

PETRONAS TECHNICAL STANDARDS

DESIGN AND ENGINEERING PRACTICE

GLASS LINED STEEL EQUIPMENT AND PIPING

PTS 30.48.70.30

OCTOBER 2009



© 2010 PETROLIAM NASIONAL BERHAD (PETRONAS)

All rights reserved. No part of this document may be reproduced, stored in a retrieval system or transmitted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) without the permission of the copyright owner

Full document details: PETRONAS 30.48.70.30 2009

AVA Documents
Document Sharing Hub

PTS Circular 2009 - 1



PTS No:	30.48.70.30
PTS Title:	GLASS LINED STEEL EQUIPMENT AND PIPING

This revision of PTS **30.48.70.30 – GLASS LINED STEEL EQUIPMENT AND PIPING (October 2009, Revision 1)** has been updated to incorporate PETRONAS Lessons Learnt, Best Practice and new information issued by relevant industry code and standards. All updates in the document are highlighted in italic font.

The previous version of this PTS **30.48.70.30 (July 1998)** will be removed from PTS binder / e-repository from herein onwards.

The custodian of this PTS is:

Name : Johar Juhari

Tel. No : 603 – 2783 6525

Please direct any questions regarding this PTS to the above-named.

Document Approval

	Name	Designation	Date	Signature
Prepared/ Reviewed	Muhammad Nazmi Dawa @ Dewa	Engineer (Corrosion)	21 / 10 / 2009	
Approved	Johar Juhari ZAMALUDDIN ALI	Principal Engineer (Corrosion)	21 / 10 / 2009	
Verified	Che Wan Ibrahim Che Wan Sudin	Technical Manager, Materials, Corrosion & Inspection, GTS	22/10/2009	
Verified	Pau Kiew Huai	General Manager Engineering, GTS	3.11.09	
Endorsed	Pramod Kumar Karunakaran	Senior General Manager, GTS	3.11.09	

Revision History

Rev No.	Reviewed by	Approved by	Date
1	Muhammad Nazmi Dawa @ Dewa	Johar Juhari	21 / 10 / 2009

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/Divisions 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.

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:

- 1) PETRONAS and its affiliates.
- 2) Other parties who are authorized 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.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, PETRONAS 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 PTS, combination of PTS or any part thereof. The benefit of this disclaimer shall inure in all respects to PETRONAS and/or any company affiliated to PETRONAS that may issue PTS or require the use of PTS.

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 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 PETRONAS in order to ascertain how users implement this requirement.

TABLE OF CONTENTS

1.	INTRODUCTION	5
1.1	SCOPE	5
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	5
1.3	DEFINITIONS	5
1.4	CROSS-REFERENCES	6
1.5	SUMMARY OF CHANGES SINCE PREVIOUS EDITION	6
2.	MATERIALS	7
2.1	GENERAL	7
2.2	CARBON STEEL	7
2.3	LINING MATERIAL	7
2.4	GASKETS	8
3.	DESIGN AND MANUFACTURE	9
3.1	DESIGN	9
3.2	MANUFACTURE	9
3.3	CONNECTIONS	9
3.4	TOLERANCES	10
3.5	DEFECTS	10
4.	TESTING, INSPECTION AND DOCUMENTATION	12
4.1	TESTING	12
4.2	INSPECTION	12
4.3	DOCUMENTATION	13
5.	REPAIR PROCEDURE	15
5.1	REPAIR PLUGS	15
5.2	IMPURITIES	16
6.	PACKAGING, TRANSPORTATION AND INSPECTION	17
6.1	GENERAL	17
6.2	PACKAGING AND TRANSPORTATION	17
6.3	ARRIVAL INSPECTION	17
7.	INSTALLATION	18
7.1	GENERAL	18
7.2	CONNECTIONS	18
7.3	BOLTING	18
7.4	WELDING	18
7.5	MARKING	18
8.	OPERATION	19
8.1	THERMAL SHOCK	19
8.2	ACID SPILLS	19
8.3	STEAM HAMMER	19
9.	MAINTENANCE, INSPECTION AND REPAIR	20
9.1	MAINTENANCE	20
9.2	INSPECTION	20
9.3	REPAIRS	20
9.4	CLEANING OF THE JACKET SPACE	20
10.	REFERENCES	21

1. INTRODUCTION

1.1 SCOPE

This new PTS specifies requirements and gives recommendations for the manufacture, inspection and supply of process equipment, and components made of glass-lined carbon steel. Typical operating temperature for glass-lined steel process equipment is from -25 °C to +230 °C.

This PTS specifies the quality requirements and the tests to be carried out by the Manufacturer as well as the necessary actions for repairing defects. Installation, operation and maintenance aspects are also included in the scope of this PTS.

This PTS is a revision of the PTS of the same number dated July 1998; a summary of the main changes is given in (1.5).

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 Group 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 PTSs 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 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

1.3.1 General definitions

The **Contractor** is the party which carries out all or part of the design, engineering, procurement, construction and commissioning or management of the project or operation of a facility. The Principal may sometimes undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party which manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party which 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

Glass-lined steel Composite material produced by smelting a vitreous and enamel coat onto a steel substrate.

Thermal shock Sudden change of temperature resulting from contact with a shock medium (heating or cooling).

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 (10).

1.5 SUMMARY OF CHANGES SINCE PREVIOUS EDITION

The previous edition of this PTS was dated July 1998; a summary of the main changes since the last edition is given below.

Section	Change
General	- Increased alignment with ASTM Standards, ISO Standards, EN Standards and PTSs - Rearranged Chapters and Sections
Appendices 1, 2 and 3	Have been removed, and partly integrated in the updated Chapters

2. MATERIALS

2.1 GENERAL

As glass lining for process equipment and components, a vitreous and porcelain enamel, normally with a thickness in the range from 1 mm to 2 mm, is applied by smelting onto a steel substrate.

2.2 CARBON STEEL

Unalloyed and low-alloy carbon steels, suitable for glass lining, with a minimum yield strength of 210 N/mm², shall be used as base material in accordance with PTS 30.10.02.11

The carbon steel equipment shall be in accordance with the design codes specified by the Principal.

2.3 LINING MATERIAL

2.3.1 General

Glass-lining enamels include all-vitreous enamel, all-semi crystalline enamel, vitreous enamel on a semi-crystalline intermediate layer, and semi-crystalline enamel on a vitreous intermediate layer.

The Manufacturer shall specify the composition of the enamel lining and the colour.

The main criteria for assessing enamel quality are resistance to chemical attack and thermal shock, and the structure of the enamel lining.

2.3.2 Chemical resistance

The glass lining material shall meet the following corrosion resistance requirements:

1. Corrosion rate in hydrochloric acid, tested in accordance with ISO 2743 or EN 14483-2, shall be not greater than 0.08 mm per year;
2. Corrosion rate in sodium hydroxide solutions, tested in accordance with ISO 2745 or EN 14483-4, shall be not greater than 0.40 mm per year. The ratio of the volume of attacking sodium hydroxide solution in cubic centimetres to the exposed enamel surface in square centimetres shall be 3.5.

2.3.3 Thermal shock resistance

The thermal shock resistance depends on several factors, including the physical properties of the enamel, material characteristics of the steel, design of the apparatus, enamelling process, and the service conditions.

For glass-lined steel, a distinction is drawn between a thermal shock on the glass-lined side (e.g. filling of a process vessel) and a thermal shock on the steel side (e.g. heating and cooling of a process vessel). This PTS applies to operating temperatures from -25 °C to + 230 °C. Exceeding this temperature range shall be subject to the approval of the Principal. The Manufacturer shall define the thermal shock limits (heating and cooling), and provide thermal shock diagrams for the glass-lined system in accordance with prEN 15159-3.

The measure for thermal shock resistance is the crack formation temperature, tested according to ISO 13807. The crack formation temperature for glass lining used in process vessels shall be at least 190 °C.

For enamels used in components, e.g. agitators, baffles, pumps, and piping, the crack formation temperature shall be at least 170 °C.