20 wppm; S < 0.3 wt. %; TAN < 0.3; H₂S < 0.01 mol.%
- 13 See MESC SPE 77/302 for Fugitive Emission Tightness Class
- 14 Minimum and maximum temperature relate to the design limits of the piping class components independent of the medium
- 15 The applicable temperature range, encountered in practice, may be determined by the medium, e.g. due to corrosion. These temperatures provides guidance

Notes for E&P piping classesSpecific

- 20 Piping classes 31410 and 31411; 31450 and 31451 are interchangeable.

Symbols and indications of danger for dangerous substances and preparations [1]



E : Explosive



O : Oxidizing



F+ : Extremely flammable



F : Highly flammable



T+ : Very toxic



T : Toxic



C : Corrosive



Xn : Harmful



Xi : Irritant



N : Dangerous to the environment

N® : Dangerous to the environment, including R50

The following substances and preparations are "dangerous" (EC-Directive 92/32/EEC) [2]:

Explosive substances and preparations: solid, liquid, pasty or gelatinous substances and preparations which may also react exothermically without atmospheric oxygen thereby quickly evolving gases, and which, under defined test conditions, detonate, quickly

Oxidising substances and preparations: substances and preparations which give rise to a highly exothermic reaction in contact with other substances, particularly flammable substances.

Extremely flammable substances and preparations: liquid substances and preparations having an extremely low flash-point and a low boiling-point and gaseous substances and preparations which are flammable in contact with air at ambient temperature and pressure

Highly flammable substances and preparations:

- substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any application of energy, or
- solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn or to be consumed after removal of the source of ignition, or
- liquid substances and preparations having a very low flash-point, or
- substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities.

Flammable substances and preparations: liquid substances and preparations having a low flash-point.

Very toxic substances and preparations: substances and preparations which in very low quantities cause death or acute or chronic damage to health when inhaled, swallowed or absorbed via the skin.

Toxic substances and preparations: substances and preparations which in low quantities cause death or acute or chronic damage to health when inhaled, swallowed or absorbed via the skin.

Harmful substances and preparations: substances and preparations which may cause death or acute or chronic damage to health when inhaled, swallowed or absorbed via the skin.

Corrosive substances and preparations: substances and preparations which may, on contact with living tissues, destroy them.

Irritant substances and preparations: non-corrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucous membrane, may cause inflammation.

Sensitizing substances and preparations: substances and preparations which, if they are inhaled or if they penetrate the skin, are capable of eliciting a reaction of hypersensitization such that on further exposure to the substance or preparation, character

Carcinogenic substances and preparations: substances or preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce cancer or increase its incidence.

Mutagenic substances and preparations: substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce heritable genetic defects or increase their incidence.

Substances and preparations which are **toxic for reproduction**: substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may produce, or increase the incidence of, non-heritable adverse effects in the progeny and/or

Substances and preparations which are **dangerous for the environment**: substances and preparations which, were they to enter the environment, would present or may present an immediate or delayed danger for one or more components of the environment.

Nature of special risks attributed to dangerous substances and preparations: R- and S-phrases [3]

Nature of special risks attributed to dangerous substances and preparations: R-phrases

R 1	Explosive when dry
R 2	Risk of explosion by shock, friction, fire or other sources of ignition
R 3	Extreme risk of explosion by shock, friction, fire or other sources of ignition
R 4	Forms very sensitive explosive metallic compounds
R 5	Heating may cause an explosion
R 6	Explosive with or without contact with air
R 7	May cause fire
R 8	Contact with combustible material may cause fire
R 9	Explosive when mixed with combustible material
R 10	Flammable
R 11	Highly flammable
R 12	Extremely flammable
R 14	Reacts violently with water
R 15	Contact with water liberates extremely flammable gases
R 16	Explosive when mixed with oxidizing substances
R 17	Spontaneously flammable in air
R 18	In use, may form flammable/explosive vapour-air mixture
R 19	May form explosive peroxides
R 20	Harmful by inhalation
R 21	Harmful in contact with skin
R 22	Harmful if swallowed
R 23	Toxic by inhalation
R 24	Toxic in contact with skin
R 25	Toxic if swallowed
R 26	Very toxic by inhalation
R 27	Very toxic in contact with skin
R 28	Very toxic if swallowed
R 29	Contact with water liberates toxic gas
R 30	Can become highly flammable in use
R 31	Contact with acids liberates toxic gas
R 32	Contact with acids liberates very toxic gas
R 33	Danger of cumulative effects
R 34	Causes burns
R 35	Causes severe burns
R 36	Irritating to eyes
R 37	Irritating to respiratory system
R 38	Irritating to skin
R 39	Danger of very serious irreversible effects
R 40	Limited evidence of a carcinogenic effect
R 41	Risk of serious damage to eyes
R 42	May cause sensitization by inhalation
R 43	May cause sensitization by skin contact
R 44	Risk of explosion if heated under confinement
R 45	May cause cancer
R 46	May cause heritable genetic damage
R 48	Danger of serious damage to health by prolonged exposure
R 49	May cause cancer by inhalation
R 50	Very toxic to aquatic organisms
R 51	Toxic to aquatic organisms
R 52	Harmful to aquatic organisms
R 53	May cause long-term adverse effects in the aquatic environment
R 54	Toxic to flora
R 55	Toxic to fauna
R 56	Toxic to soil organisms
R 57	Toxic to bees
R 58	May cause long-term adverse effects in the environment
R 59	Dangerous for the ozone layer
R 60	May impair fertility
R 61	May cause harm to the unborn child
R 62	Possible risk of impaired fertility
R 63	Possible risk of harm to the unborn child
R 64	May cause harm to breastfed babies
R 65	Harmful: may cause lung damage if swallowed
R 66	Repeated exposure may cause skin dryness or cracking

R 67

Vapours may cause drowsiness and dizziness