
Tank Heaters

THS, THSX, THW,
THWX

Installation and operating instructions

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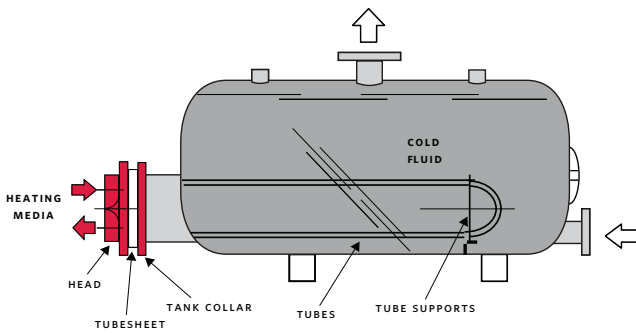
1.0 INTRODUCTION

Armstrong Tank Heaters are designed for highest efficiency and trouble-free service, based on many years of technical and operational research. Careful supervision and inspection of materials and workmanship are important factors in the manufacturing of each unit.

In any correspondence relating to Armstrong units, please refer to the serial number which is stamped on the nameplate.

2.0 CONSTRUCTION

A Tank Heater is for immersion heating of water in storage tanks and consists of the tubing, tube supports and tubesheet which make up the tube bundle and the head and tank collar or mating flange. The wall of the tubes is the boundary between the cold fluid in the tank and the heating media inside the tubes and is known as the heat transfer surface.



WARNING



The tank, inlet pipe and suitable angle support within the tank to support the tube bundle is to be provided by the end user.

When the temperatures of the two fluids are such to cause a difference in linear expansion of the tank and the tubes, provisions must be provided within the tank to prevent this expansion damaging the unit. With a u-tube type tank heater the tubes move independently from the tank and the only precautions for thermal expansion are having enough room between the end of the tubes and the tank wall and a wide enough angle support to accommodate the movement.

Every care is taken in design to provide a heat exchanger most suitable to meet each situation, consistent with reasonable cost. All Armstrong tank heaters are built to ASME code.

3.0 INSTALLATION PROCEDURES

3.1 When installing the tank, provide sufficient clearance at the tank heater location to permit removal of the tube bundle from the tank.

- 3.2** Provide valves and bypasses in the piping system so that both the tank and the tube side may be by passed to permit isolating the unit for inspection and repairs.
- 3.3** Provide as considered necessary based on history of scaling, means for cleaning the unit periodically.
- 3.4** Provide thermometer wells and pressure gauge connections for all piping to and from the unit and located as near the unit as practical.
- 3.5** Provide necessary air vent valves so that gas vapor may be purged to prevent binding. If steam is the heating media a vacuum breaker in a steam spacer or in piping close to the steam spacer is desirable to minimize the effect of water hammer.
- 3.6** The tank shall have internal supports for the tank heater that give full support under the tube supports for the bundle, keep the bundle square to the tank collar and allow for differential thermal expansion of the tubes. Typical installations are shown below. Fig. A is a horizontal tank installation and Fig. B is a vertical tank installation.

FIG. A - Horizontal tank

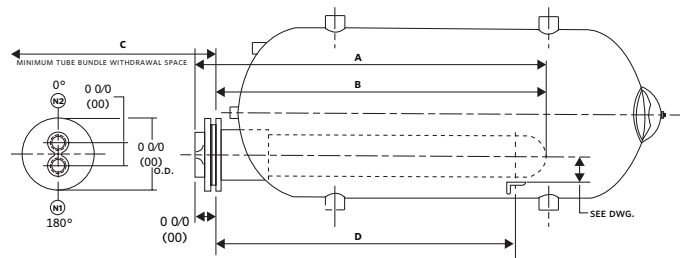
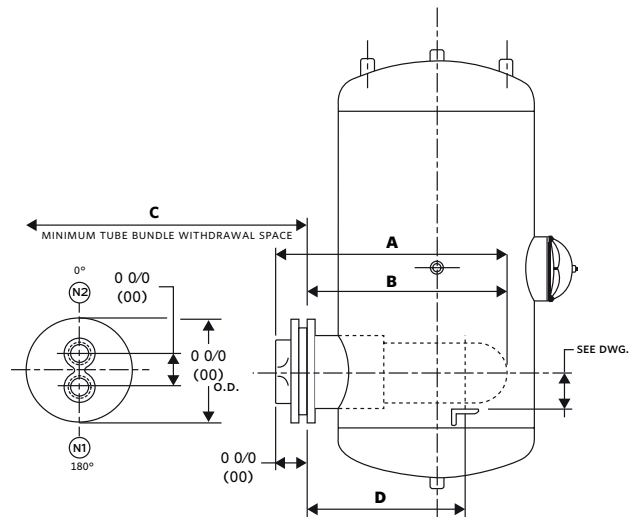


FIG. B - Vertical tank



3.7 Prior to installing the tank heater the Armstrong provided tank collar or mating flange shall be welded to the tank at the appropriate position and accordance with applicable

safety codes. The bolt holes shall be aligned so when the head is installed the inlet and outlet connections are in the proper location. The tank collar shall be installed so tank heater remains square when the final installation is complete.

- 3.8** Set the tube bundle level and square to the tank collar and inlet piping. Bundle must be supported at all times by at least two points. All support must be from the tube supports, tube sheet or an appropriate sling around the tube bundle. During the insertion process inside the tank, the bundle can be supported by slinging from above or temporary support below depending on the tank design and accessibility.

WARNING



Use caution when handling the tube bundle to avoid damaging it. See Paragraph 5.2.

- 3.9** Install gaskets and head in accordance with Paragraph 5.4.
3.10 Install and tighten bolts in accordance with Paragraph 5.5.
3.11 Hydrostatically test unit in accordance with pressures listed on the certified nameplate.

WARNING



When pressure testing do not exceed limits specified on nameplate as leaks or damage can occur.

4.0 OPERATING INSTRUCTIONS

- 4.1 Start-up:** When replacing a unit in operation, open the vent connections and fill the tank with the cold fluid only. Be sure the tank is entirely filled with cold fluid before closing the vents. The heating media should then be introduced gradually until all passages are filled with the liquid or water vapor, as the case may be. Then close the vents and slowly bring the tank up to temperature.
- 4.2 Re-tighten bolts:** Heat exchangers are hydrostatically tested in accordance with **code** requirements and are certified as satisfactory by inspection agencies agreed upon by the manufacturer and the purchaser. However, normal yielding of gaskets will occur in the interval between hydrostatic testing in the manufacturer's shop and installation at the job site. Therefore, all external bolted joints should be properly re-tightened after installation and again after the exchanger has been heated, to prevent blowing out of gaskets.

WARNING:



Design and operating conditions:

Do not operate equipment under pressure and temperatures in excess of those indicated on the nameplate.

- 4.3 Shutting down:** In shutting down, flow of heating medium should be shut off first. If it is necessary to stop circulation of cold fluid, the circulation of the heating medium should be stopped also, through bypassing or other means.

When shutting down the system, all fluids should be completely drained to minimize the possibility of freezing and corrosion. To guard against water hammer, condensate should be drained from steam heaters when starting up, as well as shutting down.

To minimize water retention after drainage, the tube side of boiler water fired tank heaters may require blowing out with air.

- 4.4 Water hammer:** In the case of steam as the heating medium, the steam trap should be manually by passed until the heat exchanger is switched to manual control. Costly damages can result if care is not exercised in the start up of a heat exchanger. Water hammer often results when a large quantity of steam is allowed to condense rapidly in an enclosure. Thin walled tubes are very vulnerable. Copper tubing is used extensively and is a relatively soft metal.

Water hammer is a type of implosion effect particularly pronounced when low pressure steam is used, one reason being the high volume ratio of steam and water at low pressure. For instance: Volume of 1 lb. of steam at 5 psig is about 20 Cu. Ft. Volume of 1 lb. of water (condensate) is 0.0168 cu. ft.

This volume ratio of 1200 to 1 gives us some idea of how the tremendous hammer effect may be produced when there is enough transfer surface present to remove the latent heat of vaporization rapidly. Slugs of water are hurled about in the vacuum created by the condensation, and one can visualize the damage possible to the fragile tubes.

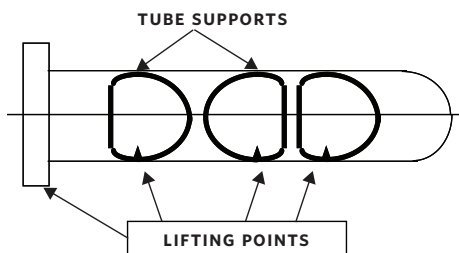
5.0 MAINTAINING THE TANK HEATER

WARNING:



Follow carefully the procedure recommended for operation. Quick start up and shut down without proper condensate removal is a major cause of heat exchanger damage.

- 5.1 Frequently, and at regular intervals, observe the interior and exterior condition of all tubes and keep them clean. Neglect in keeping all tubes clean may result in complete stoppage of flow through some tubes, causing overheating of these tubes. The overheating may result in severe expansion strains and leaking tube joints.
- 5.2 When removing tube bundles from tanks for inspection or cleaning, care should be taken to see that improper handling does not damage them. Tube bundles are often of great weight, yet the tubes are small and of relatively thin metal. The tube bundle should therefore never be supported on the tubes but should rest on parts designed to carry it, i.e. on the tube sheets or tube supports. An appropriate sling that wraps around the tube bundle and distributes the weight across a broad area may also be used.



WARNING:



Do not handle the tube bundles with hooks or other tools which may damage the tubes

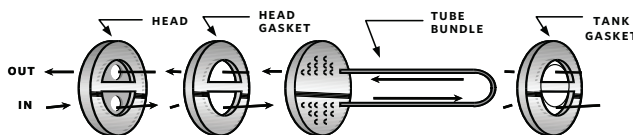
The tube bundles should be moved about on cradles or skids. Horizontal tube bundles should be lifted by means of suitable slings. Tube supports can be easily damaged by dragging a bundle over a rough surface.

When installing or removing tube bundles from an existing Tank, suitable slings can be placed through the top connection and wrapped around the tube bundle.

- 5.3 **Tube rolling:** To tighten a loose tube joint, use a suitable roller expander. Do not roll tubes that are not leaking as this needlessly thins the tube wall, and work hardens the metal which makes it brittle. Tubes are rolled in our fac-

tory by means of roller type expanders, and the amount of expansion is controlled by means of a torquing device for uniformity and positive sealing. Do not over roll the tubes as this would permanently damage the tubesheet.

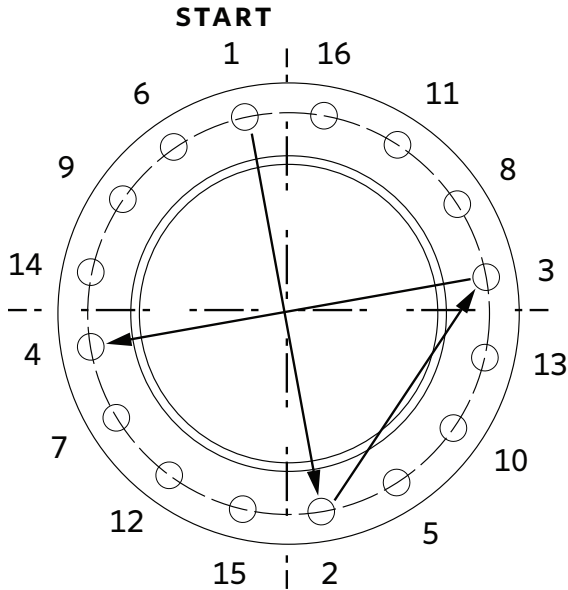
- 5.4 **Gasket replacement:** Gaskets and gasket faces should be thoroughly clean and should be free of scratches and other defects. Gaskets should be accurately positioned before retightening the bolts. It is recommended when a tank heater is dismantled for any reason, it be reassembled with new gaskets. Composition gaskets become dried out and brittle so they do not always provide an effective seal when reused. Metal or metal jacketed gaskets, when compressed initially, flow to match their contact surfaces. In so doing, they are work hardened, and when reused, may provide an imperfect seal. Reused metallic gaskets could result in deformation or damage to the gasket contact faces of the exchanger.



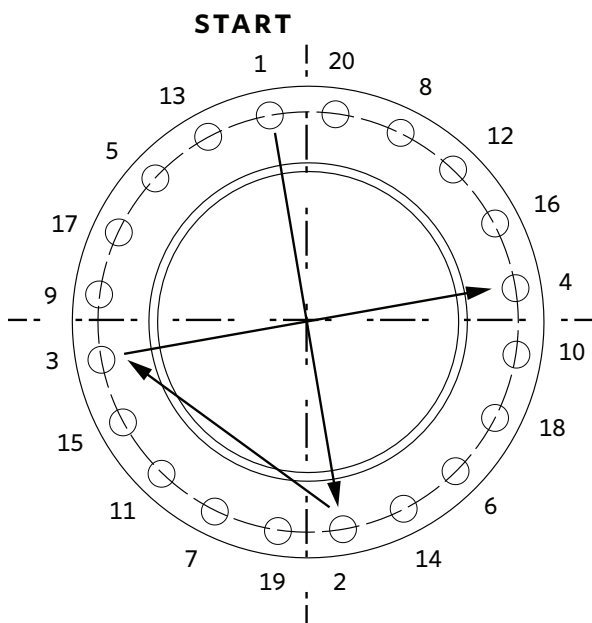
- 5.5 **Bolting:** It is important that all bolted joints be tightened uniformly and in a diametrically staggered pattern, as illustrated in the diagram, except for special high pressure closures when the instructions of the manufacturer should be followed.

NOMINAL BOLT DIAMETER	STD. MACHINE BOLTS A-307 TORQUE IN FT/LB	HIGH TENSILE BOLTS A-326 OR A193-B7 TORQUE IN FT/LB
1/2	15	40
5/8	30	75
3/4	50	125
7/8	80	200
1	125	310
1 1/8	200	450
1 1/4	276-5	650
1 3/8	-	850
1 5/8	-	1000
1 1/2	-	1400
1 3/4	-	1900
1 7/8	-	2500
8	-	2800

16 BOLTS



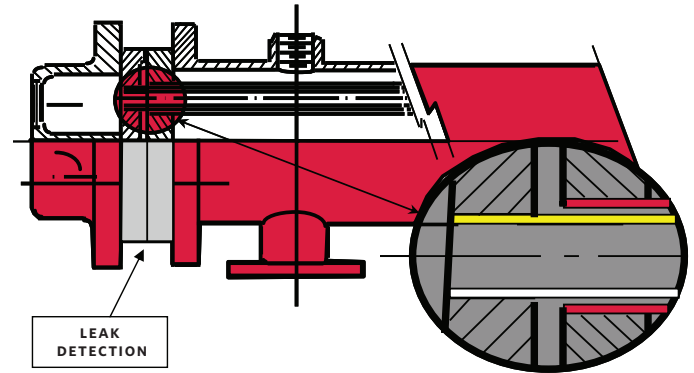
20 BOLTS



Torque required to tighten new flange ring bolts.

Parts of the above excerpts from the Standards of the Tubular Exchanger Manufacturers Association.

5.6 When installing a tank heater with double wall tubes and double tubesheets be certain that the leak detection area is visible from the outside and that any leak or drip from this area is properly contained.



6.0 CLEANING THE EXCHANGER

Provide convenient means as necessary for cleaning tank heater at regular intervals to guarantee continued performance.

Removal of various scales and foreign material by chemical cleaning is now being extensively practiced. Certain qualified organizations will check the nature of the deposits to be removed, furnish proper acid solutions containing inhibitors, and provide equipment and personnel for a complete apparatus and piping cleaning job.

In areas of extremely hard water that cannot be softened it is suggested that a routine cleaning schedule be established to avoid disruption of service at an unexpected time.

7.0 SPARE AND REPLACEMENT PARTS

Spare or replacement parts may be obtained for Armstrong heat exchangers by reference to the part required and to the serial number of the exchanger appearing on the nameplate. Consideration should be given to stocking parts for exchangers used in process as inconvenient shutdowns may be necessary until receipt of parts. Since some gaskets are made to order with a long lead time, it may be desirable to have them on hand.

In situations where a shut down for cleaning and/or repairs could not be conveniently arranged, a standby tank heater connected in parallel, or a complete replacement tube bundle on hand for emergency is recommended.

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