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ISO 15547-2

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Petroleum, petrochemical and natural gas industries — Plate-type heat exchangers —

Part 2: Brazed aluminium plate-fin heat exchangers

Industries du pétrole, de la pétrochimie et du gaz naturel — Échangeurs thermiques à plaques —

Partie 2: Échangeurs thermiques à plaques en aluminium brasé

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15547-2 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 6, *Processing equipment and systems*.

This first edition of ISO 15547-2, together with ISO 15547-1 cancels and replaces ISO 15547:2000, of which it constitutes a technical revision.

ISO 15547 consists of the following parts, under the general title *Petroleum, petrochemical and natural gas industries — Plate-type heat exchangers*:

— *Part 1: Plate-and-frame heat exchangers*

— *Part 2: Brazed aluminium plate-fin heat exchangers*

Introduction

Some of the requirements within this part of ISO 15547 have been extracted from the standards of the brazed aluminium plate-fin heat exchanger manufacturers' association (ALPEMA).

Users of this part of ISO 15547 should be aware that further or differing requirements may be needed for individual applications. This part of ISO 15547 is not intended to inhibit a vendor from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This may be particularly applicable where there is an innovative or developing technology. Where an alternative is offered, the vendor should identify any variations from this part of ISO 15547 and provide details.

A recommended practice is included within this part of this International Standard (see Annex A).

This part of ISO 15547 requires the purchaser to specify certain details and features.

A bullet (●) at the beginning of a clause or subclause indicates a requirement for the purchaser to make a decision or provide information (for information, a checklist is provided in Annex B).

In this part of ISO 15547, where practical, US Customary units are included in parentheses for information.

Petroleum, petrochemical and natural gas industries — Plate-type heat exchangers —

Part 2: Brazed aluminium plate-fin heat exchangers

1 Scope

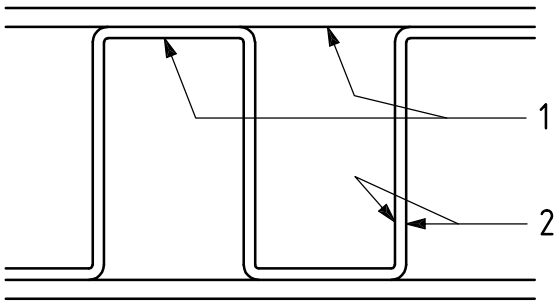
This part of ISO 15547 gives requirements and recommendations for the mechanical design, materials selection, fabrication, inspection, testing, and preparation for shipment of brazed aluminium plate-fin heat exchangers for use in petroleum, petrochemical and natural gas industries.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
heat transfer area
sum of the primary and secondary heat transfer surface areas of all heat-transfer passages in contact with a stream

See Figure 1.



Key

1 primary heat transfer surface
2 secondary heat transfer surface

NOTE 1 The primary heat transfer surface within the plate-fin heat exchanger consists of the bare parting sheet and the fin base directly brazed to the parting sheet.

NOTE 2 The secondary heat transfer surface is provided by the fins. This area includes both sides of the fins where they are in contact with the fluid.

Figure 1 — Cross-sectional view of fin and parting sheet — Heat transfer area

2.2
item number
purchaser's identification number for a plate-fin heat exchanger

2.3
minimum design metal temperature
lowest metal temperature at which pressure-containing elements can be subjected to design pressure

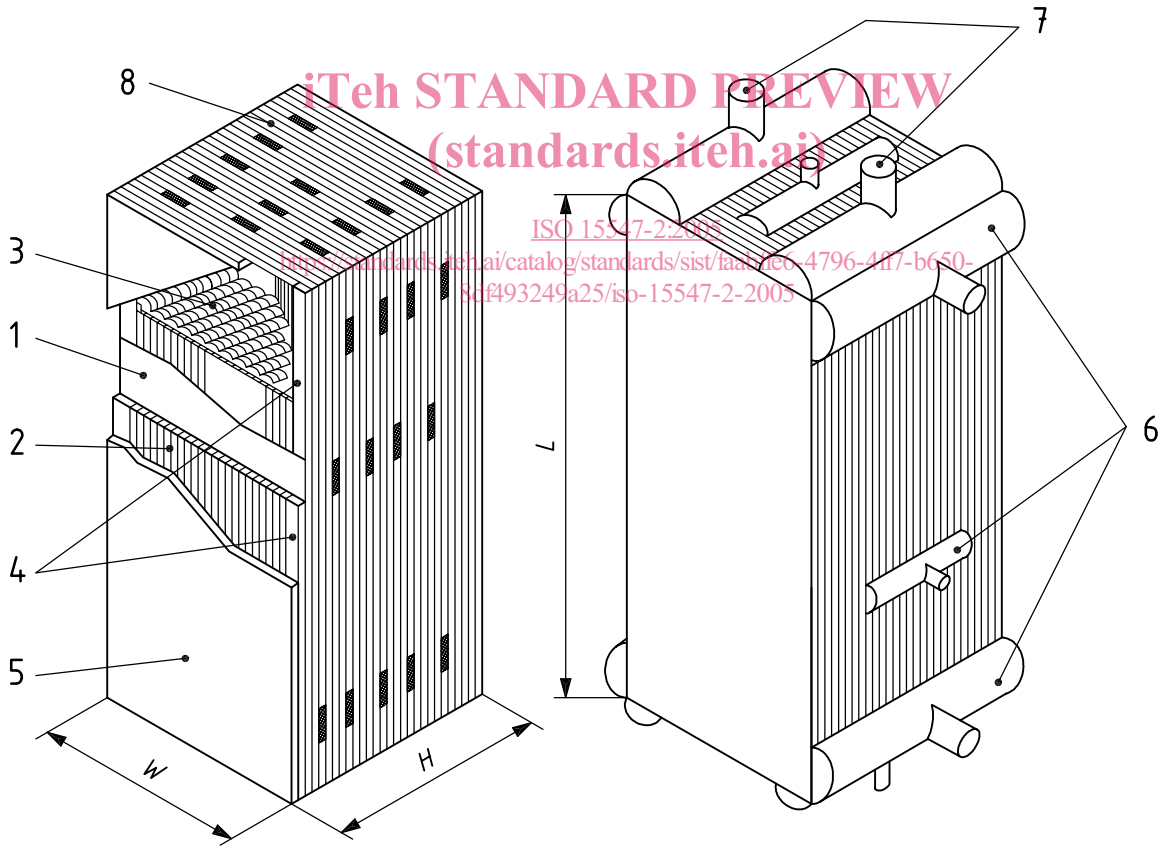
EXAMPLE Ambient temperature, process fluid temperature.

2.4
plate-fin heat exchanger
heat exchanger consisting of a block (core) of alternating layers (passages) of corrugated fins

See Figure 2.

NOTE 1 The layers are separated from each other by parting sheets and sealed along the edges by means of side bars, and are provided with inlet and outlet ports for the streams. The block is bounded by cap sheets at the top and bottom.

NOTE 2 All the layers carrying the same stream are connected together by headers (inlet, outlet, intermediate) directly attached by welding onto the brazed core.



Key

H	height	1	parting sheet	5	cap sheet
L	length	2	heat transfer fins	6	headers
W	width	3	distributor fins	7	nozzles
		4	side bars	8	block (core)

Figure 2 — Typical brazed aluminium plate-fin heat exchanger and components

2.5
pressure design code
recognized pressure vessel standard specified or agreed by the purchaser

EXAMPLE ASME Section VIII, EN 13445.

2.6
structural welding code
recognized structural welding code specified or agreed by the purchaser

3 General

- **3.1** The pressure design code shall be specified or agreed by the purchaser. Pressure components shall comply with the pressure design code and the supplemental requirements in this part of ISO 15547.

  The structural welding code shall be specified or agreed by the purchaser.

3.2 Annex A provides some recommended practices for information.

- **3.3** The vendor shall comply with the applicable local regulations specified by the purchaser.

- **3.4** If specified by the purchaser, or if required by regulations, the vendor shall register each plate-fin heat exchanger.

3.5 Further information on brazed aluminium plate-fin heat exchangers can be found in the ALPEMA standards [1].

4 Proposal information required

4.1 The vendor shall provide a completed data sheet, including materials of construction. An example of a suitable format is given in Annex C.

4.2 The vendor shall specify operating limitations, e.g. temperature limits.

4.3 The vendor shall include a detailed description of any exception to the specified requirements.

4.4 The first-time use of a plate-fin heat exchanger design, component or material by the vendor for the purchaser's intended service shall be clearly indicated by the vendor.

4.5 The vendor shall provide recommended strainer requirements for each stream.

- **4.6** If a mercury-tolerant design is specified by the purchaser, the vendor shall provide details of special design, manufacturing techniques and operating procedures.

1) The standards of the Brazed Aluminium Plate-Fin Heat Exchanger Manufacturers' Association, 29 Clevelands, Abingdon, Oxon, OX14 2EQ, UK.

5 Drawings and other data requirements

5.1 Drawings

5.1.1 The vendor shall furnish general arrangement drawings for each plate-fin heat exchanger for review. The drawings shall include the following information:

a) service, item number, project name and location, vendor's shop order number and purchaser's order number;

b) maximum allowable working pressure, design pressure including vacuum if applicable, test pressure, maximum design temperature, minimum design metal temperature and any restrictions regarding testing or operation of the plate-fin heat exchanger;

c) dimensions and location of supports;

d) overall plate-fin heat exchanger dimensions;

e) type and details of fins used;

f) presence and location of any inactive areas;

g) mass of the plate-fin heat exchanger, both empty and full of liquid with a specific gravity of 1,0;

h) centre of gravity of the plate-fin heat exchanger for empty and operating conditions;

i) material specifications for all components;

j) allowable forces and moments on connections;

k) size, flange rating and facing, location, orientation, and flow identification of all connections;

l) applicable design codes.

5.1.2 If controlled torquing of flange bolting is required the vendor shall furnish torquing requirements.

5.1.3 The vendor shall furnish detailed instructions on lifting and handling of the plate-fin exchanger.

5.1.4 The review of general arrangement drawings by the purchaser shall not relieve the vendor of the responsibility of meeting the requirements of the purchase order.

5.1.5 After receipt of the purchaser's general arrangement drawing review comments, the vendor shall furnish the certified general arrangement drawings and the detail drawings.

- **5.1.6** If specified by the purchaser, the vendor shall furnish copies of applicable welding procedure specifications and weld maps for review or record.

- **5.1.7** If specified by the purchaser, brazing procedures shall be made available for purchaser's review.

- **5.1.8** If specified by the purchaser, the vendor shall furnish copies of applicable calculations for review or record.

- **5.1.9** If specified by the purchaser, the vendor shall furnish stress analysis calculations in accordance with the methods prescribed by the applicable pressure design code for review or record.

5.1.10 The vendor shall furnish procedures for pressure and leak testing, and drying for review.

5.2 Final records

5.2.1 The vendor shall furnish the purchaser with a user's manual which shall contain the following:

a) technical description;

b) operating instructions (including any start-up or shut-down constraints);

c) installation and maintenance instructions (including lifting and handling);

d) data sheets and drawings (as-built).

5.2.2 The vendor shall retain, for at least five years, records which confirm compliance of the material and fabrication with the requirements of this part of ISO 15547.

6 Design

6.1 General

If the design method is based on proof testing, the vendor shall provide the necessary details to the purchaser for verification of compliance with the pressure design code.

6.2 Design temperature

- The purchaser shall specify a maximum design temperature and a minimum design metal temperature.

6.3 Design pressure

The plate-fin heat exchanger design shall not be based on differential pressure.

6.4 Thermal stress

- **6.4.1** In addition to the design operating condition(s), the purchaser shall specify all operating conditions which could impose significant thermal stresses on the plate-fin heat exchanger. This shall consider any alternative operating cases, turn-down operation, upset-operation cases (with particular attention to cases where a stream's flowing condition might change or cease abruptly), and the process control philosophy being applied to the plate-fin heat exchanger. The purchaser shall specify which streams are subject to cyclic or frequently-repeated temperature fluctuations.

6.4.2 The vendor's design shall allow for thermally induced stresses, with the following assumptions:

a) a local temperature difference of 50 K (90 °F) between any two adjacent streams;

b) a local temperature difference of 30 K (54 °F) between any two adjacent streams in two-phase flow, or in transient or cyclic conditions.

6.5 Fouling resistance

A fouling resistance of zero shall be assumed unless otherwise specified by the purchaser.

NOTE Plate-fin heat exchangers are typically only suitable for clean services.

6.6 Corrosion allowance

The corrosion allowance shall be zero.

6.7 Components

6.7.1 The vendor shall provide details of the reaction at the support points.

6.7.2 If specified by the purchaser, the units shall have an earthing lug or boss.

6.8 Connections

6.8.1 If specified by the purchaser, the plate-fin heat exchanger, assemblies and manifolds shall be self-draining and self-venting through the connections for all pass arrangements.

6.8.2 The projection of flanged connections shall allow through-bolting to be removed from either side of the flange without removing the insulation. The insulation thickness shall be specified by the purchaser.

6.8.3 All bolt holes for flanged or studded connections shall straddle centrelines.

6.8.4 Connection sizes of DN 32 (NPS 1-1/4), DN 65 (NPS 2-1/2), DN 90 (NPS 3-1/2) or DN 125 (NPS 5) shall not be used.

6.8.5 The vendor shall prepare the ends of nozzles that are to be welded by others, unless otherwise approved by the purchaser.

6.8.6 The vendor shall perform calculations proving the adequacy of aluminium alloy pipe flanges, considering the mating flange, bolting and gasket materials as specified by the purchaser. The differential thermal expansion of bolting and flanges shall be considered.

6.8.7 Inactive areas in plate-fin heat exchangers, such as dummy layers, shall be ventable and drainable.

6.8.8 Unless otherwise specified by the purchaser, each nozzle shall be capable of withstanding the simultaneous applications of the resultant moments and forces defined in Figure 3 and Table 1.

These resultant forces, F_r, and moments, M_r, are as follows:

$$M_r = \sqrt{M_x^2 + M_y^2 + M_z^2}$$

$$F_r = \sqrt{F_x^2 + F_y^2 + F_z^2}$$

6.9 Metal temperature monitoring

Unless otherwise specified by the purchaser, the vendor shall provide suitable metal-temperature indicating devices at locations on the plate-fin heat exchanger to allow the operator to measure and monitor cool-down and warm-up rates.

6.10 Handling devices

The plate-fin heat exchanger shall be provided with suitable lifting lugs, holes or similar devices. The vendor's lifting design shall be based on twice the empty mass of the plate-fin heat exchanger.