



INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE.

Model FLP

Straight Tube Removable Bundle Heat Exchangers

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Introduction and Safety

Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance



CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

Safety



WARNING:

- The operator must be aware of safety precautions to prevent physical injury.
 - Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment. This includes any modification to the equipment or use of parts not provided by Xylem. If there is a question regarding the intended use of the equipment, please contact a Xylem representative before proceeding.
 - Do not change the service application without the approval of an authorized Xylem representative.
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CAUTION:

You must observe the instructions contained in this manual. Failure to do so could result in physical injury, damage, or delays.

Safety terminology and symbols

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:

- Personal accidents and health problems
- Damage to the product
- Product malfunction

Hazard levels



DANGER:

A hazardous situation which, if not avoided, will result in death or serious injury.



WARNING:

A hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION:

A hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE:

- A potential situation which, if not avoided, could result in undesirable conditions.
 - A practice not related to personal injury.
-

Hazard categories

Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

These are examples of other categories that can occur. They fall under the ordinary hazard levels and may use complementing symbols:

- Crush hazard
- Cutting hazard
- Arc flash hazard

User safety

General safety rules

These safety rules apply:

- Always keep the work area clean.
- Pay attention to the risks presented by gas and vapors in the work area.
- Avoid all electrical dangers. Pay attention to the risks of electric shock or arc flash hazards.
- Always bear in mind the risk of drowning, electrical accidents, and burn injuries.

User safety



This product can expose you to Lead, which is known to the state of California to cause cancer and birth defects and other reproductive harm. For more info go to: www.P65Warnings.ca.gov

Safety equipment

Use safety equipment according to the company regulations. Use this safety equipment within the work area:

- Hard hat
- Safety goggles, preferably with side shields
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection
- First-aid kit
- Safety devices

NOTICE:

Never operate a unit unless safety devices are installed. Also see specific information about safety devices in other chapters of this manual.

Product Warranty

Coverage

Xylem undertakes to remedy defects in products from Xylem under these conditions: The faults are due to defects in design, materials, or workmanship.

- The faults are reported to a local sales and service representative within the warranty period.
- The product is used only under the conditions that are described in this manual.
- The monitoring equipment that is incorporated in the product is correctly connected and in use.
- All service and repair work that is done by Xylem authorized personnel.
- Genuine Xylem parts are used.
- Only Ex-approved spare parts and accessories that are authorized by an Ex-approved Xylem representative are used in Ex-approved products.

Product Warranty

Limitations

The warranty does not cover defects that are caused by these situations:

- Deficient maintenance
- Improper installation
- Modifications or changes to the product and installation that are made without consulting a Xylem authorized representative
- Incorrectly executed repair work
- Normal wear and tear

Xylem assumes no liability for these situations:

- Bodily injuries
- Material damages
- Economic losses

Warranty claim

Xylem products are high-quality products with expected reliable operation and long life. However, should the need for a warranty claim arise, contact your local sales and service representative.

Product Description

General description

Description

Standard Xchange model FLP heat exchangers are of the shell and straight tube type. Tube bundles are removable and tubes are easily cleaned both inside and outside. Tube ends are roller expanded into both the front and rear tubesheets. Floating tubesheet construction within the rear head compensates for expansion or contraction of the entire tube bundle regardless of temperature variations. Baffles are stamped to close tolerances, minimizing the slippage of liquids or vapors between the baffles and shell wall.

Code Compliance

Heat exchangers are designed according to ASME Section VIII Division 1 requirements and include an ASME U-stamp.

Storage

Xylem heat exchangers are protected against the elements during shipment. If they cannot be installed and put into operation immediately upon receipt at the jobsite, certain precautions are necessary to prevent deterioration during storage. Responsibility for integrity of the heat exchangers must be assumed by the user. Xylem will not be responsible for damage, corrosion or other deterioration of heat exchanger equipment during transit and storage.

Good storage practices are important, considering the high costs of repair or replacement, and the possible delays for items which require long lead times for manufacture. The following suggested practices are provided solely as a convenience to the user, who shall make his own decision on whether to use all or any of them.

1. On receipt of the heat exchanger, inspect for shipping damage to all protective covers. If damage is evident, inspect for possible contamination and replace protective covers as required. If damage is extensive, notify the carrier immediately.
2. If the heat exchanger is not to be placed in immediate service, take precautions to prevent rusting or contamination.
3. Heat exchangers for oil service, made of ferrous materials, may be pressure-tested with oil at the factory. However, the residual oil coating on the inside surfaces of the exchanger does not preclude the possibility of rust formation. Upon receipt, fill these exchangers with appropriate oil or coat them with a corrosion prevention compound for storage. These heat exchangers have a large warning decal, indicating that they should be protected with oil.
4. The choice of preservation of interior surfaces during storage for other service applications depends upon your system requirements and economics. Only when included in the original purchase order specifications will specific preservation be incorporated prior to shipment from the factory.
5. Remove any accumulations of dirt, water, ice or snow and wipe dry before moving exchangers into indoor storage. If unit was not filled with oil or other preservative, open drain plugs to remove any accumulated moisture, then reseal. Accumulation of moisture usually indicates rusting has already started and remedial action should be taken.
6. Store under cover in a heated area, if possible. The ideal storage environment for heat exchangers and accessories is indoors, above grade, in a dry, low-humidity atmosphere which is sealed to prevent entry of blowing dust, rain or snow. Maintain temperatures between 70°F and 105°F (wide temperature swings may cause condensation and “sweating” of steel parts). Cover windows to prevent temperature variations caused by sunlight. Provide thermometers and humidity indicators at several points, and maintain atmosphere at 40% relative humidity or lower.

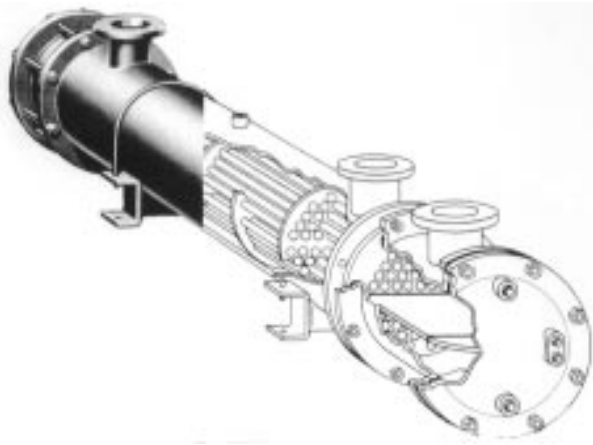
Storage

7. In tropical climates, it may be necessary to use trays of renewable desiccant (such as silica gel), or portable de-humidifiers, to remove moisture from the air in the storage enclosure. Thermostatically controlled portable heaters (vented to outdoors) may be required to maintain even air temperatures inside the enclosure.
8. Inspect heat exchangers and accessories frequently while they are in storage. Start a log to record results of inspections and maintenance performed while units are in storage. A typical log entry should include, for each component, at least the following:
 - a) Date
 - b) Inspector's name
 - c) Identification of unit or item
 - d) Location
 - e) Condition of paint or coating
 - f) Condition of interior
 - g) Is free moisture present?
 - h) Has dirt accumulated?
 - i) Corrective steps taken
9. If paint deterioration begins, as evidenced by discoloration or light rusting, consider touch-up or repainting. If the unit is painted with our standard shop enamel, areas of light rust may be wire brushed and touched-up with any good quality air-drying synthetic enamel. Units painted with special paints (when specified on customers' orders) may require special techniques for touch-up or repair. Obtain specific information from the paint manufacturer. Painted steel units should never be permitted to rust or deteriorate to a point where their strength will be impaired. But a light surface rusting, on steel units which will be re-painted after installation, will not generally cause any harm (See Items 3 and 4 for internal surface preservation).
10. If the internal preservation (Items 3 and 4) appears inadequate during storage, consider additional corrosion prevention measures and more frequent inspections. Interiors coated with rust preventive should be restored to good condition and re-coated promptly if signs of rust occur.



CAUTION: Provide fire extinguishers, fire alarms or telephone to protect building and equipment against fire damage. Be sure that the building and storage practices meet all local, state, and federal fire and safety codes

Installation



1. Provide sufficient clearance at the stationary tube sheet end of the unit to permit removal of tube bundles from shells. On the packed floating tube sheet end, a space of 3 or 4 feet should be provided to permit the removal of the rear head, packing and retainer rings.
2. Provide valves and by-passes in the piping systems so that both the shells and tube bundles may be by-passed to permit cutting out the unit for inspection or repairs.
3. Provide thermometer wells and pressure gauge connections in all piping to and from the unit and located as near the unit as possible.
4. Provide convenient means for frequently cleaning the unit as suggested under "Maintenance."
5. Provide necessary air vent cocks for units so they can be purged to prevent or relieve vapor or gas binding of either the tube or the shell sides.
6. Foundations must be adequate so that exchangers will not settle and cause piping strains. Foundation bolts should be set to allow for setting inaccuracies. In concrete footings, pipe sleeves at least one size larger than bolt diameter slipped over the bolt and cast in place are best for this purpose, as they allow the bolt center to be adjusted after the foundation has set.
7. Loosen foundation bolts at one end of unit to allow free expansion of shells. Oval holes in foundation brackets are provided for this purpose.
8. Set exchangers level and square so that pipe connections may be made without forcing.

Installation

9. Inspect all openings in exchanger for foreign material. Remove all thread protectors and shipping pads just before installing. Do not expose units to the elements with pads or other covers removed from openings since rain water may enter the unit and cause severe damage due to freezing.
10. Be sure the entire system is clean before starting operation to prevent plugging of tubes with sand or refuse. The use of strainers in settling tanks in pipe lines leading to the unit is recommended.
11. Drain connections should not be piped to a common closed manifold.
12. Steam hammer can cause serious damage to the tubes of any heat exchanger. A careful consideration of the following points before an installation is made can prevent costly repairs which may be caused by steam hammer.
 - a) A vacuum breaker and/or vent, should be used in accordance with the type of steam system installed.
 - b) The proper trap for the steam system installed should be used.
 - c) The trap and the condensate return line to the trap should be properly sized for the total capacity of the convertor.
 - d) The trap should be sized for the pressure at the trap, not the inlet pressure to the steam controller.
 - e) The trap must drain into an unpressurized condensate return system. Condensate return lines must not be run at an elevation above the bottom of the heat exchanger. To do so may result in a buildup of the condensate level in the heat exchanger, which could cause water hammer and damaged tubes.



CAUTION: During times of shutdown, volumetric expansion can occur. We recommend the installation of a properly sized relief valve on both sides of the heat exchanger.

Operation

1. When placing a unit in operation, open the vent connections and start to circulate the cold medium only. Be sure that the passages in the exchanger are entirely filled with the cold fluid before closing the vents. The hot medium should then be introduced gradually until all passages are filled with liquid, close vents and slowly bring the unit up to temperature.
2. Start operation gradually. Do not admit hot fluid to the unit suddenly when empty or cold. Do not shock unit with cold fluid when unit is hot.



CAUTION: Fluids must be gradually introduced to the unit. Failure to do so can cause damage to the heat exchanger.

3. In shutting down, flow of hot medium should be shut off first. If it is necessary to stop circulation of cooling medium the circulation of hot medium should also be stopped by bypassing or otherwise.
4. Do not operate equipment under conditions in excess of those specified on nameplate.



WARNING: Failure to operate the heat exchanger within the design pressure and temperature on the nameplate may result in damage to the heat exchanger and potential injury to adjacent personnel.

5. Drain all fluids when shutting down to eliminate possibility of freezing and corrosion. To guard against water hammer, condensate should be drained from steam heaters and similar apparatus both when starting up and when shutting down.
6. In all installations there should be no pulsation of fluids since this causes vibration and strain with resulting leaks.
7. All gasketed joints should be checked after starting for leaks and tightened if necessary.

Maintenance

1. Do not open heads until all pressure is off equipment and the unit is drained.
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.



Illustration No. 1 – The method employed to push tube bundle out of shell.

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 none of the above described methods are effective for the removal of hard scale or coke a mechanical means may be used. The interior of the tubes may be rodded.
 - e) The exterior or shell side of the tubes of a fixed tube sheet heat exchanger can only be cleaned chemically by using a chemical dissolved in water solution. We suggest that the user contact the manufacturer of the cleaning chemical for instructions.

Maintenance



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

4. To clean or inspect inside of tubes, remove channel cover and rear head. On exchangers having bonnet type heads (without channel cover), piping must be disconnected and both heads removed.
5. 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.
6. 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.

7. Exchangers subject to fouling or scaling should be cleaned periodically. A light sludge or scale coating on the tube greatly reduces its effectiveness. Therefore, low-fouling fluids should be used in the shell side of all heat exchangers with non-removable tube bundles. A marked increase in pressure drop and/or reduction in performance usually indicates cleaning is necessary, especially 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.
8. Tube bundle removal:
 - a) During bundle removal, the dead weight of bundle should never be supported on individual tubes since the tubes are small and of relatively thin metal. Rest the bundle on the tube sheet, support plates, or wood blocks cut to fit periphery of the bundle.
 - b) Be sure there is a soft wood filler between ends of tubes and steel bearing plate when pushing bundle out. On smaller bundles of 12" diameter and under, it is permissible to use hard wood block in place of wood filler and steel bearing plates. See Illustration No. 1.
 - c) 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.

Maintenance



CAUTION: Failure to follow the procedures mentioned in steps 8a, b, and c may result in damage to the tubes or tube joints leading to premature failure of the heat exchanger.

9. Removing the tube bundle:

Refer to drawings on pages 17 and 18 giving part names of model FLP.

- a) If the exchanger is difficult to work upon, hoist it into the open after disconnecting piping.
- b) Remove front (A) and rear (F) heads. See Illustration No. 2



Illustration No. 2 – Removing rear head (completely remove front and rear heads).

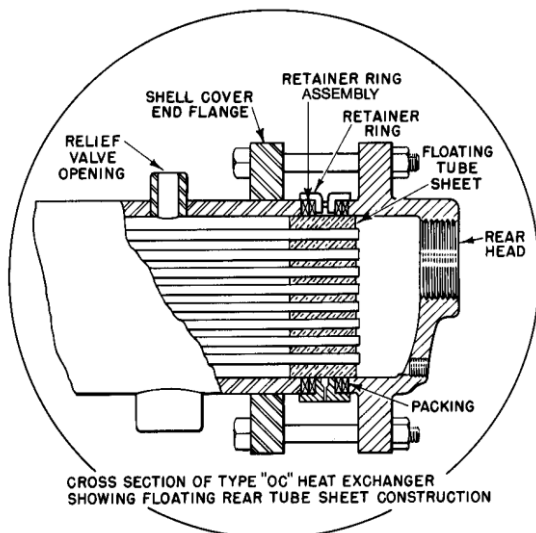


Illustration No. 3 – Cross section of type "FLP" Heat Exchanger showing rear tube sheet construction. (See packing retainer detail)

Maintenance

- c) Remove packing (G) and retaining rings (H). It may be necessary to tap lightly on the retainer rings for starting their removal. More detail of floating tube sheet is given in Illustration No. 3. Illustration No. 4 shows the method of prying retainer rings off. If tapping is necessary, be sure to tap evenly about the circumference so the retainer ring does not bind on the floating tube sheet.
- d) Mark tube sheet (B) and shell flange for later re-alignment. See Illustration No. 5.
- e) Use chain jack. One suitable is Coffing Hoist, Model MA-15 3/4 ton capacity. Place short piece of 4x4 hardwood (oak) between chain of jack and floating tube sheet (E). See Illustration No. 1. Use longer 4x4 pieces as bundle is removed. Support the bundle by lifting or resting on the stationary tube sheet (B), as bundle is pushed out. See Illustration No. 6.



Illustration No. 4 – Prying off retainer rings.

Maintenance

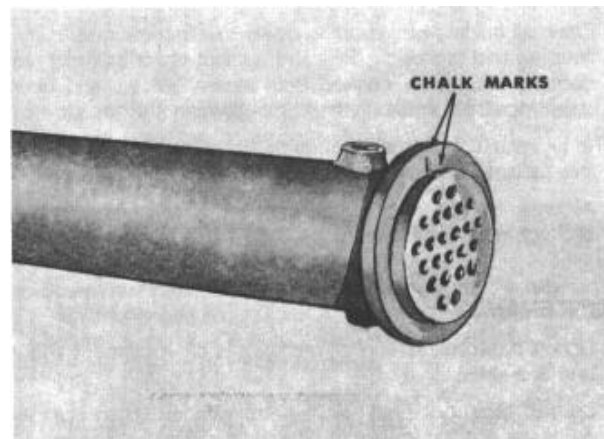


Illustration No. 5 – Marking of tubesheet and shell flange.



Illustration No. 6 – Removal of tube bundle showing method of tube bundle support.

Maintenance

10. Replacing the tube bundle:

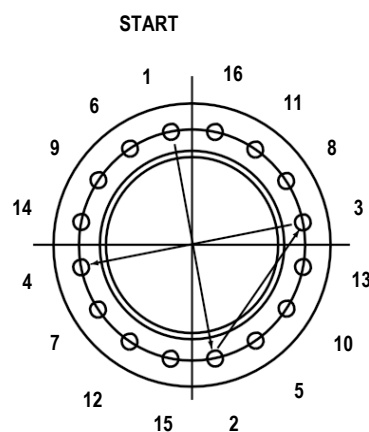
The tube bundles for model FLP (the packed floating tube sheet units) can be replaced using the tools and reverse procedure given for bundle removal. Usually, the bundle FLP can be shoved back into the shell (C) manually without the use of the chain jack.

NOTE: When replacing heads use a torque wrench.

- a. On heads (front heads) with gaskets, tighten 1/2" diameter bolts to 40 ft. lbs. and 5/8" diameter bolts to 80 ft. lbs. If the gasket joint still leaks, tighten in 5 ft. lbs. increments until leak stops.
- b. On heads with packing (rear heads), tighten initially to 50 ft. lbs. If the packing still leaks tighten in 5 ft. lbs. increments until leak stops. Do not exceed 100 ft. lbs. on the bolts for the packed heads.

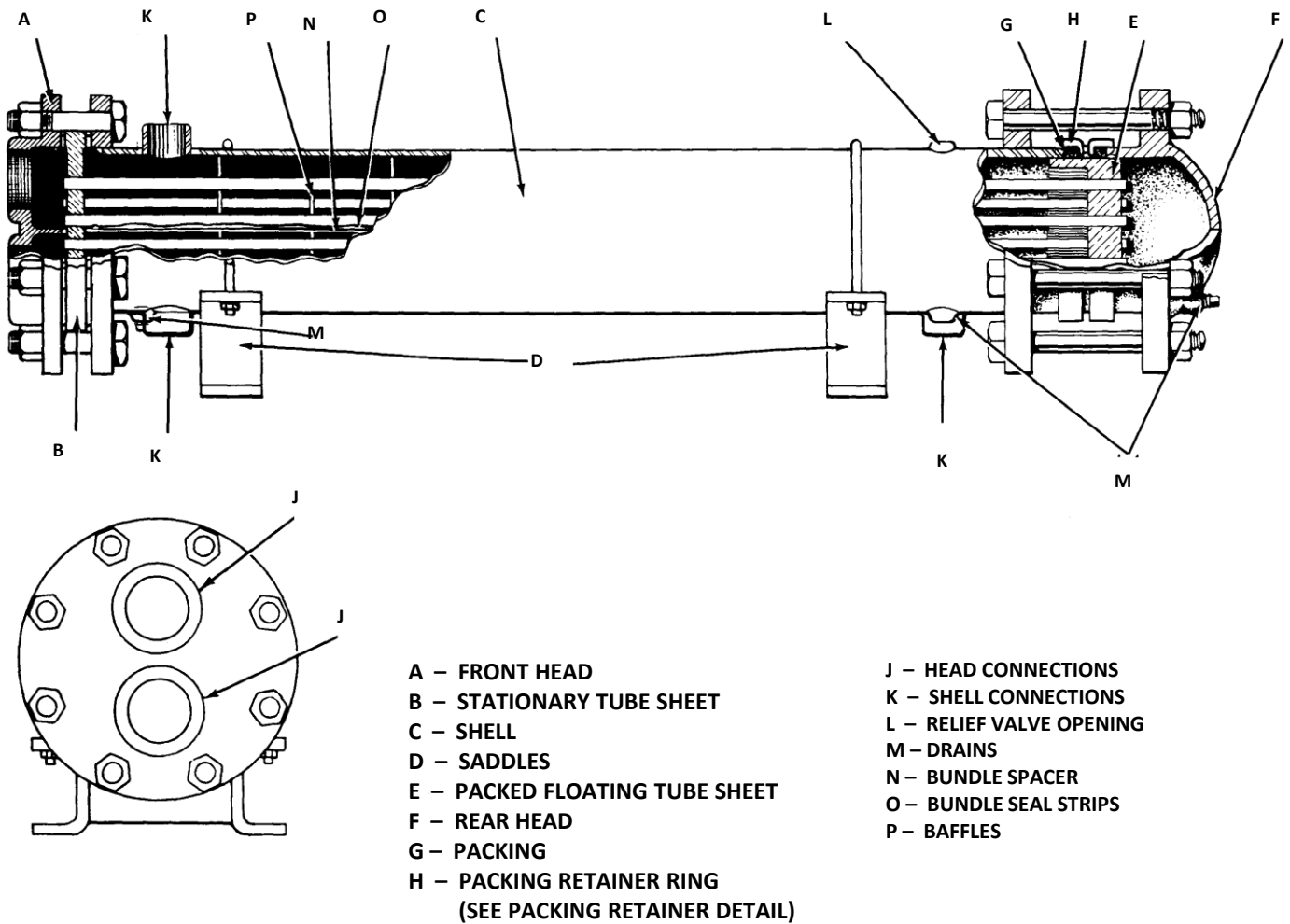
*The above torque values apply to well lubricated nut bearing surfaces.

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



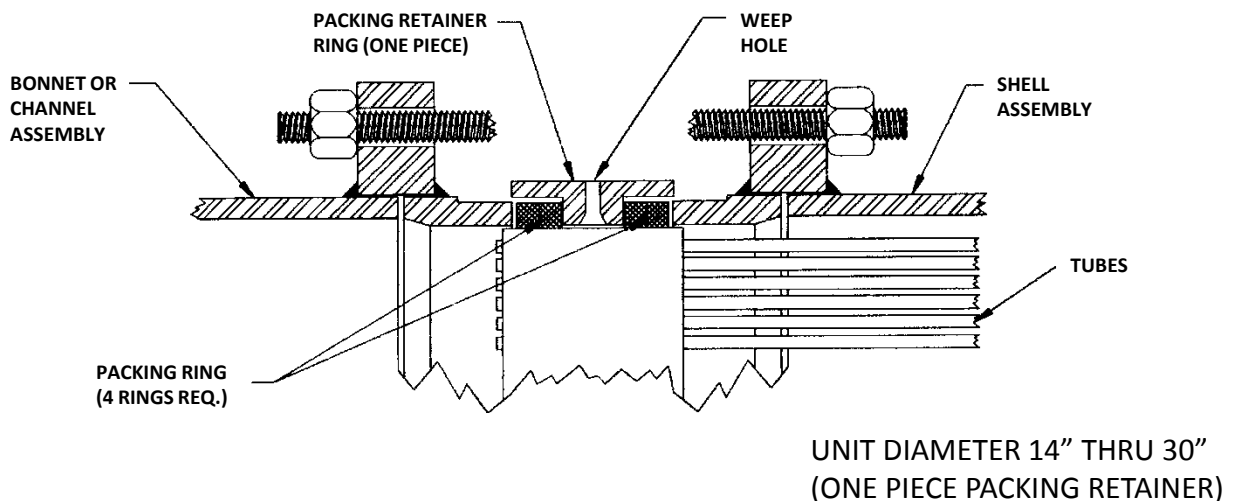
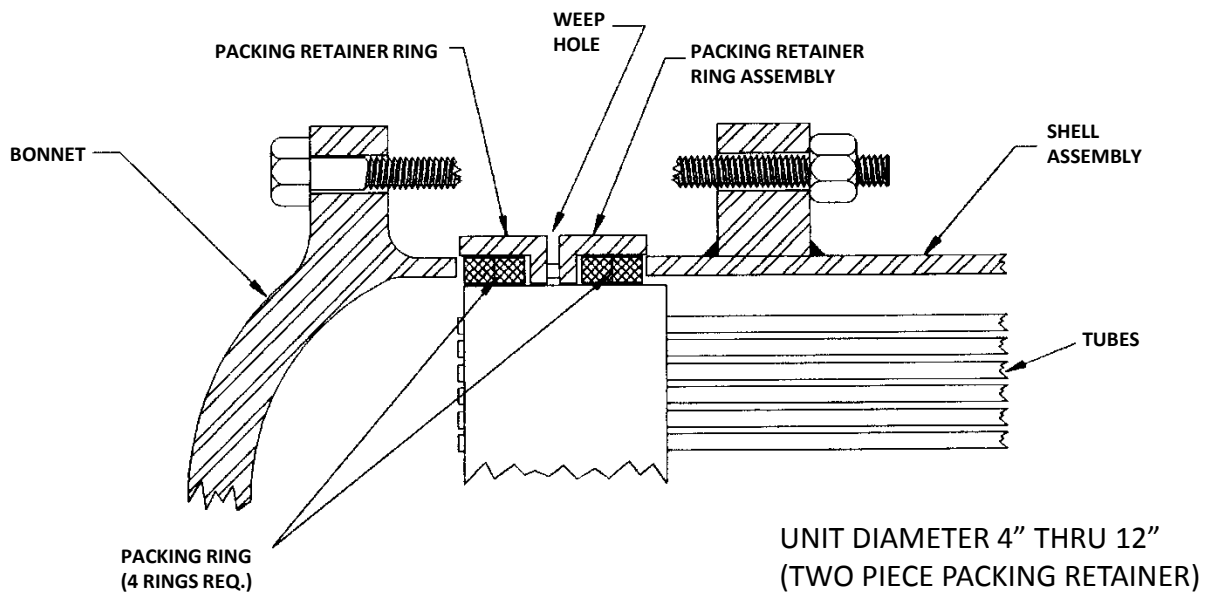
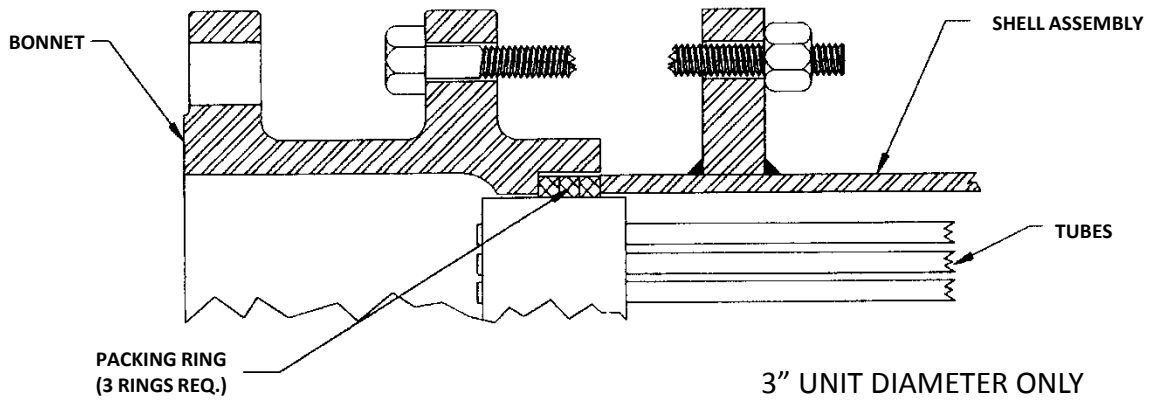
Parts List

MODEL FLP HEAT EXCHANGERS (BONNET HEAD)



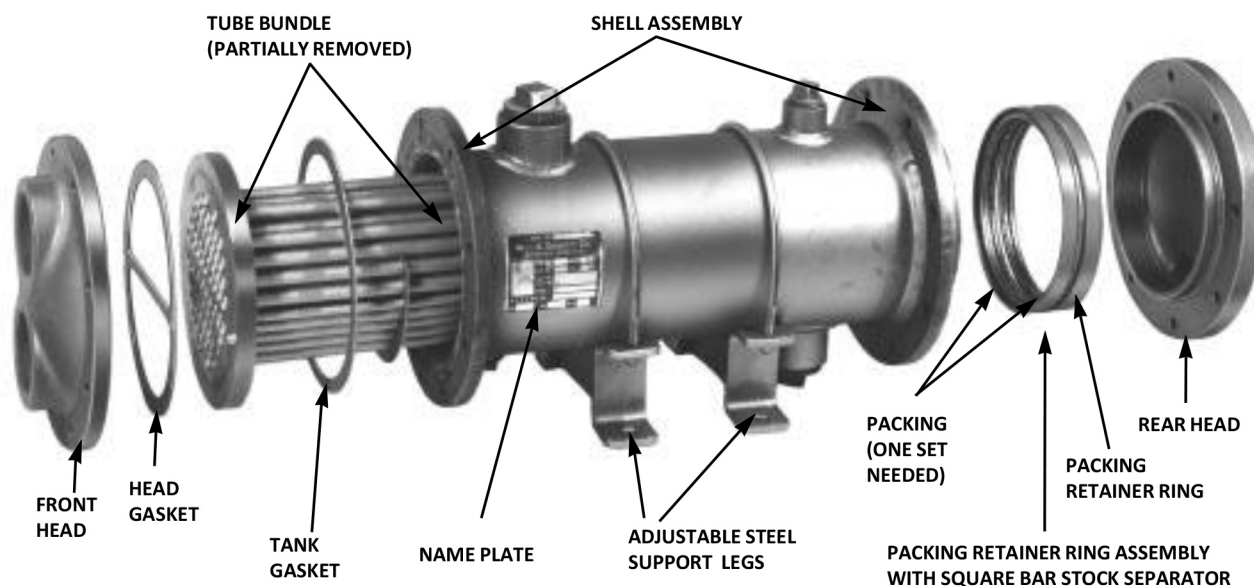
When ordering replacement parts give name of part, plus heat exchanger part number and factory serial number from nameplate

Packing Retainer Detail



Assembly View

Model FLP – Two pass tubeside design



When ordering replacement parts give name of part, plus heat exchanger part number and factory serial number from nameplate