



NATIONAL PETROCHEMICAL COMPANY
STANDARDS

ENGINEERING STANDARD
FOR
SHELL & TUBE HEAT EXCHANGERS

NPCS-ES-HM-01

REVISION : 0

JUNE 1992



CONTENTS

1 GENERAL

1.1 SCOPE

1.2 REFERENCE

2 MATERIAL

3 DESIGN

3.1 GENERAL

3.2 DESIGN PRESSURE AND TEMPERATURE

3.3 EXCHANGER TYPE

3.4 VELOCITY LIMITATION

3.5 CONNECTION ON EXCHANGERS

3.6 VIBRATION

4 SPECIAL APPLICATION

4.1 KETTLE REBOILER - GENERAL

4.2 KETTLE REBOILER - STEAM GENERATOR

4.3 SLURRY HANDLING

4.4 "HF" ACID SERVICE

4.5 SEA WATER OR BRACKISH WATER SERVICE

4.6 HYDROGEN SERVICE CONSTRUCTION

5 DRAWINGS AND DOCUMENTS

THIS DOCUMENT IS THE PROPERTY OF NPCC. IT IS CONFIDENTIAL AND ALL RIGHTS RESERVED. TO THE OWNER NEITHER THE WHOLE NOR ANY PART OF THIS DOCUMENT MAY BE DISCLOSED TO ANY THIRD PARTY, REPRODUCED, STORED IN ANY RETRIEVAL SYSTEM OR TRANSMITTED IN ANY FORM OR ANY MEANS WITHOUT THE PRIOR WRITTEN CONSENT OF NPCC.

PREPARED BY : PETROCHEMICAL INDUSTRIES DESIGN & ENGINEERING COMPANY (P.I.D.E.C.)



THIS DOCUMENT IS THE PROPERTY OF NPCC. IT IS CONFIDENTIAL AND ALL RIGHTS RESERVED TO THE OWNER. NEITHER THE WHOLE NOR ANY PART OF THIS DOCUMENT MAY BE DISCLOSED TO ANY THIRD PARTY, REPRODUCED, STORED IN ANY RETRIEVAL SYSTEM OR TRANSMITTED IN ANY FORM OR ANY MEANS WITHOUT THE PRIOR WRITTEN CONSENT OF NPCC.

1 GENERAL

1.1 SCOPE

1.1.1 This standard covers the minimum requirements for process and thermal design, guarantee, and material of unfired shell and tube type heat exchangers.

1.1.2 The intent of this standard is to supplement, amend or limit the reference codes and standards mentioned below.

1.1.3 Exceptions or variations shown in the material/purchase requisition take precedence over requirements shown herein.,

1.1.4 No variation from the material/purchase requisition and this standard are permitted unless approved in writing by purchaser.

1.1.5 In case of any conflict between the various specifications and codes, the matter shall be referred to purchaser for clarifications, and clarifications provided by purchaser shall be final and binding on designer.

1.1.6 The compliance with this standard and accompanying data dose not relieve the designer from his own responsibilities and performance guarantees, nor from any further contract obligations.

1.1.7 The exchangers designer shall be responsible for the accuracy of all computer programs used for the thermal analysis of the exchangers.

1.2 REFERENCES (LATEST EDITIONS)

1.2.1 TEMA Standards of Tubular Exchangers Manufacturers Associations .

1.2.2 API 660 Heat exchangers for general refinery service.

1.2.3 ASME Boiler and Pressure Vessel Code section II, material specific&ions.

1.2.4 NPCS National Petrochemical Company Standards.



2

MATERIAL

- 2.1 Materials of construction of exchanger parts shall conform to specification given in section II of ASME.
- 2.2 The designer shall specify in process/thermal data sheets the material of construction of each component in general terms.
- 2.3 If design conditions requires use of a certain material, the full material specification shall be clearly stated in process/thermal data sheet by designer.
- 2.4 The material shall be selected so as to produce an economical design for the specified design conditions.
- 2.5 If process designer specifies materials or alloys not covered by relevant codes, the designer shall obtain all the necessary design datas from the supplier of such materials & send them for purchaser approval/further use.
- 2.6 Materials specified by purchaser in relevant documents are the minimum requirements, unless otherwise stated.
- 2.1 When purchaser desires use of special material, the same shall be chosen by designer unless otherwise conflicted with process requirements. In this case the reasons shall be raised to purchaser for approval of suggested material by designer.
- 2.8 Cast iron shall not be used for any pressure parts.
- 2.9 GASKET
- 2.9.1 Gasket material shall be stated on data sheet by process /thermal designer.
- 2.9.2 Copper gaskets are not permitted when fluids contains H_2S or amines.
- 2.10 TUBING
- 2.10.1 Seamless material shall be used for stainless steel and non ferrous tubes. For carbon steel tubing, welded tubing conforming or equal to ASTM A-214 or A266 is an acceptable alternate to seamless tubing. For high pressure and temperature services the use of seamless tubes is mandatory.



2.10.2

Tube gauges shall be selected from following table. The gauges specified is the minimum wall thickness.

Tube O.D.	Copper and Copper alloy	Carbon steel Aluminum and Aluminum alloys	Other Alloys
3/4	16	14	16
1 1/4	14	12	14
1 1/2	14	12	14
2	12	10	12
	12	10	12

2.10.3

The minimum mean radius of U bends shall be 1 1/2 times the OD of tubes. For U tubes the wall thickness to be written on process/thermal data sheet *shall* apply to the tubing before bending. Proposal may be based on the use of heavier wall tubing for short radius U-bends when design pressure demands thicker tube walls.

2.10.4

U-tubes shall be seamless.

3 DESIGN

3.1 GENERAL

3.1.1 Thermal design shall include a complete specification sheet for each item. This sheet shall be similar to example given in TEMA. Each sheet shall define proposed offering using TEMA nomenclature or by suitable sketch when deviation from standard construction are intended. Each sheet shall show the estimated net effective transfer surface.

3.1.2 When alternate operating conditions are specified, the exchanger unit shall be designed to handle either condition without exceeding the allowable pressure drop and the estimated pressure drop shall be stated by the licensor for all alternates.

3.1.3 Fouling factors shall be stated on process data sheets. Fouling factors are net. Tube side values shall be increased by ratio of outside to inside surfaces.

3.1.4 Calculated fouling resistances shall not be less than the fouling resistances given in the process data sheets.'

3.1.5 Maximum acceptable pressure drops indicated in the process data sheets shall be understood for fouled exchangers and as inclusive of the pressure drops through inlet and outlet nozzles. In case of alternate conditions these shall apply to the worst operating condition.

3.1.6 Designer shall guarantee pressure drops to include entrance & exit losses.

3.1.7 When deemed important, viscosities will be specified. Erroneous data shall be reported to purchaser, when viscosity values are omitted, it shall be the responsibility of thermal designer to establish proper values for their calculations.

3.1.8 When the physical properties of the fluids (specific heat, density, viscosity, etc.) are to be taken from available literature, preference shall be given to maxwell's handbook and TEMA standards.

3.1.9 All the exchangers of the same size, type and material shall maximize interchangeability of parts where practical. The highest practical number of exchangers shall have interchangeable tube bundles. whenever possible tube bundles shall be designed to permit rotation through 180°.