

PETRONAS TECHNICAL STANDARDS

DESIGN AND ENGINEERING PRACTICE

TECHNICAL SPECIFICATION

METALLIC MATERIALS - PREVENTION OF BRITTLE FRACTURE

PTS 30.10.02.31

OCTOBER 2009



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PTS Title:	METALLIC MATERIALS - PREVENTION OF BRITTLE FRACTURE

This revision of PTS **30.10.02.31- METALLIC MATERIALS - PREVENTION OF BRITTLE FRACTURE** (October 2009 Revision 1) 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 30.10.02.31 (October 1995)** will be removed from herein onwards.

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PREFACE

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

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

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

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

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

The right to use PTS rests with three categories of users:

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Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, PTS shall not, without the prior written consent of PETRONAS, be disclosed by users to any company or person whomsoever and the PTS 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 PETRONAS. The copyright of PTS vests in PETRONAS. Users shall arrange for PTS to be held in safe custody and PETRONAS may at any time require information satisfactory to them in order to ascertain how users implement this requirement.

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1. INTRODUCTION

1.1 SCOPE

This PTS specifies requirements and gives recommendations for the selection and application of steels in order to prevent brittle fracture at low temperature. This PTS applies irrespective of the contained fluids and covers also low temperatures caused by climate. 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.

This PTS shall only be used within the context of the relevant design and construction codes and the corresponding PTSs (see Section 3) and is not applicable to:

- transmission pipelines,
- vertical atmospheric storage tanks,
- steel structures.

This is a revision of the PTS of the same number dated October 1995; see (1.5) regarding the main changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by PETRONAS, the distribution of this PTS is confined to companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them.

This PTS is intended for use in oil refineries, chemical plants, gas plants, exploration and production facilities and supply/distribution installations.

When PTS are applied, a Management of Change (MOC) process should 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 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 with regard 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 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, the objective being to obtain agreement to follow this PTS 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 materials, equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. 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 word **should** indicates a recommendation.

1.3.2 Specific definitions

Adiabatic flash temperature (AFT) is the lowest temperature a liquid reaches, when a given quantity of a mixture is adiabatically depressurised to atmospheric pressure.

Atmospheric boiling point (ABP) is the temperature at which the vapour pressure throughout the bulk of the liquid exceeds the atmospheric pressure.

Equipment in the context of this PTS is 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.

Liquefied gas is 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) is 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) is the lowest temperature at which equipment may be subjected to its design pressure. See PTS 01.00.01.30

General membrane stress is 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. It also includes long range thermal or other secondary stresses with elastic follow-up. The general membrane stress determines the elastic stored energy in the wall of the equipment.

Minimum Metal Temperature (MMT) is 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 PTS are made, the referenced section number is shown in brackets. Other documents referenced by this PTS are listed in (7).

1.5 SUMMARY OF MAIN CHANGES

This PTS is a revision of the PTS of the same number dated October 1995. This revision has been extensive and it is impractical to list the changes here.