MAINTENANCE

1. Do not open heads until all pressure is off equipment, the unit drained of all fluids, and the equipment surfaces cooled to ambient temperature.
2. Do not blow out heat exchangers with air when operating fluids are of a flammable or otherwise hazardous nature.

WARNING: Proper precautions must be taken (special clothing, equipment, etc.) to protect personnel from injury due to escaping fluids or hot heat exchanger surfaces.

3. Provide convenient means for frequently cleaning heat exchangers as suggested below:
   a. Circulating hot wash oil or light distillate through tubes or shell at good velocity will effectually remove sludge or other similar soft deposits.
   b. Soft salt deposits may be washed out by circulating hot fresh water.
   c. Some cleaning compounds on the market, such as "Oakite" may be used to advantage for removing sludge or coke, provided hot wash oil or water, as described above, does not give satisfactory results.
   d. If the above methods are ineffective for removal of hard scale, a mechanical means may be used.

WARNING: Care must be exercised when handling certain fluids. Follow manufacturers instructions. Use eye and skin protection. Wear a respirator when required.

4. Do not attempt to clean tubes by blowing steam through individual tubes. This overheats the tube and results in tube expansion strains and sometimes leaking tubes.
5. Frequently and at regular intervals, observe interior and exterior condition of all tubes and keep them clean. Frequency of cleaning should be according to scale build-up.

CAUTION: Neglect in keeping all tubes clean may result in complete stoppage of flow through some tubes with consequent overheating of these tubes, resulting in severe expansion strains, leaking tube joints, and damage to the heat exchanger.

6. Exchangers subject to fouling or scaling should be cleaned periodically. A light sludge or scale coating on the tube greatly reduces it effectiveness. A marked increase in pressure drop and/or reduction in performance usually indicates cleaning is necessary, if the unit has been checked for air or vapor binding and this has been found not to be the cause. Since the difficulty of cleaning increases rapidly as the scale thickens or deposits increase, the interval between cleanings should not be excessive.
7. At times, it may be necessary to locate a ruptured tube or a leaking joint between the tubes and the tubesheet of a single wall heat exchanger. The following procedure is recommended.
   a. Following the procedures previously mentioned for front head removal, remove the head and replace it with a companion flange that mates with the shell body flange. Replace the nuts and bolts/studs.
   b. Pressurize the shellside of the heat exchanger with a cold fluid, preferably water.
   c. Observe all tube joints and tube ends for indication of test fluid leakage.
   d. To tighten a leaking tube joint, use a suitable parallel roller tube expander.

CAUTION: When tightening leaking tube joints:

1. Do not roll tubes beyond the back face of the tubesheet. Maximum rolling depth should be the tubesheet thickness minus 1/8".

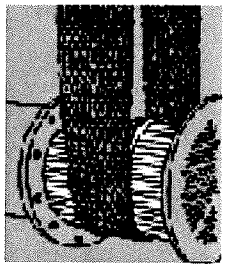
2. Do not re-roll tubes that are not leaking since this will thin the tube wall.

The result of either of the above conditions can lead to failure of the tube and a leaking bundle.

   e. If an emergency repair of a tube is required, use suitable tube plugs to seal off both ends of the U-bend tube. Some loss of performance will result until a new replacement tube bundle is obtained. Consult your local ITT Bell & Gossett Representative for proper replacement of the bundle.

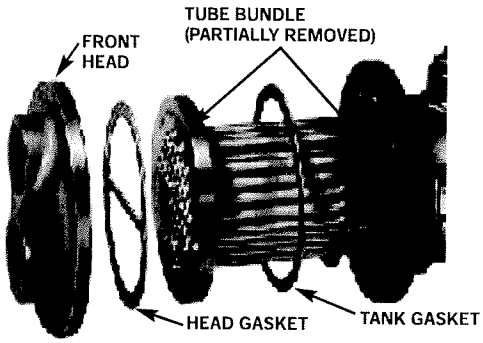
CAUTION: Field repair of Diamondback™ double wall heat exchangers is not recommended. Re-rolling of the tube joints may result in the closing of the leak detector flow paths between the two tube walls preventing the heat exchanger from providing a positive indication of potential cross contamination.

8. Tube bundle removal:
   a. During bundle removal, the dead weight of bundle should never be supported on individual tubes. Rest the bundle on the tube sheet, support plates, or wood blocks cut to fit periphery of the bundle.
   b. Tube bundles may be raised using slings formed by bending light plates into a "U" form and attaching lifting lugs to the ends of the sheets. Baffles can be easily bent and damaged if dragged over rough surfaces.

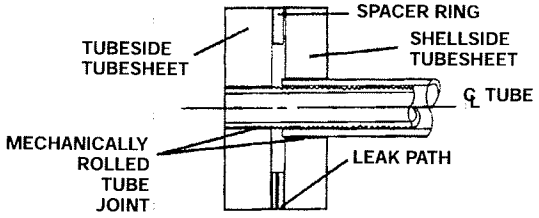


CAUTION: When cleaning a tube bundle, tubes should not be hammered on with any metallic tool and, in case it is necessary to use scrapers, care should be exercised that the scraper is not sharp enough to cut the metal of the tubes.

9. Before reinserting the tube bundle into the shell or collar of a tank, place the ring/tank gasket over the end of the tube bundle and bring forward to the backside of the tubesheet.



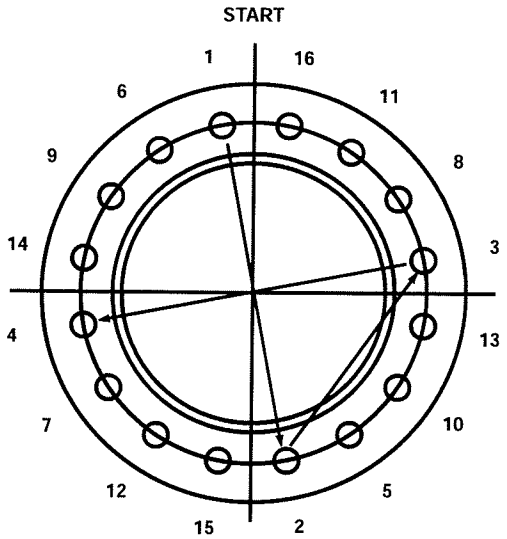
10. The tube bundle can be replaced using the tools and reverse procedure given for bundle removal.
11. When installing a Diamondback™ double-wall tube bundle, make sure the leak path drain hole in the spacer ring between the two tubesheets is in the lowest position of the tubesheet circle.



DOUBLE-WALL TUBE JOINT

12. When replacing the heads, use a torque wrench to tighten the bolts/studs and nuts. Use the following chart as a guide. All torque values apply to well lubricated nut bearing surfaces.

    All bolted joints should be tightened uniformally and in a diametrically staggered pattern as illustrated below:



⚠ WARNING: It is extremely important to follow a proper tightening sequence. If it is not followed, the flanges can become cocked and a leak will result. When tightening flanges with spiral wound gaskets, if cocking occurs, the result can be deformation and non-repairable damage to the gaskets in addition to a resultant leak. Any gasket leak can result in potential injury to adjacent personnel.

TIGHTENING TORQUES

COMPRESSED FIBER GASKETS			
Bolt Dia.	Recommended Torque ft-lbs	Torque Increment	Max. Torque
1/2"	40	5	60
5/8"	80	5	120

SPIRAL WOUND GASKETS			
Bolt/Stud Dia.	Recommended Torque ft-lbs	Torque Increment	Max. Torque
1/2"	40	5	60
5/8"	80	5	120
3/4"	120	5	200
7/8"	200	10	320
1"	300	10	490
1 1/8"	450	10	710
1 1/4"	600	10	1000

Tightening tip: It is essential that the installer follows the gasket manufacturer's installation guidelines when installing gaskets. Metallic gaskets, such as the spiral wound gaskets, usually have special installation instructions. One of these instructions includes a special procedure for tightening bolts/studs when installing new gaskets. The procedure recommends that the bolts/studs be torqued in four stages.

a. Following the staggered tightening pattern, the bolts/studs should be torqued to 1/3 of the recommended tightening torque.

b. Same as a, the bolts/studs should be torqued to 2/3 of the recommended tightening torque.

c. Same as a, the bolts/studs should be torqued to the recommmended torque valve shown in the above chart.

d. Following the staggered tightening pattern the bolts/studs torques should be checked for equilibrium since the tightening of one bolt/stud can relieve the stress on adjacent bolts/studs.

If after following the gasket manufacturer's recommended tightening procedure a leak still occurs, the bolts/studs should be tightened in the torque increments shown until the leak stops. The staggered tightening pattern is still followed.

NOTE: When using spiral wound gaskets, both the head and the shell/tank gaskets must be spiral wound. You cannot mix one spiral wound and one compressed fiber gasket on a heat exchanger.

13. Refer to "OPERATION" steps 5 and 6 regarding bolt retightening after start-up.
14. Where frequent disassembly of the heat exchanger is encountered, the use of new bolting in conformance with dimension and ASTM specifications of the original design is recommended.