

PETRONAS TECHNICAL STANDARDS

DESIGN AND ENGINEERING PRACTICE

TECHNICAL SPECIFICATION

PRINTED CIRCUIT HEAT EXCHANGERS - DESIGN AND FABRICATION

PTS 31.21.01.33

JANUARY 2010



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This revision of PTS 31.21.01.33, Release 13: January 2005 for PRINTED CIRCUIT HEAT EXCHANGERS - DESIGN AND FABRICATION has been updated incorporating PETRONAS Lessons Learnt, Best Practice and new information issued by relevant industry code and standards. All updates in the document if any are highlighted in *italic* font.

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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 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, it is expected of 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 owner.

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- 1) PETRONAS and its affiliates.
- 2) Other parties who are authorised to use PTS subject to appropriate contractual arrangements.
- 3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) and 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

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1 INTRODUCTION

1.1 SCOPE

This new PTS specifies requirements and gives recommendations for the design and fabrication of printed circuit heat exchangers (PCHes).

Selection and application of PCHes is covered by PTS 31.21.01.11.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorized by PETRONAS, the distribution of this PTS is confined to companies forming part of PETRONAS or managed by a Group company and, where necessary, to Contractors and Manufacturers nominated by them.

This PTS is intended for use in oil refineries, chemical plants, gas plants, exploration and production facilities and, where applicable, supply/marketing 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 more stringent and which combination of requirements will be acceptable as regards 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 with the object of obtaining agreement to follow this PTS as closely as possible.

1.3 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 or maintenance of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier/Vendor** 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 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.

1.4 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 (13).

1.5 CHANGES FROM PREVIOUS REVISION

The previous edition of this PTS was dated January 2005. The main changes are as follows:

Old Section	New Section	Changes
4.4.1	4.4.1	Add new para for stress analysis to include header to plate stack joints and around the nozzle
4.4.3	4.4.3	Add new para for acceptance of FEA method for stress calculation.
4.7	4.6	Update and reposition para references for fatigue analysis from 4.7 to 4.6
5.6	5.6	Add new para – “Material traceability and positive material identification (PMI) shall be in accordance with PTS 31.10.00.10.”
6.22	6.22	Add new clause – “The welding electrodes, wire and flux used for the qualification of the PQRs shall be of the same type and brand as those used in the production”.
7.1	7.1	Add new clause – “Hardness testing and NDE shall be in accordance with PTS 301.10.60.18 and PTS 31.22.20.31”.
11.1	11.1	Add new clause – “All exposed parts, such as machined surfaces shall be protected against rust in accordance with PTS 70.10.70.11”.
12	12	Add to PETRONAS Standard reference list – PTS 70.10.70.11 – Preservation of Old/New Equipment & Piping Standing Idle.

2 GENERAL INFORMATION

2.1 DOCUMENT HIERARCHY AND SUBMITTALS

2.1.1 Hierarchy

In case of conflict between documents relating to an order, the following hierarchy shall apply:

1. the Purchase Order
2. this PTS

Where alternative designs are offered, all deviations from this PTS shall be clearly identified in the Manufacturer's bid.

2.1.2 Document submittals

See Appendix A.

2.2 PRESSURE VESSEL CODE

Printed circuit heat exchangers shall be considered to be pressure vessels.

Unless otherwise specified by the Principal, the pressure vessel code shall be ASME VIII, Division 1, as amended/supplemented by PTS 31.22.20.31.

NOTE: ASME VIII Div 1 Appendix 13 deals with non-cylindrical vessels and is therefore particularly relevant to PCHEs.

2.3 CERTIFYING AUTHORITY

For certain applications the design and construction of the printed circuit heat exchanger may be subject to approval of an Independent Certifying Authority. Where appropriate the Certifying Authority will be specified by the Principal. In such cases, the Manufacturer shall be responsible for obtaining the necessary design approvals and meeting the inspection requirements.

2.4 SCOPE OF SUPPLY

Unless otherwise specified, the scope of supply shall be as specified on the data/requisition sheets.

The Manufacturer shall include all special features necessary for reliable and safe operation. These should include, where applicable, adequate means of control to cope with the specified variations in operating conditions.

With regard to safety and reliability, offset conditions may occur during start-up, shut-down, power failure or interruption of the process flow. These conditions will be reflected in the Principal's printed circuit heat exchanger data sheets and shall be taken into account when designing the heat exchanger.

2.5 UNITS OF MEASUREMENT

The SI unit system has been applied in this PTS but, where considered necessary, the metric sizes are followed by their imperial equivalents in brackets.

Care shall always be taken to indicate whether absolute pressure or gauge pressure is intended. The unit of pressure should be qualified as bar (abs) or bar (ga), whichever is applicable.

2.6 EQUIPMENT NUMBERING

Heat transfer equipment shall be identified by a specific equipment number in accordance with PTS 31.10.03.10.

Equipment consisting of two or more heat exchangers connected in series or parallel and performing a common duty is termed a unit. In such cases, the unit as a whole is identified

by the specific equipment number, and each heat exchanger within the unit is separately identified by the addition of a capital letter in alphabetical progression, e.g. E-101-A, E-101-B, E-101-C, etc.