

# PETRONAS TECHNICAL STANDARDS

## DESIGN AND ENGINEERING PRACTICE

### TECHNICAL SPECIFICATION

#### **BRAZED ALUMINIUM PLATE-FIN HEAT EXCHANGERS (AMENDMENTS/SUPPLEMENTS TO ISO 15547-2)**

PTS 31.21.01.34

December 2009



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This new PTS 31.21.01.34 - BRAZED ALUMINUM PLATE-FIN HEAT EXCHANGERS (December, 2009, Revision 0) has been developed to reflect the requirement of the new ISO 15547-2 that has been released in 2005.

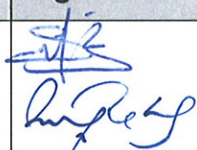
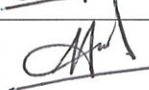
This PTS also include PETRONAS Lessons Learnt and Best Practices for the subject matter  
BRAZED ALUMINUM PLATE-FIN HEAT EXCHANGERS.

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### Document Approval

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## TABLE OF CONTENTS

|          |                                                                |    |
|----------|----------------------------------------------------------------|----|
| PART I   | INTRODUCTION .....                                             | 5  |
| 1.1      | SCOPE .....                                                    | 5  |
| 1.2      | DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS ..... | 5  |
| 1.3      | TERMS AND DEFINITIONS .....                                    | 5  |
| 1.4      | CROSS REFERENCES .....                                         | 5  |
| PART II  | GENERAL INFORMATION AND DEFINITIONS .....                      | 6  |
| 1.1      | DESIGN RULES .....                                             | 6  |
| 1.2      | DOCUMENT SUBMITTALS .....                                      | 6  |
| 1.3      | PRESSURE DESIGN CODE .....                                     | 6  |
| 1.4      | GENERAL PLATE-FIN HEAT EXCHANGER INFORMATION .....             | 6  |
| 1.5      | SCOPE OF SUPPLY .....                                          | 6  |
| 1.6      | UNITS OF MEASUREMENT .....                                     | 6  |
| 1.7      | EQUIPMENT NUMBERING .....                                      | 7  |
| PART III | GENERAL REQUIREMENTS .....                                     | 8  |
| 1        | THERMAL AND HYDRAULIC DESIGN .....                             | 8  |
| 1.1      | SCOPE .....                                                    | 8  |
| 1.2      | INFORMATION SPECIFIED BY THE PRINCIPAL .....                   | 8  |
| 1.3      | PRESSURE DROP .....                                            | 8  |
| 1.4      | INFORMATION SUPPLIED BY THE MANUFACTURER .....                 | 8  |
| 1.5      | OPTIMISATION OF PLATE-FIN HEAT EXCHANGER GEOMETRY .....        | 8  |
| 1.6      | THERMOSYPHON REBOILER .....                                    | 9  |
| 1.7      | STRAINER .....                                                 | 9  |
| 1.8      | TWO-PHASE FLOW INLET DISTRIBUTORS .....                        | 10 |
| 1.9      | DESIGN MARGINS .....                                           | 10 |
| 2.0      | MECHANICAL DESIGN .....                                        | 10 |
| 2.1      | GENERAL .....                                                  | 10 |
| 2.2      | DESIGN PRESSURE AND TEMPERATURE .....                          | 11 |
| 2.4      | LOAD CASES .....                                               | 11 |
| 2.5      | ALLOWABLE STRESSES .....                                       | 11 |
| 2.6      | SUBMERGED PLATE-FIN HEAT EXCHANGERS .....                      | 12 |
| 2.7      | HEADERS .....                                                  | 12 |
| 2.8      | NOZZLE CONSTRUCTION .....                                      | 12 |
| 2.9      | NOZZLE LOADS .....                                             | 12 |
| 2.10     | VENTS AND DRAINS .....                                         | 12 |
| 2.11     | THREADED CONNECTIONS .....                                     | 13 |
| 2.12     | INSTRUMENT CONNECTIONS .....                                   | 13 |
| 2.13     | SUPPORTS .....                                                 | 13 |
| 2.14     | PIPING .....                                                   | 13 |
| 2.15     | GASKETS .....                                                  | 13 |
| 2.16     | COLD BOX DESIGN .....                                          | 14 |
| 2.17     | INSULATION .....                                               | 15 |
| 2.18     | FIRE PROTECTION .....                                          | 16 |
| 2.19     | PLATE-FIN HEAT EXCHANGER RELIEF SCENARIOS .....                | 16 |
| 2.20     | SAFETY/RELIEF VALVE NOZZLE CONNECTIONS .....                   | 16 |
| 2.21     | SPARE AND REPLACEMENT PARTS .....                              | 16 |
| PART IV  | AMENDMENTS AND SUPPLEMENTS TO ISO 15547-2 .....                | 17 |
| 2.       | TERMS AND DEFINITIONS .....                                    | 17 |
| 3        | GENERAL .....                                                  | 17 |
| 4        | PROPOSAL INFORMATION REQUIRED .....                            | 17 |
| 5        | DRAWINGS AND OTHER DATA REQUIREMENTS .....                     | 17 |
| 6        | DESIGN .....                                                   | 18 |
| 7        | MATERIALS .....                                                | 21 |
| 8        | FABRICATION .....                                              | 21 |
| 9        | INSPECTION AND TESTING .....                                   | 22 |
| 10       | PREPARATION FOR SHIPMENT .....                                 | 24 |

|         |                                           |    |
|---------|-------------------------------------------|----|
| ANNEX C | PLATE FIN HEAT EXCHANGER DATASHEETS ..... | 25 |
| PART V  | REFERENCES .....                          | 26 |

## PART I INTRODUCTION

### 1.1 SCOPE

This new PTS specifies requirements and gives recommendations for the design and fabrication of vacuum brazed aluminium plate-fin heat exchangers.

Part IV of this PTS provides amendments and supplements to ISO 15547-2:2005.

### 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 or managed by a Group company, and 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/marketing installations.

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 Authorities concerned with the object of obtaining agreement to follow this PTS as closely as possible.

### 1.3 TERMS AND 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 plate-and-frame heat exchangers and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project work 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 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 (Part V).

## **PART II GENERAL INFORMATION AND DEFINITIONS**

### **1.1 DESIGN RULES**

The design, engineering and fabrication of vacuum brazed aluminium plate-fin heat exchangers shall be based on this PTS.

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

1. The purchase order;
2. This PTS;
3. ISO 15547-2.

In the event of any conflict, the Principal shall be consulted.

### **1.2 DOCUMENT SUBMITTALS**

See Part IV, Annex C.

### **1.3 PRESSURE DESIGN CODE**

Plate-fin heat exchangers shall be considered to be pressure vessels.

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

NOTE: ASME VIII Division 1 Appendix 13 deals with non-cylindrical vessels and is therefore particularly relevant to plate-fin heat exchangers.

### **1.4 GENERAL PLATE-FIN HEAT EXCHANGER INFORMATION**

General background information on plate-fin heat exchangers can be derived from the standards of the brazed aluminium plate-fin heat exchanger manufacturer's association (ALPEMA) at <http://www.alpema.org>.

### **1.5 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, as specified by the Principal, to cope with the specified variations in operating conditions.

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

### **1.6 UNITS OF MEASUREMENT**

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

## 1.7 EQUIPMENT NUMBERING

Plate-fin heat exchangers shall be identified by a specific equipment number and 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.

## **PART III GENERAL REQUIREMENTS**

### **1 THERMAL AND HYDRAULIC DESIGN**

#### **1.1 SCOPE**

Since plate-fin heat exchangers are proprietary designs, the Manufacturer shall be totally responsible for the performance design of the heat exchanger.

The performance design of a plate-fin heat exchanger can be checked with reasonable accuracy using the Aspen MUSE program. Manufacturer's fin data sheets shall include F and J factors for all fin types proposed by the Manufacturer. This information is required to enable the Principal to evaluate the Manufacturer's design and shall be included. If required, the Principal is prepared to consider entering into a secrecy agreement concerning this information.

#### **1.2 INFORMATION SPECIFIED BY THE PRINCIPAL**

The Principal shall specify the heat transfer duty, allowable pressure drop, flow rates, compositions and physical properties of the fluids passing through the heat exchanger. If a number of operating cases and design conditions are specified the Manufacturer shall select the most stringent case so that all design conditions are met.

If fluids may contain mercury, a mercury removal system shall be considered and the Manufacturer shall be consulted. For certain applications the Manufacturer may be able to develop a mercury tolerant plate-fin heat exchanger design.

The Manufacturer shall notify the Principal if insufficient information has been supplied to satisfactorily design the plate-fin heat exchanger.

#### **1.3 PRESSURE DROP**

For potentially fouling systems, as advised by the Principal, the pressure drop for the clean plate-fin heat exchanger shall be restricted to 90 % of the specified maximum allowable value.

In calculating the pressure drop, losses shall include all those occurring in nozzles, headers, bends, fittings, manifolds, distribution and thermal sections.

The pressure drop for any upstream strainer shall be additional to the stated plate-fin heat exchanger pressure drop.

For two-phase streams, the pressure drop shall include frictional, static head and acceleration components.

#### **1.4 INFORMATION SUPPLIED BY THE MANUFACTURER**

The Manufacturer shall provide completed data/requisition sheets and outline drawings for the Principal's review. This shall include sufficient information for the Principal to assess the thermal and hydraulic performance of the unit.

The Manufacturer shall indicate any start-up or shutdown operation limitations in the operations manual.

#### **1.5 OPTIMISATION OF PLATE-FIN HEAT EXCHANGER GEOMETRY**

Within the mechanical, thermal and hydraulic constraints detailed in the requisition, the Manufacturer shall optimise the design of the plate-fin heat exchanger by selecting suitable geometry to balance the following objectives:

- Minimise cost;
- Minimise size and weight.