

SCOPE

- I ↕ 1.1 This practice covers the design, fabrication, inspection, and shipping of bare and extended surface tubes/pipes and fittings for new or replacement coils for fired heaters, boilers, and heat recovery steam generators (HRSG). It does not apply to cast tubes.
- I 1.2 An asterisk (*) indicates that a decision by the Owner's Engineer is required or that additional information is to be supplied by the Purchaser.

SUMMARY OF ADDITIONAL REQUIREMENTS

- I 2.1 **Table 1** lists the practices, codes and standards which shall be used with this practice.
- I * 2.2 **Table 2** lists the practices and codes that will be used with this practice as specified by the Purchaser.

↕ **TABLE 1**

PRACTICES			
IP 3-16-1	Flanged Joints, Gaskets, and Bolting	IP 18-7-1	Welding Procedures
IP 3-18-1	Piping Fabrication Shop or Field	IP 18-10-1	Additional Requirements for Materials
IP 18-3-2	Statically Cast Steel and Alloy - Pressure Containing Parts and Tube Supports for Fired Heaters	IP 18-12-1	Positive Materials Identification
		IP 20-1-1	Inspection of Equipment and Materials
CODES AND STANDARDS			
ASME		API	
B1.20.1	Pipe Threads, General Purpose (inch)	560	Fired Heaters for General Refinery Service
Section I	Power Boilers	530	Calculation of Heater Tube Thickness in Petroleum Refineries

TABLE 2

PRACTICES			
IP 3-6-1	Piping for Instruments	IP 20-1-2	Administrative Procedures for Obtaining Inspection
IP 19-7-1	Protection of Stainless Steel during Fabrication, Shipping, Storage and Field Construction		
CODES			
ASME			
Section II	Materials		
Section V	Non-destructive Examinations		
B31.1	Power Piping		

DESIGN OF TUBES AND HEADERS

FIRED HEATER TUBES

- R 3.1 **Minimum tube wall thickness calculations** shall be based upon all of the following:
 - a. Minimum thickness calculated per current edition of API-530.
 - b. 100,000-hour design life (minimum rupture strength).
 - * c. Design temperature, if not specified by the Owner, shall include 25°F (14°C) temperature allowance (TA).
 - * d. Operating conditions (normal and emergency) specified by the Owner.
 - ↕ * e. Corrosion allowance, if not specified by the Owner's Engineer, shall be per current edition of API-560.

IP 7-5-1		Coils for Fired Heaters and Boilers	
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(This practice is appropriate for attachment to Inquiry or Purchase Document)

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- R 3.2 **Minimum new wall thickness for any tube** shall be:
- Radiant, Shield and Convection Tubes - 0.125 in. (3.18 mm) + CA but not less than Schedule 40.
 - Studded Tubes - 0.220 in. (5.59 mm).
- R 3.3 The bottom two bare rows of convection tubes, when exposed to the radiant section, are defined as shield tubes and shall meet the following:
- Material shall be the same as the first radiant tube, if in the same service.
 - Tube thickness shall be at least equal to that of the first radiant tube, if in the same service and equal tube outside diameter.
- R 3.4 Tubes shall be of continuous length with no intermediate welds except where the furnace length exceeds the available tube length, then one intermediate weld is permitted.

RETURN BENDS, HEADERS, AND MANIFOLDS

- R 3.5 **Forged return bends are preferred.** Cast return bends are acceptable if they meet the requirements of [IP 18-3-2](#). Fabricated return bends may only be used if specifically approved by the Owner's Engineer.
- M 3.6 Plug headers and rolled fittings are not acceptable unless expressly approved by the Owner's Engineer.
- R 3.7 **Piping external to the heater** such as crossovers, jumpovers, and including manifolds shall be as follows:
- Crossover and jumpover piping shall be welded and insulated.
 - Design criteria for Incoloy 800 piping will be specified by the Purchaser.
- O 3.8 **Distribution and collection manifolds** on multipass heaters shall be designed so that the dynamic head in the manifold at the point of maximum velocity is not more than 10 percent of the individual pass pressure drop unless otherwise specified.

EXTENDED SURFACE

- O 3.9 Convection section surface selection shall be governed by the following:

FUEL FIRED	TUBE SURFACE
a. Gas	Bare; or "Thin" Fins 1 in. (25 mm) high max. and 60 fins per ft max. (197 fins per meter)
b. Liquid fuel lighter than 25° API (0.904 relative density) and containing less than 0.01% (mass) ash	Bare; Studs; or Fins 3/4 in. (19 mm) high max. and 42 fins per ft (138 fins per meter)
c. Liquid fuels heavier than 25° API or containing more than 0.01% (mass) ash	Bare; Studs; or "Thick" Fins 3/4 in. (19 mm) high max. and 36 fins per ft max. (118 fins per meter)
d. Dirty gaseous fuels producing more than 5 ppm (mass) or 5 mg/kg particulates in flue gas	

- O 3.10 **Fin-type extended surface** shall be as follows:
- Fins shall be solid (serrated fins may be bid as an alternate).
 - Flanged or "L"-shaped fins are not acceptable.
 - Alternative proposals of other fin-type extended surface shall be submitted for approval.
 - "Thin" fins shall have a nominal thickness of 0.05 in. (1.27 mm).
 - "Thick" fins shall have a nominal thickness of 0.105 in. (2.67 mm).
- O,R 3.11 Fin material selection shall be based on calculated fin tip temperature. Representative fin materials and their maximum allowable temperatures are as follows:

FIN MATERIAL	MAXIMUM FIN TIP TEMPERATURE	
CS	850°F	455°C
2-1/4 - 5 Cr	1000°F	540°C
11 - 13 Cr	1250°F	675°C
18/8 Cr/Ni	1450°F	795°C
25/20 Cr/Ni	1800°F	980°C

- C 3.12 Calculated stud tip temperature for CS studs shall not exceed 1050°F (565°C).