

TEMA Type Shell-and-Tube Heat Exchangers

GP 06-01-01

Scope

This ExxonMobil Global Practice (GP) covers the requirements of shell-and-tube exchangers according to API STD 660, 7th Edition, ISO 16812 (E), April 2003, titled "Shell-and-Tube Heat Exchangers for General Refinery Services," which is a part of this GP.

API STD 660 7th Edition, ISO 16812 (E), April 2003, as amended by this GP, defines the minimum requirements for shell-and-tube heat exchangers for general refinery services. This GP does not cover double pipe exchangers or scraped surface exchangers.

[I] Only the paragraphs amended are listed. For user convenience, the nature of the amendment is noted as follows:

Addition:

Denotes additions to the corresponding API/ISO paragraph.

Exception:

Denotes a complete replacement of the corresponding API/ISO paragraph.

New:

Denotes a new requirement that does not appear in API STD 660/ISO 16812.

[I] An asterisk (*) indicates that a decision by Purchaser is required or that additional information shall be furnished by Purchaser as required in Table A-1 of the Appendix of this GP. All bulleted (•) paragraphs in the API/ISO document are addressed in the Appendix.

Downstream, Chemical, Downstream Imperial Oil	For ExxonMobil Use Only	Version 4.0.0
Page 1 of 20	©ExxonMobil Development Company	

**Documents**

Document Sharing Hub

GP 06-01-01	TEMA Type Shell-and-Tube Heat Exchangers	February 2005
-------------	--	---------------

Table of Contents

1. Required References.....	3
1.1. Global Practices–ExxonMobil Engineering Practices	3
1.2. API–American Petroleum Institute	3
2. Additional Requirements	3
2.1. Global Practices–ExxonMobil Engineering Practices	3
2.2. ASME–American Society of Mechanical Engineers	3
2.3. ASTM–American Society for Testing and Materials	4
2.4. NACE–National Association of Corrosion Engineers.....	4
3. Revisions to API Standard 660/ISO 16812.....	4
Revision to Section 3: Terms and Definitions	4
Revision to Section 4: General.....	4
Revision to Section 5: Proposals.....	4
Revision to Section 6: Drawings and Other Required Data.....	5
Revision to Section 7: Design	5
Revision to Section 8: Materials.....	10
Revision to Section 9: Fabrication.....	10
Revision to Section 10: Inspection and Testing	13
Revision to Section 11: Preparation for Shipment	13
Revision to Section 12: Supplemental Requirements.....	14
Appendix: Exception to Annex B of API Standard 660/ISO 16812.....	15
Record of Change.....	18
Attachment: Purpose Codes Definitions.....	21

DNST, CHEM, DIOL	For ExxonMobil Use Only	Version 4.0.0
Page 2 of 20	©ExxonMobil Development Company	



Documents

Document Sharing Hub

GP 06-01-01	TEMA Type Shell-and-Tube Heat Exchangers	February 2005
-------------	--	---------------

1. Required References

This Section lists Practices and Standards that are generically referenced and assumed to be a part of this document. Unless otherwise specified herein, use the latest edition.

1.1. Global Practices–ExxonMobil Engineering Practices

GP 03-16-01	Flanged Joints, Gaskets, and Bolting
GP 05-01-01	Pressure Vessels
GP 05-03-01	Pressure Testing of Unfired Pressure Vessels
GP 18-07-01	Welding Procedures
GP 18-10-01	Additional Requirements for Materials
GP 20-01-01	Inspection of Equipment and Materials

1.2. API–American Petroleum Institute

API STD 660/ISO 16812	Shell-and-Tube Heat Exchangers for General Refinery Services
-----------------------	--

2. Additional Requirements

*The following Practices and Standards shall be used with this Practice as specified by the Owner's Engineer.

2.1. Global Practices–ExxonMobil Engineering Practices

GP 03-08-01	Expansion Joints
GP 05-01-02	Additional Requirements for Special Criteria Pressure Vessels
GP 18-04-01	Postweld Heat Treatment of Equipment Handling Alkaline Solutions
GP 18-12-01	Positive Material Identification
GP 19-01-01	Paint and Protective Coatings
GP 20-01-03	Quality Programs

DNST, CHEM, DIOL	For ExxonMobil Use Only	Version 4.0.0
Page 3 of 20	©ExxonMobil Development Company	



Documents

Document Sharing Hub

GP 06-01-01	TEMA Type Shell-and-Tube Heat Exchangers	February 2005
-------------	--	---------------

2.2. ASME–American Society of Mechanical Engineers

ASME B16.5	Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24
ASME SEC VIII D1	BPVC Section VIII - Rules for Construction of Pressure Vessels - Division 1
ASME SEC VIII D2	BPVC Section VIII - Rules for Construction of Pressure Vessels - Division 2 Alternative Rules

2.3. ASTM–American Society for Testing and Materials

ASTM A 193/A 193M	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 320/A 320M	Standard Specification for Alloy/Steel Bolting Materials for Low-Temperature Service

2.4. NACE–National Association of Corrosion Engineers

NACE MR0103	Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments
-------------	---

3. Revisions to API Standard 660/ISO 16812

[I] All headings contained herein correspond to paragraph numbering within API STD 660/ISO 16812 and reflect additions, exceptions, and new requirements to the standard. All provisions not modified or deleted remain in force.

Revision to Section 3: Terms and Definitions

3.3. Addition

[I] Effective surface—the area associated with tube bends in U-tube bundles shall be considered as effective heat transfer surface in kettle-type reboilers only.

Revision to Section 4: General

4.1. Exception

* [I] Design, fabrication, inspection, and testing of heat exchangers shall be in accordance with the latest edition of ASME SEC VIII D1. Alternatively, codes of other countries shall be permitted in accordance with [GP 05-01-01](#).

DNST, CHEM, DIOL	For ExxonMobil Use Only	Version 4.0.0
Page 4 of 20	©ExxonMobil Development Company	



Documents

Document Sharing Hub

Revision to Section 5: Proposals

5.2.7.b) Exception

* [I] Spare gaskets shall not be supplied unless otherwise specified by Purchaser.

5.2.8. New

* [I] If specified, the proposal shall include a copy of a detailed description of the Vendor Quality Assurance program. This is required to contain a positive materials identification (PMI) program for alloy components.

Revision to Section 6: Drawings and Other Required Data

6.2.4.c) Exception

* [I] Vendor shall submit for review the proposed procedure for assembly of girth flanged joints, if controlled bolt-up of girth flanges is required by the Purchaser. Any required lubricants shall be stated.

6.2.5. Exception

[I] Vendor shall submit for review mechanical design calculations for supports and lifting/pulling devices and details of vibration analysis.

Revision to Section 7: Design

7.1.1. Exception

* [R] All exchangers shall have two design temperatures for each side, a maximum design temperature as specified on API STD 660/ISO 16812, Annex A, Line 41, and a critical exposure temperature (CET), specified by Purchaser as shown in Table B-1 of this Practice.

7.1.4. New

[R] For fixed tubesheet exchangers, if the differential between the average shell metal temperature and the coincident average metal temperature of any one tube pass exceeds 50°F (28°C), the need for a shellside or tubeside expansion joint shall be evaluated based on the ASME calculation procedure.

7.1.5. New

[R] For two-pass-shell exchangers, the differential between the inlet and the outlet temperatures of the shell side fluid shall not exceed 350°F (177°C).

7.4.4. New

[O] TEMA Type C channels shall have an internal pass partition box (where pass partitions are sealed independently from the channel cover).

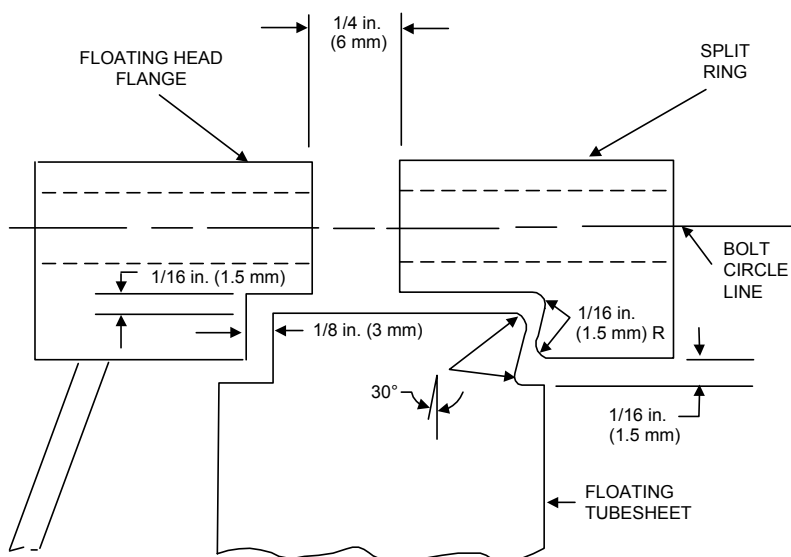
DNST, CHEM, DIOL	For ExxonMobil Use Only	Version 4.0.0
Page 5 of 20	©ExxonMobil Development Company	



7.5.6. New

[M] Split ring design for TEMA Type S units shall be as shown in Figure 1 of this GP unless otherwise agreed between Purchaser and Vendor.

Figure 1: Split Ring for TEMA Type S Bundles



NOTE: Hardness of completed ring shall not exceed values given in GP 05-01-01.

7.6.1.5. New

[R] When integrally finned tubes are specified, the tube wall thickness under the root diameter of the fins shall meet the thickness specified on the Heat Exchanger Specification Sheet.

7.6.1.6. New

[R] Integrally finned U-tubes shall be finned in the bend area, except when the mean bend diameter is less than six outside tube diameters, in which case the entire bend plus 2 in. beyond the tangent shall not be finned.

7.7.5.d) Exception

Slip-on flanges shall not be used in hydrogen and wet H₂S services, as defined in [GP 18-10-01](#).

7.7.7. Addition

[M] The projection of a flanged connection shall provide adequate clearance between the back of the flange and the insulation on the heat exchanger to allow bolt removal when a valve is to be installed on the neck of the nozzle.

7.7.11. New

[R] Threaded connections shall not be provided on exchanger components that are of clad construction:

- where the design temperature is greater than or equal to 750°F (400°C)

DNST, CHEM, DIOL	For ExxonMobil Use Only	Version 4.0.0
Page 6 of 20	©ExxonMobil Development Company	



Documents

Document Sharing Hub