# INSTALLATION

 When installing the heat exchanger provide sufficient space for U-tube and floating tube bundle removal at the stationary end. In fixed tubesheet units allow sufficient space at one end to permit removal and replacement of tube(s) and at the other end for removal of the bonnet or channel.

# FOUNDATIONS

 Foundations must be adequate so that exchangers will not settle and cause excessive piping strains.

# BOLTING

 Loosen foundation bolts at one end of unit to permit free expansion of shells. Obround or oversize boltholes in one support are provided for this purpose.

## LEVELING

 Set horizontal units level and vertical units plumb so that piping connections are not forced.

## CLEANLINESS AND CLEANING PROVISIONS

 Remove all protective plugs and shipping covers prior to installation and inspect all openings for foreign material.

 Clean the entire system prior to commencing operation. In some instances, the use of strainers in the piping may be necessary.

 Periodic cleaning of the shell and tubesides of the exchanger is necessary to remove sediment and fouling deposits that collect on and in the tubes. These deposits will inhibit heat transfer through the tube wall and will decrease the efficiency of the exchanger.

 Cleaning of heat exchangers can be accomplished by either chemical or mechanical means. The type of cleaning method to be utilized depends on the experience of the plant operator. Some typical cleaning procedures involve circulating hot fresh water through the unit to remove salt deposits. Circulating commercial cleaning agents or chemical solvents is another option. Hard deposits can be removed with high-pressure water jet cleaning or mechanical means such as scrapers or rotary brushes.

 Precautions in cleaning

 Do not hammer the tubes or use sharp edged scrapers which can cut the tubes. Ensure that chemical cleaning solutions are compatible with the heat exchanger materials of construction. Do not blow steam through the tubes as this may cause thermal strain, deformation and loosening of the tube-tubesheet joint. Thoroughly flush out all chemical cleaning solution before operating the exchanger.

# OPERATION

 Do not operate the exchanger at pressure and temperature conditions which exceed those shown on the nameplate.

# START UP

 Before placing the unit in operation be sure the shell and tubesides are cleaned and properly vented. Check piping against the assembly drawing and verify control and safety valves are operating properly.

 To begin operation, open the vent connection and begin to circulate the cold medium only. When all of the passages are completely filled close the vent. Slowly introduce the hot medium, allowing time for the unit to vent and allowing time for the exchanger to adjust to the temperature differences. Close vents and continue increasing flows until operating conditions are met. AVOID temperature shocks!! Gradually bring unit up to temperature. Do not suddenly introduce the hot fluid when the unit is cold nor cold fluid when the unit is hot.

 Check all pipe connections and bolted joints for leaks. Our units are hydrostatically tested prior to leaving our factory, however gaskets will relax in the interval between testing and installation at the jobsite. All external bolted joints should be properly retightened after installation and again after the unit has been brought up to operating conditions.

# SHUT DOWN

 Gradually stop the flow of the hot medium, then stop the flow of the cold medium. If it is necessary to stop the flow of the cold medium, then the flow of the hot medium must also be stopped.

 When shutting the system down, drain all fluids to minimize the possibility of freezing or corrosion. To prevent water hammer, steam condensate should be drained during start up or shut down. The tubeside of water-cooled exchangers should be blown out with air after drainage, to minimize water retention in the tubeside.

# MAINTENANCE

 If it is necessary to remove the tube bundle from removable bundle type heat exchangers, be sure the shell and tubeside pressures have been relieved and the unit is completely drained. Remove the channels/bonnets, floating head covers, split rings, packing glands or retaining rings when applicable. The tubesheet may have to be pried loose from the shell flange when starting the removal operation if pulling eyes or lifting lugs are not available. Care must be taken so as not to damage the gasket-sealing surface.

When the bundle is withdrawn, care should be taken not to support the bundle on its tubes, but it should be rested on parts designed to carry it, i.e.: tubesheets, baffles or support plates. Large bundles may require pulling devices to remove them from the shell. Floating tubesheet bundles can be started by jacking against a soft block of wood placed on the floating tubesheet. When the bundle begins to move, a pulling device should be used to pull the bundle out from the fixed end carefully distributing the pulling force over the tubesheet perimeter. Care must be taken to prevent the bundle from sagging which could result in tube damage. Protect all machined surfaces and packed ends when the bundle is removed from the shell. It is recommended that wide fabric slings be used when handling the bundles with lifting devices to prevent damage to thin walled tubes.

When individual tube leaks occur due to a loose tube joint, they can be re-rolled using a suitable roller type tube expander. Do not over roll tubes or roll tubes not leaking, as this will thin out and work harden the tube wall.

If rolling does not stop the leak as in the case of a puncture or hole in the tube wall, the tube can be plugged with fiber or metal tube plugs compatible with the tube material and that can be supplied by Rubicon. If the quantity of tubes plugged results in diminished heat transfer, the tubes should be replaced.

To remove and replace tubes, the following procedure is suggested:

1. With a cut-off tool face off the tube ends flush with the tube sheet.
2. Use a tube wall reducing drill to thin the tubes out at the tubesheets, then drive the tube out from the tubesheet using a tube knockout tool.
3. Remove all dirt and chips from the old tube material out of the tube hole and thoroughly clean.
4. Clean and insert the new tube and roll the tube into the tubesheet, careful not to over roll the tube which will tend to work harden the material or loosen adjacent tubes.

Gasket Replacement

 Gasket and gasket surfaces should be thoroughly cleaned and should be free of scratches and other defects. Properly position gaskets before attempting to retighten bolts.

NOTE: Do not change gasket material without checking with the factory as flange and tubesheet

design calculations are dependent upon gasket selection, i.e.: type, thickness, material, dimensions.

 It is recommended that when a heat exchanger is disassembled, it be reassembled with new gaskets to prevent future leaks and/or damage to gasket seating surfaces. Any leak at a gasketed joint should be remedied as it may result in damage to the gasket surfaces or cause potential safety issues.

 Metal or metal-jacketed gaskets when used with a tongue and groove joint with or without a nubbin should be installed so that the tongue or tongue with nubbin bears on the seamless side of the gasket.

# REASSEMBLY AND TESTING

 Clean all gasket surfaces and use new gaskets of the same material, thickness and dimensions originally supplied.

 Tighten bolts uniformly in a diametrically staggered pattern only enough to produce a leak proof seal without overstressing bolting or flanges. If bolting is to be replaced, use the same alloy and grade as originally supplied.

 Hydrostatically test the unit with water not exceeding the test pressure indicated on the nameplate. Do not pressurize the unit with air or gas until it has been tested with liquid and never at a pressure exceeding the test pressure on the nameplate.

The unit should be inspected regularly for evidence of corrosion especially around the flange connections and bolted joints.

 With proper operation within the design parameters of the unit and with periodic inspection and maintenance the heat exchanger will perform efficiently.