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

Part 1:
Plate-and-frame heat exchangers

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

Partie 1: Échangeurs thermiques à plaques et cadre

ISO 15547-1:2005

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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 15547-1 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 15547-1, together with ISO 15547-2, 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

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.

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.

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

Part 1: Plate-and-frame 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 plate-and-frame heat exchangers for use in petroleum, petrochemical and natural gas industries. It is applicable to gasketed, semi-welded and welded plate-and-frame heat exchangers.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8501-1, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

3 Terms and definitions

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

3.1

drip tray

tray that is able to collect droplets from an entire heat exchanger plate pack

3.2

end plate

plate which prevent the fluids in a plate-and-frame heat exchanger from contacting the fixed and removable covers

NOTE There are two end plates, one at each end of the plate-and-frame heat exchanger.

3.3

frame

assembly that provides the structural support and pressure containment of a plate-and-frame heat exchanger

3.4

welded plate pack

plate pack where the gaskets have been replaced by welds

3.5
heat transfer area

sum of the surface areas of one side of all plates in contact with both heat-transfer fluids

NOTE Areas of end plates are not included.

3.6
item number

purchaser's identification number for a plate-and-frame heat exchanger

3.7
minimum design metal temperature

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

EXAMPLE Ambient temperature, process fluid temperature.

3.8
pass plate

plate used to change the direction of flow of a stream in a plate-and-frame heat exchanger with two or more passes

3.9
plate

sheet of material precision-pressed or -formed into a corrugated pattern

3.10
plate chevron angle

angle formed between the corrugated plate pattern and the horizontal

3.11
plate-and-frame heat exchanger

assembly of a gasketed, semi-welded or welded plate pack and its supporting frame

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See Figure 1.

3.12
plate gap

b
height to the underside of a corrugation of a plate

See Figure 2.

3.13
plate pack

grouping of all plates contained within a frame

3.14
port

inlet or outlet opening in the plate

3.15
pressure design code

recognized pressure vessel standard specified or agreed by the purchaser

EXAMPLE ASME Section VIII, EN 13445.

3.16**semi-welded plate pair**

two adjacent plates welded together where the weld replaces the function of a gasket

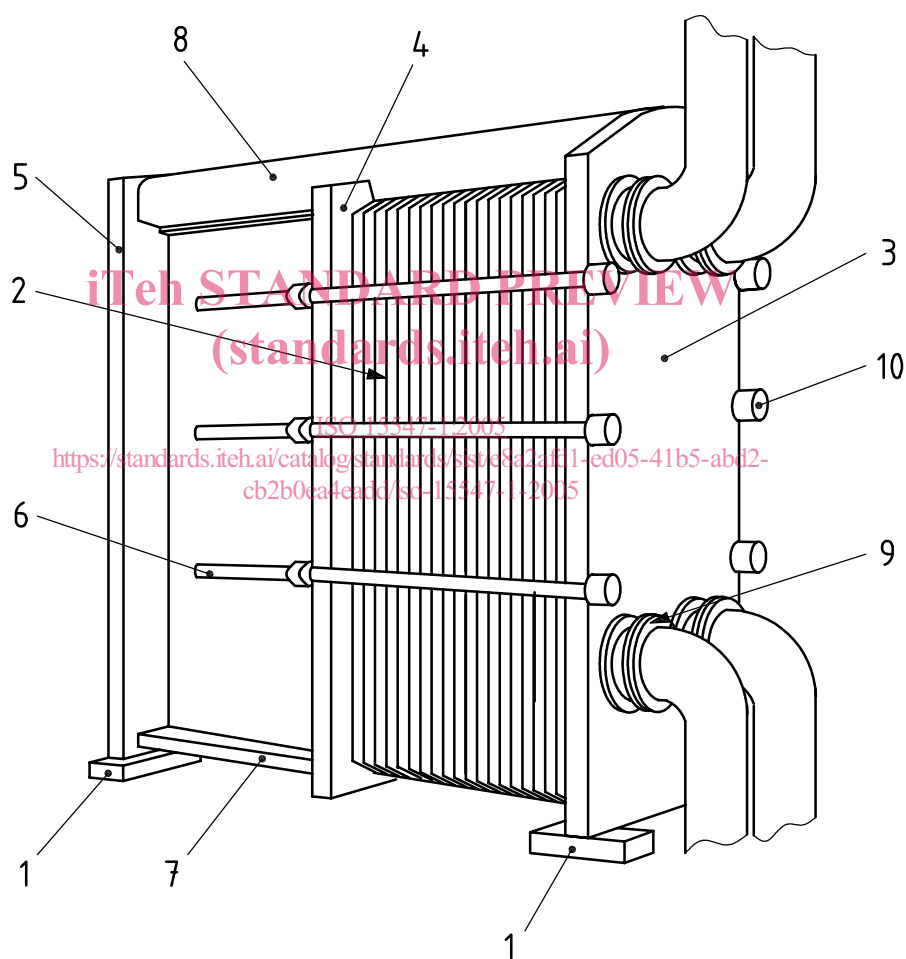
NOTE Gaskets are used to seal adjacent semi-welded plate pairs

3.17**shroud**

removable covering for the top and sides of the plate pack of the plate-and-frame heat exchanger, which provides protection in the event of a spray leak or fire

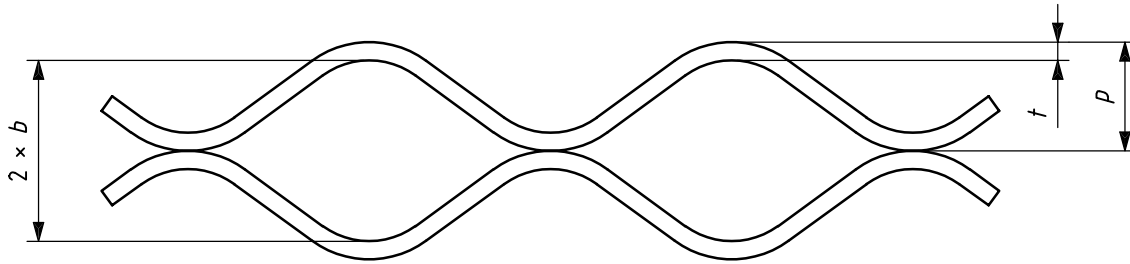
3.18**structural welding code**

recognized structural welding code specified or agreed by the purchaser

**Key**

- | | |
|------------------|-----------------------------------|
| 1 mounting feet | 6 tie bolts |
| 2 plate pack | 7 guide bar (bottom) |
| 3 fixed cover | 8 carrying bar (top) |
| 4 movable cover | 9 connections, studded or flanged |
| 5 support column | 10 tie nuts |

Figure 1 — Typical single-pass plate-and-frame heat exchanger



$$b = p - t$$

Key

- b* plate gap
- t* plate thickness
- p* compressed pitch per plate

Figure 2 — Plate gap

4 General

- **4.1** The pressure design code shall be specified or agreed by the purchaser. Pressure components (i.e. covers, tie bolts, tie nuts and connections) 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.

Annex A provides some recommended mechanical and design details for information. Annex A also includes some precautions for consideration when specifying fouling margin, fireproof shrouds and plate gaskets.

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

5 Proposal information required

5.1 The vendor shall complete all information requested on the data sheet. Annex C provides suitable formats.

5.2 For components whose terms and definitions are not fully identified by Clause 3, the vendor shall describe the details of construction and assembly.

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

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

5.5 The vendor shall state the anticipated life of the proposed gaskets in the specified service and in storage. Special requirements for gasket storage to maintain gasket shelf-life shall be specified.

5.6 The vendor shall state the method of support used for the movable cover.

5.7 The vendor shall supply a recommended spare parts list for each plate-and-frame heat exchanger.

5.8 If a fireproof shroud is specified, the plate-and-frame heat exchanger vendor shall submit proof that the proposed design has passed suitable type testing.

6 Drawings and other data requirements

6.1 Drawings

6.1.1 The vendor shall submit general arrangement drawings for each plate-and-frame 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) design pressure, test pressure, maximum design temperature, minimum design metal temperature and any restrictions regarding testing or operation of the plate-and-frame heat exchanger;
- c) dimensions and location of supports;
- d) overall exchanger dimensions;
- e) maximum and minimum compressed plate pack length;
- f) side clearance required for plate removal;
- g) mass of the plate-and-frame heat exchanger, both empty and full of water;
- h) centre of gravity of the exchanger for empty and operating conditions;
- i) corrosion allowance;
- j) material specifications for all components;
- k) allowable forces and moments on connections;
- l) size, flange rating and facing, location, orientation, and flow identification of all connections;
- m) applicable design codes;
- n) number of plates installed and maximum number of plates for specified frame;
- o) gasket materials and attachment method (e.g. glued, clip-on, etc.).

6.1.2 The vendor shall recommend the tools needed for the assembly and maintenance of the plate-and-frame heat exchanger. If torquing of bolts is required, the vendor shall provide torquing procedures.

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

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

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

6.2 Final records

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

- a) technical description;
- b) assembly instructions;
- c) operating instructions;
- d) installation and maintenance instructions (including lifting and handling);
- e) spare parts list;
- f) data sheets and drawings (as-built).

6.2.2 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.

7 Design

7.1 General

7.1.1 The frame and tie bolts of the gasketed or semi-welded plate-and-frame heat exchanger shall be designed to permit the future installation of at least 20 % additional plates.

7.1.2 Gasketed plates shall be replaceable individually, and semi-welded plates in pairs, without having to remove any other plate.

7.1.3 The plate pack shall incorporate means for positive alignment of the plates and gaskets.

7.2 Design temperatures

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

7.2.2 The design temperatures shall be used for the design of all pressure-retaining components.

7.3 Design pressure

Unless otherwise specified or approved by the purchaser, the plate-and-frame heat exchanger shall be designed for design pressure on either side, with atmospheric pressure or, if specified, vacuum on the other side.

7.4 Fouling margin

- The purchaser shall specify a percentage fouling margin, F , calculated by

$$F = \left(\frac{U_{\text{clean}}}{U_{\text{service}}} - 1 \right) \times 100 \quad (1)$$

where U is the heat transfer coefficient (overall thermal transmittance).