



Exploration & Production

GENERAL SPECIFICATION

PIPING VALVES VESSELS

GS EP PVV 411

Shell and tube heat exchangers

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1. Scope

This General Specification covers the Company practices and minimum requirements for the design, materials, fabrication, inspection and testing of Shell and Tube Heat Exchangers subject to internal and/or external pressure and conforming in definition to **TEMA** Standards.

Such equipment may contain liquid or gaseous petroleum or chemical products, air, water or steam. However, this specification does not cover steam condensers, double pipe, multi-tube heat exchangers, plate heat exchangers, cryogenic heat exchangers and air cooled heat exchangers.

Shell and tube heat exchangers shall be considered to be pressure vessels.

Unless otherwise specified, the Pressure Vessel Code shall be **ASME Section VIII div. 1** or **ASME Section VIII div. 2** as amended/supplemented by **GS EP PVV 211** or **BSI PD 5500** as amended/supplemented by **GS EP PVV 212**.

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.

Shell and Tube Heat Exchangers covered by this specification shall be designed, engineered, and built in accordance with the latest revisions issued at the date of the call for tender of the documents listed hereafter.

Any divergence between any of the Contractual Reference Documents, or between this specification and any other Contractual Reference Document, shall be reported to the Company for decision. In such a case, and unless otherwise agreed or decided by the Company, it is understood that the more stringent requirement shall apply.

Exceptions to, or deviations from this specification are not permitted unless previously accepted in writing by the Company. For this purpose, Manufacturer's requests for substitution or change of any kind shall be complete with all pertinent information required for the Company assessment. In case of approval, such approval shall be valid only for a specific case and shall not be construed as having general validity for other applications

Standards

Reference	Title
Not applicable	

Professional Documents

Reference	Title
Not applicable	



Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
API STD 660	Shell-and-Tube Heat exchanger for general refinery service
ASME B1.1	Unified inch screw threads
ASME B16.5	Steel pipe flanges and flanged fittings
ASME B16.11	Forged steel fittings, socket welding and threaded
ASME B16.20	Ring joint jackets and grooves for steel pipe flanges
ASME B16.21	Non-metallic gaskets for pipe flanges
ASME B16.25	Butt-welding ends
ASME B16.47	Large Diameter Steel Flanges
ASME B46.1	Surface texture
ASME Section II	Boiler and Pressure Vessel Code - Materials specification
ASME Section V	Boiler and Pressure Vessel Code - 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	Boiler and Pressure Vessel Code - Welding and brazing qualifications
ASTM A 193	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A 194	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A 435	Straight-Beam Ultrasonic Examination of Steel Plates
ASTM A 578	Straight-Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications
BSI PD 5500	Specification for unfired fusion welded pressure vessels
OCMA TEW-1	Recommendations for tube and welding
TEMA	Standards of the Tubular Exchanger Manufacturers Association
WRC 107	Welding Research Council: Bulletin 107 ^(*)
WRC 297	Welding Research Council: Bulletin 297 ^(*)

^(*) Published by the "Welding Research Council" (New-York)

**Other documents**

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP COR 350	External protection of offshore and coastal structures and equipment by painting
GS EP COR 352	Internal protection of equipment by painting
GS EP COR 354	External protection of onshore structures and equipment by painting
GS EP COR 356	Corrosion Protection of Fasteners for Subsea and Topsides applications
GS EP COR 560	Physical and chemical treatment of hydrostatic test water
GS EP PVV 107	Piping Stress Analysis
GS EP PVV 146	Bolting for piping
GS EP PVV 211	Design and fabrication of pressure vessels according to ASME VIII
GS EP PVV 212	Design and fabrication of pressure vessels according to BSI PD 5500
GS EP PVV 441	Procedure for shop hydraulic tests of shell and tube heat exchangers
GS EP PVV 611	Welding of pressure containing piping and equipment
GS EP PVV 771	Thermal insulation (hot service)
GS EP PVV 772	Thermal insulation (cold service)
GS EP PVV 773	Thermal insulation (cyclic service)

3. Manufacturer's responsibility

This specification together with the particular specifications shall not be construed as releasing the Manufacturer from his responsibility, fulfilment of his duties, guarantee and/or liabilities, nor does the Company, by any acceptance or approval, assume any responsibility for the conformance of the vessels to the requirements of the Code and/or of the Governing Authority.

4. General requirements

4.1 Construction category

The selection of the construction category shall be done as follow:

- Full radiographic examination (as per [ASME Section VIII](#)) or Category 1 (as per [BSI PD 5500](#)) shall be selected in any case:
 - For heat exchangers which contain lethal substances
 - For heat exchangers to operate at low temperature¹
 - For heat exchangers in vacuum service (when vacuum occurs during start-up or in other conditions than normal service, it is not considered as "vacuum service")
 - For heat exchangers which are to be heat treated for any reason
 - For heat exchangers in cyclic service
 - For heat exchangers made in Titanium.
- Spot radiographic examination (as per [ASME Section VIII](#)) or Category 2 (as per [BSI PD 5500](#)) may be selected for other heat exchangers not related for category 1.
- No radiographic examination option (as per [ASME Section VIII](#)) or Category 3 (as per [BSI PD 5500](#)) shall not be selected.

4.1.1 Selection of TEMA class

Selection of the [TEMA](#) class (R, C or B) shall be made as per section RCB 1.1 of [TEMA](#).

Class R shall apply for hydrocarbon and gas services. Class R shall also apply for lethal, toxic or inflammable fluids.

Class C may be used for utility services only.

5. Design

Service, duty and other design parameters as well as proposed type, position, arrangement and materials, are specified on the Heat Exchanger data sheets.

The design calculations shall take into account the various mechanical and thermal loadings (and their combination) to which the exchanger may be submitted.

5.1 Pressure

The design pressure is indicated in the data sheet.

Any part or element of the exchanger submitted to the stresses exerted by both fluids shall be capable to withstand the maximum pressure of each side. It shall not be designed for the differential pressure between both sides.

The minimum hydrostatic test pressure shall be established in accordance with the code.

¹ An exchanger is considered as "low temperature service" when the design temperature in operation is equal or lower than -30°C, or for a exchanger with a design temperature in operation greater than -30°C when the impact tests are required at -30°C and lower.