

Specification for Indirect Type Oilfield Heaters

API SPECIFICATION 12K
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Upstream Segment

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Contents

	Page
1 Scope	1
2 References	1
3 Definitions	2
4 Materials	5
4.1 General	5
4.2 Coils	5
4.3 Flanges	5
4.4 Fittings	5
4.5 Proprietary Fittings	5
4.6 Bolting	5
4.7 Shells, Firetubes and Stacks	8
5 Design	8
5.1 Coil Design	8
5.2 Shell Design	9
5.3 Standard Firebox Rating	10
5.4 Firetube Heat Flux	11
5.5 Firetube Heat Density	11
5.6 Stack Height	11
6 Fabrication, Testing and Painting	11
6.1 General	11
6.2 Coil Fabrication	11
6.3 Shell, Firetube, Stack and Accessories	15
6.4 Painting	15
7 Marking	16
7.1 Nameplate	16
7.2 Shell Nameplate	16
7.3 Coil Nameplate	17
7.4 Coil Connection	17
8 Inspection and Rejection	18
8.1 Inspection Notice	18
8.2 Inspection by Purchaser	18
8.3 Rejection	18
8.4 Compliance	18
Annex A (informative) Indirect Heater Design Information	19
Annex B (informative) Gas Flow Rate	21
Annex C (informative) Combustion Efficiency	23
Annex D (informative) Heat Transfer	25
Annex E (informative) Structural Design Guidelines	29
Annex F (informative) Corrosion Guidelines	31
Annex G (informative) Use of the API Monogram by Licensees	33

Figures

1	Typical Indirect Heater Assembly	6
2	Indirect Heater Coils	7
3	Safety Drilling of Return Bends	15
4	Indirect Heater Shell Nameplate Format	16
5	Indirect Heater Coil Nameplate Format	17
C.1	Approximate Combustion Efficiency of Natural Gas (1,050 BTU/SCF, HHV) in Direct Type Oilfield Heaters	24

Tables

1	Maximum Allowable Coil Stress (S)	10
2	Maximum Coil Working Pressure (P)	12
3	Thread Allowance for Pipe Wall Thickness Calculations	12
4	Standard Firebox Rating Based on Heat Input to the Water Bath	13
5	Limitations on Imperfections in Circumferential Butt Welds Visual and Radiographic Examination	14
B.1	Gas Flow Rate	21

Specification for Indirect Type Oilfield Heaters

1 Scope

This specification covers minimum requirements for the design, fabrication, and shop testing of oilfield indirect type fired heaters used in the production of oil, gas, and their associated fluids. They are usually located at some point on the producing flow-line between the wellhead and pipeline. Heater components covered by this specification include the pressurized coils, the shell, heater bath, firetube and the firing system.

Termination of a heater coil shall be at the first bevel when coils are furnished beveled for welding, or the face of the first fitting when fittings are furnished as the inlet or outlet connection to the coil. All fittings and valves between the inlet and outlet of the coil are to be considered within the coil limit.

Heaters outside the scope of this specification include steam and other vapor generators, reboilers, indirect heaters employing heat media other than water solutions, all types of direct fired heaters, shell-and-tube bundles or electrical heating elements, and coils operating at temperatures less than -20°F .

2 References

API Specification 5L, *Specification for Line Pipe*

API Specification 6A, *Specification for Wellhead and Christmas Tree Equipment*

API Specification 12B, *Specification for Bolted Tanks for Storage of Production Liquids*

API Recommended Practice 14E, *Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems*

ASME B2.1 ¹, *Standard Welding Procedure Specification (WPS)*

ASME B16.11, *Forged Steel Fittings, Socket-Welding and Threaded*

ASME B16.5, *Pipe Flanges and Flanged Fittings*

ASME B31.3, *Process Piping*

ASME B36.10, *Welded and Seamless Wrought Steel Pipe*

ASME Boiler and Pressure Vessel Code, Sections V and IX—*Welding and Brazing Qualifications*

ASTM A36 ², *Standard Specification for Carbon Structural Steel*

ASTM A53, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*

ASTM A105, *Standard Specification for Carbon Steel Forgings for Piping Applications*

ASTM A106, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*

ASTM A194, *Standard for Medium Carbon Alloy Steel Nuts*

¹ ASME International, 3 Park Avenue, New York, New York 10016, www.asme.org.

² ASTM International, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428, www.astm.org.

ASTM A234, *Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service*

ASTM A283, *Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality*

ASTM A285, *Standard Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength*

ASTM A307, *Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength*

ASTM A515, *Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service*

ASTM A516, *Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service*

ASTM A570, *Standard Test Method for Water Absorption of Plastics*

ASTM B569, *Standard Specification for Brass Strip in Narrow Widths and Light Gage for Heat-Exchanger Tubing*

NACE MR 0175 ³, *Sulfide Stress Corrosion Cracking Resistant Metallic Materials for Oil Field Equipment*

3 Definitions

Heating of oil and gas streams close to the wellhead is normally done for the purpose of preventing hydrate or wax formation. Wellstream heating may also be done to prevent liquids from condensing in the gathering line or to facilitate subsequent fluid separations.

An indirect type oilfield heater employs a water solution, maintained below the boiling point, as the heating medium for the purpose of heating the process fluids in the coils. Refer to Figure 1, entitled Typical Indirect Heater Assembly, showing general arrangement of heater components, piping and instrumentation.

3.1

burner system

System for firing the heater designed for the specific fuel to be used (either natural or forced draft design).

NOTE When multiple U-tubes are used, they should be designed to use separate burners, pilots and stacks. The burner system includes the firing accessories. Intake flame arrestors and other optional burner accessories as listed in Annex A may also be included.

3.2

choke

Device to restrict and control the flow rate of well fluids, it may have a positive fixed orifice with removable bean or an adjustable variable orifice, located upstream of the coil, between passes in the coil bundle, or on the coil outlet.

NOTE A submerged or long nose choke may be used with pressure reduction taking place within the water bath to minimize hydrate formation.

3.3

coil area

Heat transfer area and is normally calculated using the outside surface area of the pipe.

³ NACE International (formerly the National Association of Corrosion Engineers), 1440 South Creek Drive, Houston, Texas 77218-8340, www.nace.org.

3.4 coils

Also referred to as a tube bundle, the device through which fluid to be heated is passed.

NOTE One or more coils which may be typically arranged as a single pass coil, split pass coil, or spiral coil, illustrated in Figure 2. The single pass coil is normally a serpentine pattern with only one flow path. This coil may also be arranged to provide two or more parallel flow paths for reduced pressure drop, but it is still referred to as a single pass coil. The split pass coil may be designed for two pressure ratings, allowing for a choke to be located between the two coil sections. Split pass coils are used when it is necessary to use two heating stages to minimize hydrate formation within the coil. The spiral coil is generally used on smaller heaters and is normally a single pass coil. Multiple coils may be used if more than one well stream is processed in the same heater shell.

3.5 fill connection

Connection on the top of the shell provided with a pressure-vacuum venting device.

NOTE If a water saver is furnished, the fill and vent connection may be integral with it.

3.6 firebox

Complete assembly consisting of the firetube, mounting flange, intake and stack adaptors.

3.7 firetube

Consisting of one or more U-tubes fired, normally by natural gas, at one end and exhausting through a vertical stack.

NOTE In larger heaters, the firetube may consist of a large diameter first pass firetube and multiple return tubes manifolded into a common stack. The firetube is that portion of the firebox in contact with the heater bath.

3.8 fusion

Melting together of filler material and base material, or of base material only, which results in coalescence.

3.9 heat density

Heat released through the cross section of the firetube, expressed as BTU/hr/in.² of cross sectional area.

3.10 heat flux

Applied to the average transfer rate through the firetube, expressed as BTU/hr/ft² of exposed area.

3.11 heater bath

Indirect heating medium, limited to water or water solutions.

NOTE When freezing is possible, ethylene glycol may be added for anti-freeze protection. Other additives to the water bath may include corrosion inhibitors.

3.12 intake flame arrestor

Device placed on the air intake of the firetube to prevent propagation of flame from inside the firetube to the outside atmosphere, consisting of a corrugated aluminum cell mounted in a metal housing which attaches to the firebox.

3.13 linear indication

Closed surface area marking or denoting a discontinuity requiring evaluation, whose longest dimension is at least three times the width of the indication.

3.14**removable**

Total component is field replaceable without welder assistance.

3.15**rounded indication**

Closed surface area marking or denoting a discontinuity requiring evaluation, whose longest dimension is at least three times the width of the indication.

3.16**shell**

Normally a horizontal vessel which contains the coil, firetube and heater bath.

3.17**slag inclusion**

Nonmetallic solid material entrapped in weld metal or between weld metal and base metal.

3.18**spark arrestor**

Device placed on the exhaust of the stack to prevent sparks from being emitted to the outside atmosphere, consisting of a metallic wire screen attached across the top diameter of the stack.

3.19**stack downdraft diverter**

Device attached to the top of the stack designed to reduce the effects of wind currents on the burner system.

3.20**stack flame arrestor**

Device placed on the exhaust of the stack to prevent propagation of flame from inside the firetube to the outside atmosphere, normally consisting of a corrugated aluminum or stainless steel cell mounted in a metal housing which attaches to the top of the stack.

3.21**stack rain shield**

Device attached to the top of the stack to prevent rain from falling directly into the stack. It may also serve as a stack downdraft diverter.

3.22**undercut**

Groove melted into the basic material adjacent to the toe or root of a weld and left unfilled by weld material.

3.23**water saver**

Chamber that may be directly connected to the heater shell to permit the shell to be completely filled with water.

NOTE The water in this chamber exists at a lower temperature than the heater bath which reduces evaporation losses. It may also be referred to as an economizer or expansion tank. Its capacity should be sufficient to contain the water expansion between ambient and operating temperatures.

4 Materials

4.1 General

Material to be used in the construction of indirect heaters is listed in this section. When specified by the purchaser, pressure retaining components exposed to hydrogen sulfide shall meet the requirements of NACE MR01 75.

4.2 Coils

Materials for indirect heater coils, including the fuel gas preheat coil if used, shall be seamless pipe conforming to one of the following specifications:

- a) API 5L Grade B, seamless;
- b) ASTM A53 Grade B, seamless;
- c) ASTM A106 Grade B or Grade C, seamless.

4.3 Flanges

Flanges and clamp type connectors shall conform to ANSI/ASME B16.5 or API 6A. Material shall conform to the following specifications:

- a) ANSI flanges: ASTM A105;
- b) API flanges and clamp type connectors: API 6A;
- c) Type API 6B (2,000 psi to 5,000 psi), API Type 4 material;
- d) Type API 6BX (10,000 psi), API Type 2 material;
- e) Type API 6BX (15,000 psi), API Type 3 material.

4.4 Fittings

Fittings such as couplings, return bends, ells, tees, etc., shall conform to ASTM A234 Grade WPB or WPC, or to the manufacturer's standard as appropriate. The flow area of return bends, ells, and tees shall not be less than 90% of the flow area of the coil pipe.

4.5 Proprietary Fittings

Material for fittings such as chokes, valves and unions shall conform to the fitting manufacturer's standards. Where components are to be welded, the heater manufacturer shall obtain chemical and mechanical properties for the material sufficient to establish properly qualified welding procedures as required by Section 6.

4.6 Bolting

Bolting for flanges and other pressure retaining connections shall conform to ASTM A193, Grade B7 with nuts conforming to ASTM A194, Grade 2H. Where service conditions require bolting having lower tensile strength, flange working pressure shall be de-rated in accordance with ANSI/ASME B16.5 or API 6A. Bolting for heater shells, stacks, etc., shall conform to Annex A of API 12B or ASTM A307.

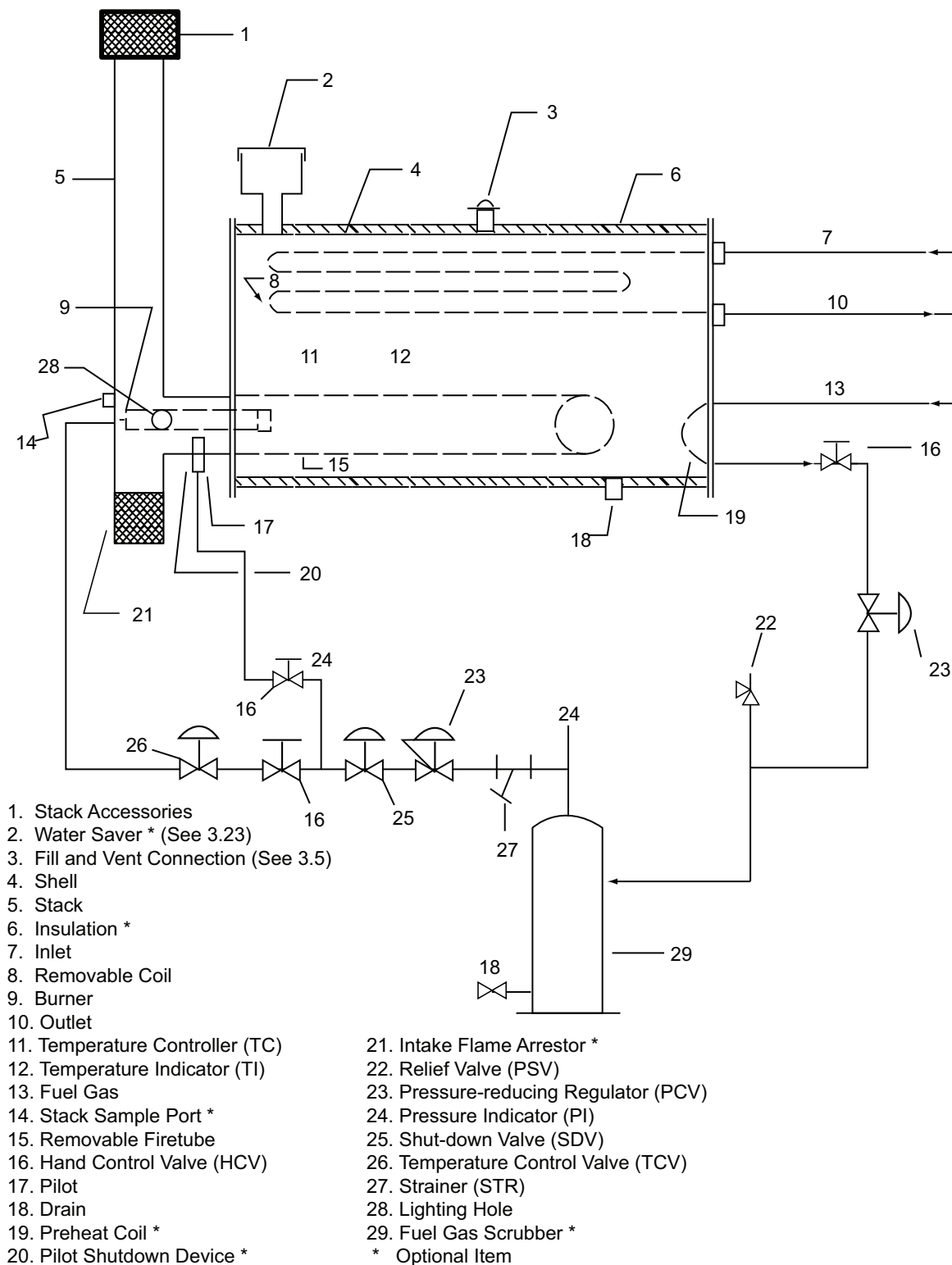
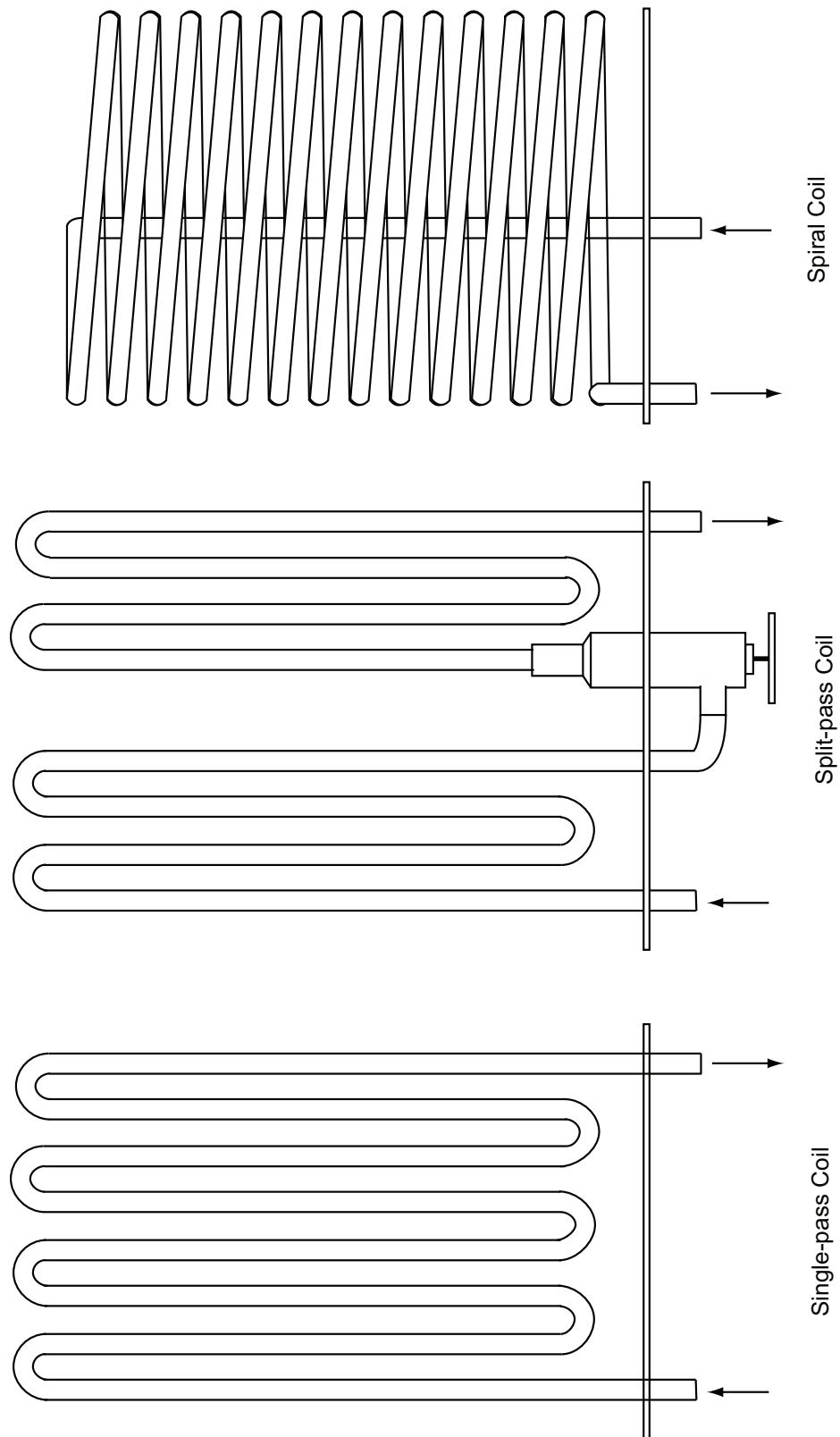


Figure 1—Typical Indirect Heater Assembly

**Figure 2—Indirect Heater Coils**