



Exploration & Production

GENERAL SPECIFICATION

PIPING VALVES VESSELS

GS EP PVV 412

Plate heat exchanger

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1. Scope

This document applies to the thermal and mechanical designs and to the fabrication of heat exchangers the transfer surface thereof consists of independent removable metal plates; tightness, between the plates, is obtained by means of gaskets.

Such plates may be of honey-comb, herring-bone, or other profile types. Any such heat exchangers are called plate exchangers (Refer to schematic attached hereto).

Plate exchangers may be used for any kind of services, provided the temperature is not more than 250°C.

They are recommended for fouling fluids and large differences between inlet and outlet temperatures. They especially meet any transfer surface adjustment need in case of a change in production capacity by removing or adding transfer plates without further modification to the plant.

Moreover, they are capable of withstanding thermal shocks, allowances being made for the small occurring masses, and may hence be used for discontinuous or cyclic duty.

Depending on the unit size of a plate (some Sq.dm to 3 Sq.m), the allowable maximum pressure varies from 6 bars to 25 bars effective as the unit surface decreases.

The total transfer surface of a plate heat exchanger assembly complete may reach 2.000 Sq.m.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

The plate heat exchangers under this specification shall be designed, engineered and constructed in accordance with the latest revisions published at the time of the Call for Tenders, of the following standards, codes and specifications:

Standards

Reference	Title
MSS SP 6	Standard finishes for contact faces of pipe flanges
NACE MR0175 / ISO 15156	Petroleum and natural gas industries - Materials for use in H ₂ S-containing environments in oil and gas production

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

Codes

The basic code is **ASME Section VIII div. 1**, **ASME Section VIII div. 2** may be specified by Engineering in the exchanger data sheet, or may be proposed by the Manufacturer.

Division II shall be recommended in particular in the following cases:

- Whenever this entails a significant saving: the Manufacturer is then requested to tender both options
- When the thicknesses calculated according to this Division lead to values similar to those imposed by local regulations as described in item below:

The selection of Division II involves the obligation of applying any requirements thereof (design, materials, fabrication, inspection, tests).

Reference	Title
ASME B1.1	Unified inch screw threads
ASME B16.5	Steel pipe flanges and flanged fitting
ASME B16.11	Forged steel fittings, socket welding and threaded
ASME B16.21	Non-metallic gaskets for pipe flanges
ASME B16.25	Butt welding ends
ASME B46.1	Surface texture
ASME Section II	Material specification
ASME Section V	Non-destructive examination
ASME Section VIII div. 1	Boiler and Pressure Vessel Code
ASME Section VIII div. 2	Boiler and Pressure Vessel Code
ASME Section IX	Welding and brazing qualification

Other documents

Reference	Title
Not applicable	

Local regulation

In the case where the country in which the exchangers shall be used has its own regulations, such regulations shall be applied whenever more severe than the basic code.

Consequently, the more severe requirements of the local regulations and basic code shall be applied.

Total General Specifications

Reference	Title
GS EP PVV 101	List of piping documents to be supplied to Total
GS EP PVV 402	Standards for exchanger accessories and equipment
GS EP PVV 611	Welding of pressure containing piping and equipment
SD EP PVV 404 *	Welding pipes
SD EP PVV 405 *	Bosses
SD EP PVV 406 *	Plugs
SD EP PVV 410 *	Earthing plates
SD EP PVV 413 *	Identification plate (plate heat exchangers)
SD EP PVV 414 *	Double tube exchanger name plate

* See [GS EP PVV 402](#)

Particular specification:

The Engineering Company shall prepare Particular Specification comprising all additions, waivers and clarifications specific to the job for which the equipment is being supplied. In particular, any such specification shall define the codes and specifications likely to be taken into consideration as a result of local regulations, and all constraints which apply to the installation site of the plant in which the equipment shall be installed.

Data sheets:

- Process data: A process data sheet comprising all the parameters required for the thermal design shall be prepared by the Engineering Company for each heat exchanger. This information shall be shown as per the form in Appendix 2.
- Mechanical engineering data: A mechanical engineering data sheet shall specify the design parameters and main geometric and dimensional particulars of each heat exchanger. This information shall be shown as per the form in Appendix 3.

Waivers:

Specific waivers from the documents of reference may be granted by the COMPANY request, if considered to be justified.

Any such waivers shall be defined in specific agreements made before signature of the purchase order.

In case of differences between this specification and the reference documents, the Manufacturer shall advise the COMPANY, who shall decide the course to be followed. It is to be understood that, in this case, the most severe requirement shall apply, unless otherwise formally agreed upon by the COMPANY.

3. Definition of design data

3.1 Pressures

All mentioned pressures are effective pressures, except in the case of a vacuum.

3.1.1 Working Pressure (WP)

The pressures prevailing in the heat exchanger under normal operating conditions.

3.1.2 Maximum Working Pressure (MWP)

This is the peak pressure reached temporality for varied causes such as: starting adjustments, increase in WP due to mishandling, momentary overpressure at a particular phase of operation, etc. Thus, it is the maximum pressure predicted during a complete cycle of operation under the most severe conditions.

3.1.3 Design Pressure (DP)

3.1.3.1 Operating above atmospheric pressure

This pressure is that used for designing the heat exchanger.

It is at least equal to the greatest of the following values:

- 110% of the operating pressure of the safety valves or other protective devices
- 110% of the MWP
- MWP + 1 bar (1 MPa)
- Maximum pressure of a pump or compressor connected to the exchanger under consideration (shut off head)
- Vapour pressure of the contained fluid at the maximum working temperature (and not at the design temperature)
- 2 bars as a minimum (2 MPa).

3.1.3.2 Operating under partial vacuum

The exchangers operating under a partial vacuum (even if only occasionally) shall be calculated for absolute vacuum operation.

3.1.4 Protective device operating pressures

The safety valves and other protective devices such as rupture discs shall be set in such a manner that the pressure of the start of opening or rupture corresponds to DP pressure. This allows for full opening of the valves at 110% of DP. Likewise, the rupture discs shall be provided for a rupture pressure tolerance of +10% of DP to ensure a progressive pressure increase.

3.2 Temperatures

3.2.1 Working Temperatures (WT)

That (those) prevailing under normal operating conditions.

3.2.2 Maximum Working Temperature (MWT)

This is the peak temperature reached temporarily:

- Regularly, during the operating cycle
- Occasionally:
 - As a result of a predictable faulty operation

- Due to the failure of any protective device
- Or to unit shutdown.

This temperature shall be taken into account for selecting the materials.

Allowances shall be made for any predictable large WT increase likely to occur in case of faulty operation or protective device failure, indicating whether such temperature increase shall effect a limited area of the exchanger. Several MWT may be so specified for each exchanger assembly.

3.2.3 Minimum Working Temperature (mWT)

This is the lowest temperature which can be reached during normal operation. (This temperature may be due to the internal fluids or to the ambient temperature). It is the temperature which shall be used for selecting the materials and mechanical design. The low temperature to be reached during occasional operation shall be indicated on the process data sheet, stating when necessary if they shall be considered for selection and design purpose according to basic code requirements.

3.2.4 Design Temperature (DT)

This temperature is that which is used for determining the mechanical characteristics of the materials. It is calculated as follows:

- $DT = MWT + 15^{\circ}C$ for MWT equal to or above the ambient temperature
- $DT = mWT - 5^{\circ}C$ for mWT below the ambient temperature.

These rules do not apply to the creep temperature range and shall not be used for the selection of the materials.

3.3 Case of several design conditions

An exchanger may be defined against several design parameter ranges (different pressures and temperatures). The exchanger shall then be calculated versus those various ranges of parameters with the aim of determining the governing conditions.

3.4 Local loads

In some particular cases, Engineering may ask the Manufacturer to include in his design the external point loads such as forces and moments transmitted to the exchanger nozzles by the plant piping, weight of equipment supplied by others, etc.

The local loading of the exchanger itself and of all associated pieces of equipment which are included in the supply must be taken into account by the Manufacturer in his calculations and are thus excluded from the parameters furnished by Engineering.

4. Thermal design

4.1 Selecting the exchanger type

The Manufacturer shall tender the type of exchanger of his fabrication which is meeting the best the required services.

4.2 Dimensioning

Each exchanger shall be designed for the most severe operating conditions.

The late sizes and profiles shall be left to the entire Manufacturer's responsibility.

5. Design conditions

The calculating rules defined by the basic code and existing local regulations must be applied taking into account the following additional provisions:

5.1 Combination of loads

The various combinations of loads must be considered for each of the following situations:

5.1.1 "Service" situation

- The exchanger is in place, complete with appurtenant equipment and filled with the fluids normally contained under operating conditions
- Corroded
- Under design pressure (or under atmospheric pressure when some parameters are increased thereby)
- At design temperature.

5.1.2 "Test" situation

- The exchanger is in place, complete with appurtenant equipment and full of water
- Corroded
- Under test pressure
- At ambient temperature
- Without insulation.

5.2 Allowable design stresses

5.2.1 Stress levels under design conditions

They shall comply with the ASME code referred to in paragraph 2 and, where applicable, to the local regulation.

The allowable stress levels defined in ASME code tables apply exclusively to ASTM materials.

In the particular case of the use of equivalent materials (paragraph 6.2 of this specification), the allowable stress levels shall be calculated by application of the safety coefficients specified in the Appendix to the code to the guaranteed minimum values of the materials.

In no part of the exchanger may the resultant of the stresses due to the combination of the loads defined in item 5.1 exceed the allowable stress levels defined above.

However, this rule does not apply to the calculation of those especially stressed points defined by the ASME code.