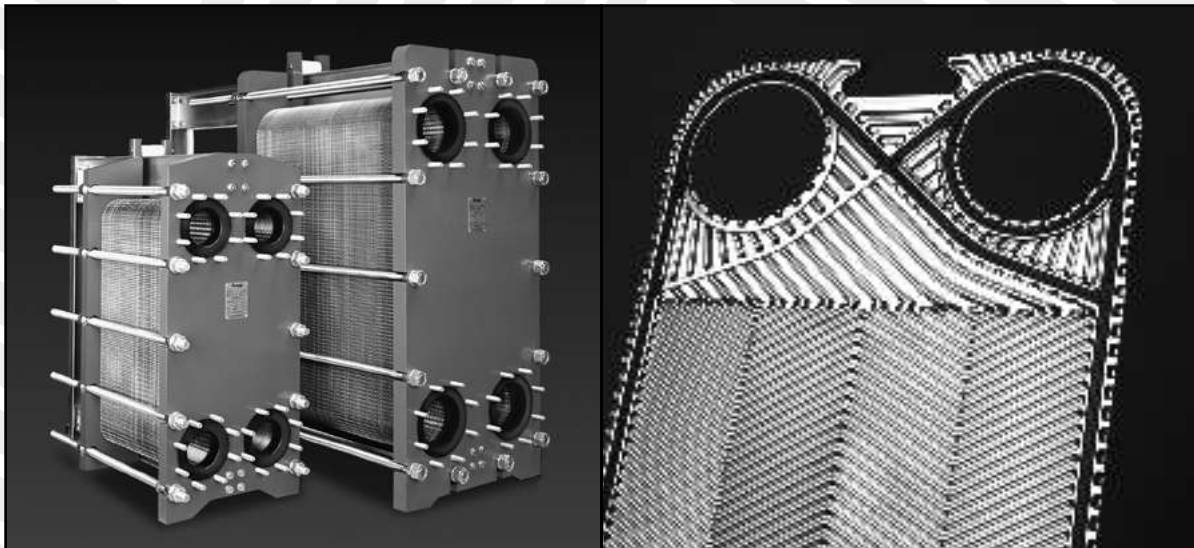


POLARIS

PLATE HEAT EXCHANGERS

Operation and Maintenance Manual



Operation and Maintenance Manual

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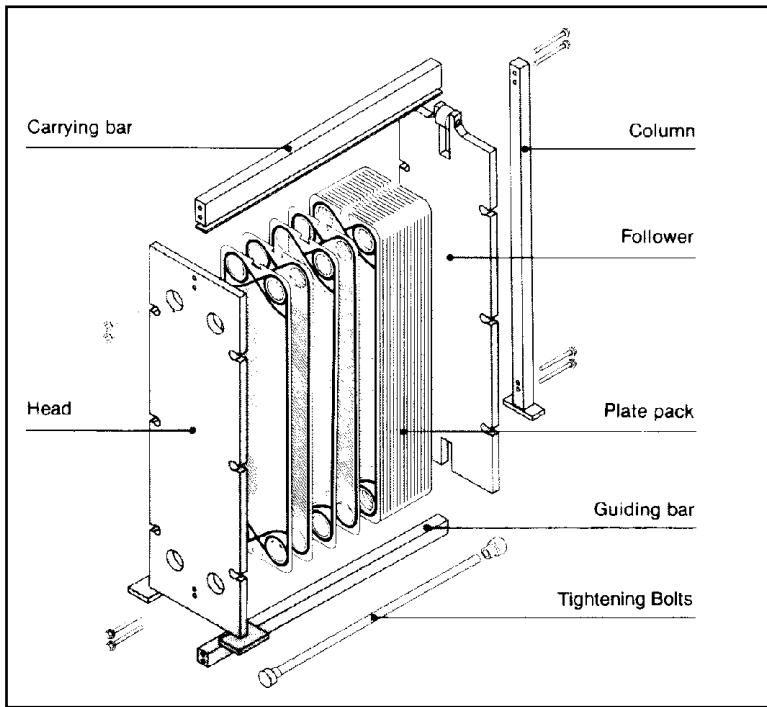


Fig. 1

A.

Plate Heat Exchanger Description

The Polaris Plate Heat Exchanger consists of a FRAME and a PLATE PACK. The frame consists of the following:

(See Fig. 1)

- Fixed Head
- Moveable Follower
- Carrying Bar
- Guiding Bar
- Support Column
- Tightening Bolts

The plate pack is where the heat transfer takes place. It is constructed of a series of embossed, gasketed metal plates. The plates are gasketed so that the hot and cold media flow in a parallel fashion across alternating channels.

(See Fig. 2)

The pack is custom-designed to the exact requirements of the heat transfer application.

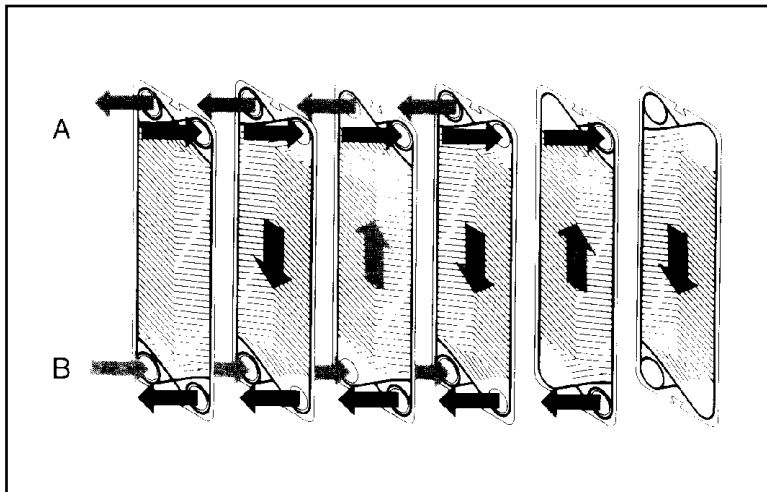


Fig. 2

B.

Construction and Function

The compact design of the Polaris PHE (*Plate Heat Exchanger*) requires only a fraction of the space of a shell-and-tube heat exchanger. Both reduced heat transfer surface and lower hold-up volume mean less operating weight. Plates are manufactured in standard sizes in virtually any material that can be cold worked, such as stainless steels (304 and 316), titanium, Hastelloy[®], and SMO-254. The gaskets serve to seal the fluids in the plate-pack and also to direct the hot and cold media into the proper flow channels. The space between the port gasket and the perimeter gasket is vented to atmosphere. This ensures that the fluids will never intermix, and that any leaks will be to the outside of the heat exchanger.

(See Fig. 3)

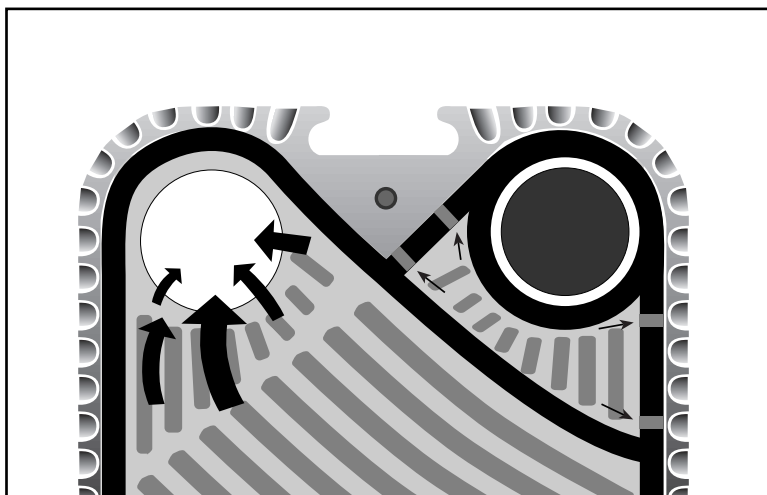


Fig. 3

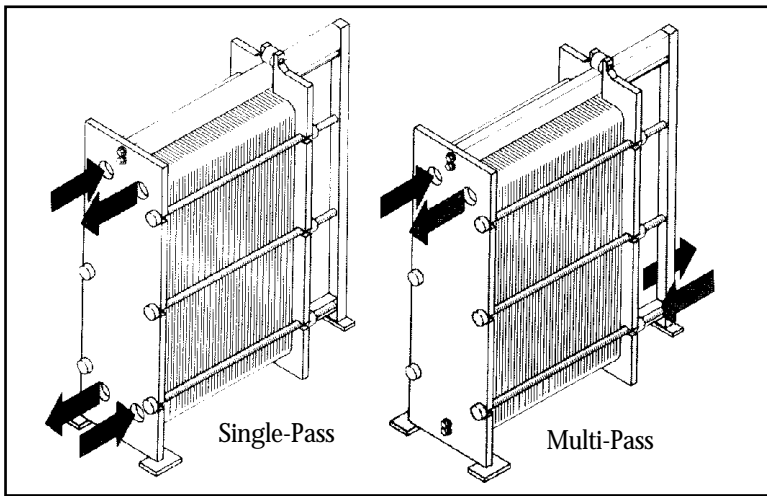


Fig. 4

The fluids enter the PHE through connections on the frame. A *single-pass* arrangement has all four connections on the fixed head. This design is preferred, where possible, because the unit may be opened for maintenance or expansion without breaking the pipe connections. For “close-approach” applications, a *multi-pass* unit may be required. This arrangement puts connections on both the fixed head and the moveable follower.

(See Fig. 4)

The most common flow pattern is called *countercurrent*, where the fluid inlets are on opposite ends of the fixed head. The co-current flow pattern is rarely used, but may be a good solution in some special cases.

C.

Plate Characteristics

The Polaris plate is designed to obtain the maximum possible heat transfer efficiency. Each plate is embossed (pressed) with a “V-shaped” *herringbone* pattern. The “V’s” always point in opposite directions on adjacent plates. This creates a large number of contact points between the plates which in turn enables the plate pack to withstand high pressures with relatively thin (0.5-0.8 mm) plate materials.

In order to more closely match the exact requirements of the application, Polaris plates are manufactured in both short and long thermal lengths. This is accomplished by varying the angle of the “V’s” in the herringbone pattern. The “long” plate features a relatively flat “V” pattern which produces extremely high turbulence and high heat transfer at the expense of higher pressure drop. The “short” plate features a more steeply-angled “V” pattern with correspondingly lower heat transfer and pressure drop. The two plate types may also be mixed to produce an intermediate result.

(See Fig. 5)

Polaris heat exchangers use the parallel flow pattern. Fluid in a circuit enters and exits on the same side of the heat exchanger. This means that the plates may be used as either left or right plates simply by turning them 180°. As shown, fluid runs from port 1 to port 4 and from port 3 to port 2.

(See Fig. 6)

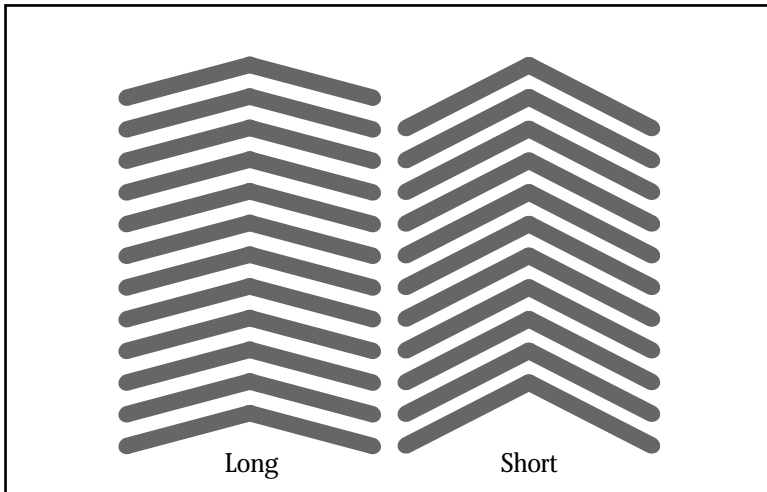


Fig. 5

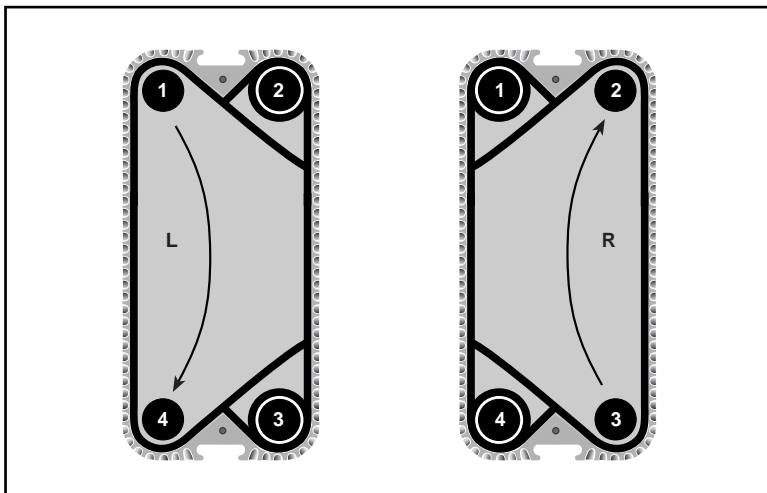


Fig. 6

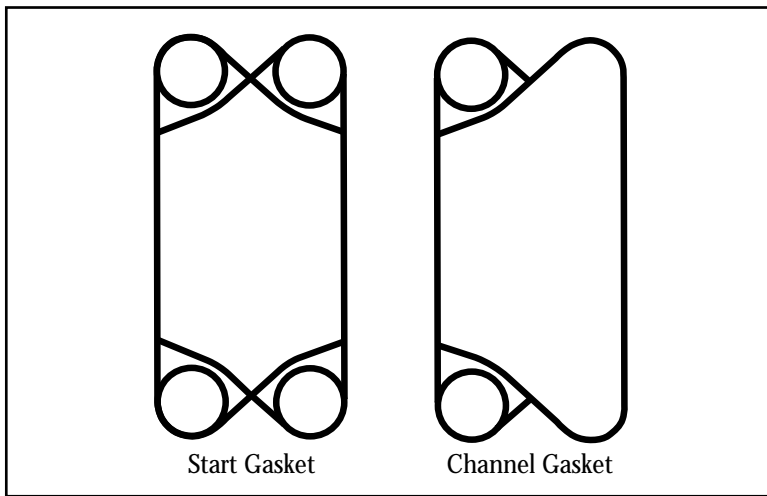


Fig. 7

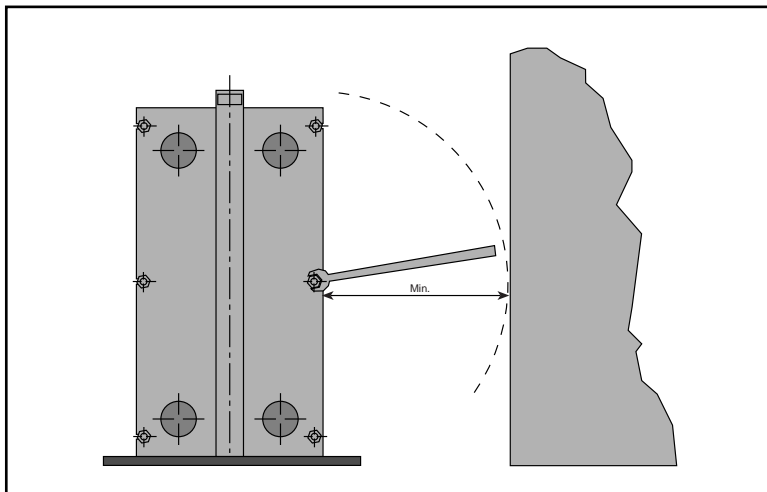


Fig. 8

D.

Gasket Design

Polaris gaskets are a single-piece molded design. The gasket materials are normally NBR, EPDM, or Viton[®]. The gasket material is selected for compatibility with the fluids being processed and the operating temperatures. Gaskets are normally bonded in the gasket groove by means of a thin layer of adhesive. This adhesive is meant only to keep the gasket in place during opening and closing of the unit. It does not provide any sealing advantage. Many Polaris plates are available with the patented “Press-Tite” glueless gasket system. These gaskets are made to be pressed into place without any tools. A START gasket (used as the first plate in the pack) and a normal channel plate gasket are illustrated.

(See Fig. 7)

E.

Installation

The Polaris plate heat exchanger is pressure tested in accordance with the design calculation before delivery and is ready for installation. The heat exchanger should be mounted in an upright position. Make sure you have enough space to open the heat exchanger for inspection or repairs without problems.

(See Fig. 8)

Space should be provided at the sides and ends of the heat exchanger to allow work to be carried out. The following recommendations should be followed when piping to the unit:

- Piping should be connected according to the design calculation and drawing.
- Pipes should be fitted so that thermal expansion does not affect the heat exchanger or the fittings.
- Flexible connectors or strain-relief piping design may be used.
- Pipe supports should be located close to the exchanger so that the piping and related valves and fittings do not put tension on the connections.
- All pipe connections to the exchanger should be fitted with shut-off valves so that the unit may be serviced without draining the system.
- If the pump’s maximum pressure (zero-flow condition) is greater than the heat exchanger’s working pressure, a safety relief valve should be installed at the inlet port, NEVER THE OUTLET.

F.

Start-Up

When starting up a plate heat exchanger for the first time, observe the following procedures:

- Check that the plate pack dimension is within the limits specified on the drawing.
- Make sure the piping system is cleaned to prevent entrance of gravel, sand, welding flux, etc. into the heat exchanger.
- Open the heat exchanger outlet valves.
- Close the pump discharge valves (or HX inlet valves).
- Start the pumps and open the pump discharge valves slowly.
- When both sides are at full pressure, vent the heat exchanger. Trapped air will reduce the heat transfer and increase pressure drop.
- Examine the unit for any leakage. Minor leakage may stop when the unit reaches operating temperature and pressure.
- Do not exceed the maximum working pressure.

G.

General Maintenance

- It is recommended that tightening bolts and tightening nuts be lubricated periodically in order that they can be easily loosened at time of disassembly.
- Check for loose tightening nuts. Temperature and pressure changes in the system may cause the plate pack length to shrink. Re-tighten to specified dimensions.
- The upper carrying bar and lower guiding bar should be coated with a lubricant to enable the plates to slide smoothly.

H.

Dismantling and Re-Assembly

- Before opening the heat exchanger, make sure that both sides are gradually lowered to atmospheric pressure.
- The temperature should be allowed to fall to ambient to avoid loosening the gaskets.
- Loosen the tightening bolts. The moving frame can now be pulled back towards the column, thus exposing the plate pack.
- The plates should be removed one by one if required.
- Dismantling of the plate pack must be carried out with great care. If not already done, number the plates before taking them out. To remove a plate from the frame, lift it and tilt it on an angle until it can be removed. If desired, the plates can be cleaned or inspected one by one while separated in the frame, and need not be removed.
- Before re-assembly, make sure that all plates and gaskets are wiped clean and are free from dirt. Solid particles adhering to the gaskets can cause damage and may also result in leakage when the unit is put back in operation.

- Upon completion of cleaning and final inspection of each plate, the unit may be closed and tightened.

CAUTION !! *Plates may have sharp edges. Gloves should be worn during disassembly and assembly.*

Tightening Procedure

- Push moveable follower to contact rear of plate pack.
- Install tightening bolts and nuts.
- Starting with the center bolts, tighten using hand tools. It is important to keep the follower parallel to the fixed head during the entire tightening operation.
- Larger units will require power tools (i.e. pneumatic wrench) to tighten further.
- When the required tightening measurement has been reached at the center of the pack, continue tightening the bolts out from the center. Do not tighten any particular bolt more than 1/2" at a time. Continue until the frame is parallel and tightened to NO MORE THAN the recommended tightening measurement.

WARNING!!

The recommended tightening measurement is a minimum value which should not be exceeded. Permanent plate deformation may occur if the pack is overtightened. A unit may be shipped from the factory with a plate-pack measurement greater than the value shown on the drawing. This is due to manufacturing tolerances and is normal.

I.

Cleaning

It is not usually necessary to open the heat exchanger for cleaning until there is a decrease in thermal transfer or an increase in pressure drop. If cleaning is indicated, it may be done either manually (by opening the unit) or it may be cleaned-in-place (CIP).

Manual cleaning:

- Open the heat exchanger according to the dismantling instructions.
- Pull the plates apart from each other. Leave the plates in the frame if possible. If the plates are removed from the

frame, mark them with numbers so you will be able to replace them easily.

- Use a soft brush and a recommended cleaning agent.
- A high-pressure washer may be used if care is taken not to loosen the gaskets.
- Do not use wire brushes or any other abrasive material on the plates.
- Rinse the cleaning agent from the plate with fresh water immediately after cleaning.

Fouling	Cleaning Agent
Organics	Alkaline detergent (2% caustic soda @ 128° F)
Fats/Oils	Kerosene
Calcium buildup	10% nitric acid or 2% sodium trimetaphosphate

Cleaning-in-Place:

- CIP is recommended when corrosive or hazardous liquids are being processed.
- Drain both sides of the PHE.
- Backflush both sides with warm water until the water flows clear. The flow rate should be at least 1.5 times the normal rate.
- If steam is used for cleaning, be certain that its temperature does not exceed the limitations of the gasket material (NBR/230° F. EPDM/302° F).
- A mild detergent or weak acid may be used. Be sure to flush with water when done.

CAUTION!!

Nitric acid and caustic soda may cause injury to exposed skin, eyes, and mucous membranes. The use of protective eyewear and gloves is strongly recommended.

J.

Regasketing

- Remove the old gasket from the gasket groove using a screwdriver if necessary.
- If the gasket does not come out easily, use mild heat on the back of the plate.
- Remove all of the old glue in the gasket groove. Methylene ketone or acetone may be used.
- Apply a thin coat of glue in the gasket groove. (Recommended adhesive is Pliobond-20 or a factory-approved equal.)

- Press gasket into place, starting at the ends and working towards the middle of the plate.
- Stack the plates horizontally and put a heavy weight on top of the stack.
- Leave stacked for approximately 12 hours before re-installing.

K.

Troubleshooting

- If a decrease in performance is noticed (decreased thermal performance or increased pressure drop), the unit may be dismantled and cleaned, or cleaned-in-place as described above. Also, check to make sure that the unit is connected for counterflow operation.
- If leakage to the atmosphere is noted, and the plate-pack measurement is greater than the minimum recommended measurement, you may further tighten the plate pack to stop the leak. Do not exceed the minimum measurement.
- If leakage between the sides is noted, you must disassemble the exchanger and examine each plate manually for a hole. This is best done using a bright lamp.
- If the leaking plate has been identified, that plate can be removed along with an adjacent plate (plates must always be removed in pairs). The unit may be re-tightened with a minimal loss in performance.
- If the gaskets are hard, shiny, or brittle, they may have been subjected to temperatures beyond their design limitations. Check for excessive operating temperatures and consider replacing the old gaskets with high-temperature gaskets.
- Gasket swelling or disintegration may be a sign of fluid compatibility problems. Samples of possible gasket materials may be soaked in the process fluid and checked for swelling.

L.

Spare Parts

Spare parts may be ordered directly from Polaris Thermal Corp. or through your local authorized Polaris representative. Plates and gaskets may be ordered separately, or the plates may be ordered with gaskets already glued in place. When ordering, please have the following information:

- Polaris model number
- Polaris serial number
- Plate material
- Gasket material

If you have any difficulty in identifying your heat exchanger, call Polaris or your local representative for assistance. We will have your unit on file, and will be able to help you in identifying the spare parts.

POLARIS

PLATE HEAT EXCHANGERS

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