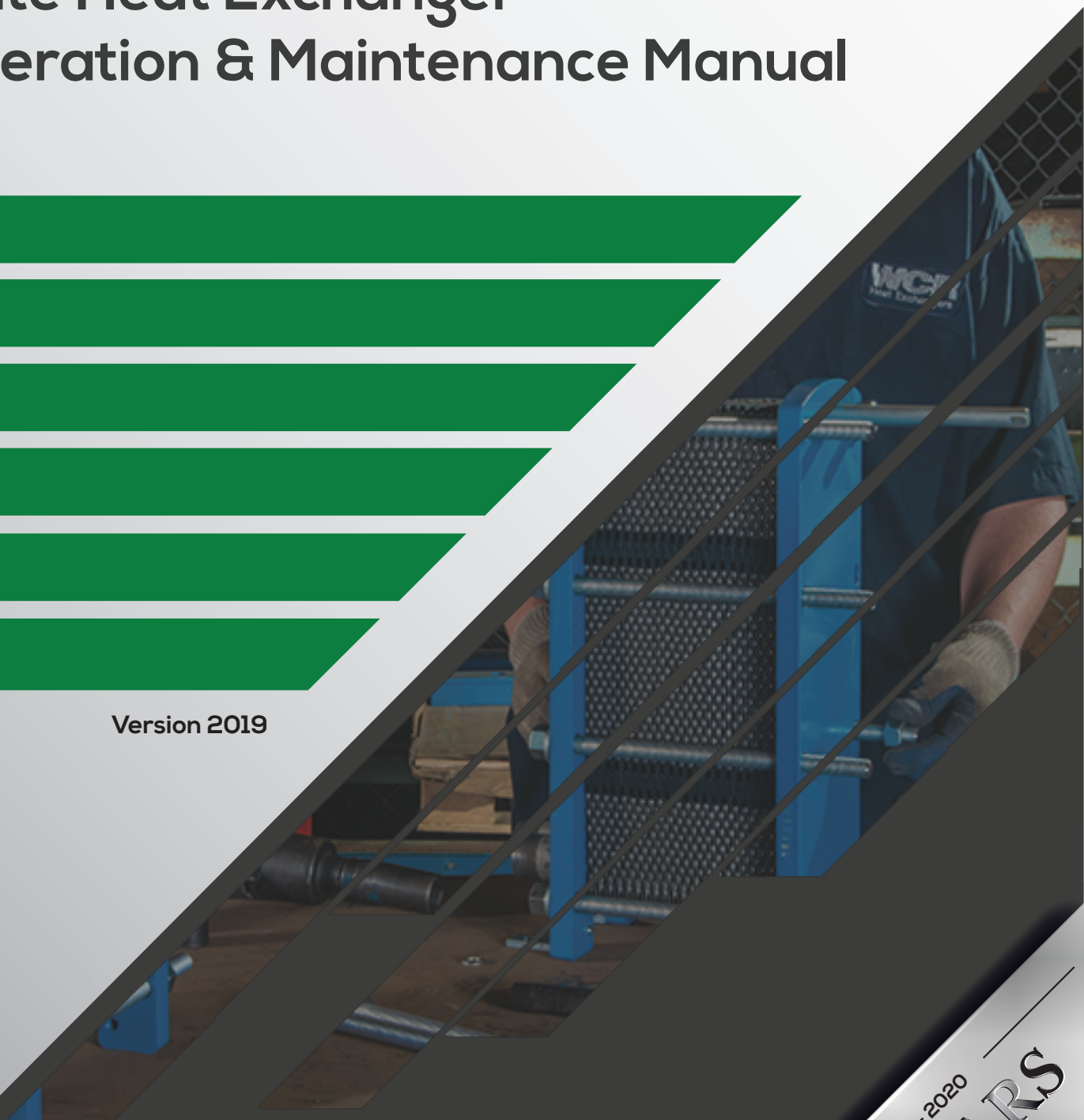




Plate Heat Exchanger Operation & Maintenance Manual

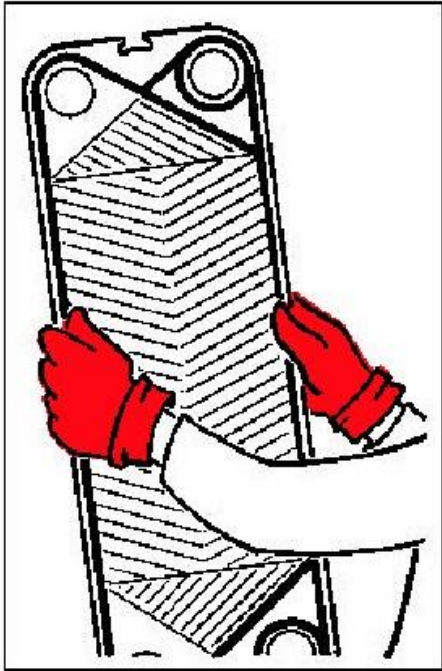
Version 2019



1980 - 2020

40 YEARS

Warning!



CAUTION!
To avoid hand injuries caused by sharp edges on plates, protective gloves should always be worn when handling plates and safety shrouds

SAFETY SHROUDS *Ref: Section 9*

To avoid injuries and damages, follow the instructions in this manual. Also comply with applicable local safety regulations.

To prevent injuries or damages in case of leakage and spouting liquid or steam, when necessary we can supply safety shrouds for all plate heat exchangers.

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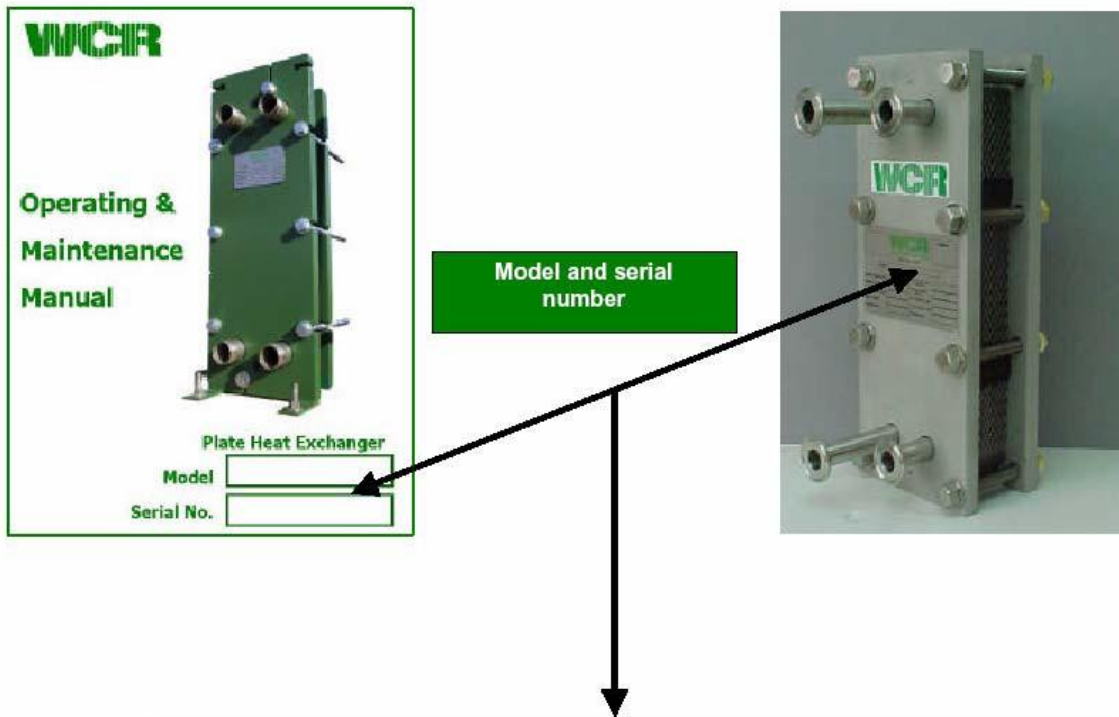
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Dear Owner,

This Instruction Manual is your instant guide when dealing with your WCR Plate Heat Exchanger in various situations. WCR advises you to study it carefully and, above all, to ensure its availability to those who install, maintain and operate the apparatus on a daily basis. This manual will be of no value for any breakdown of the equipment caused by the owner's failure to follow the instructions of this manual.

If you nevertheless should have a problem with your WCR Plate Heat Exchanger which is beyond the scope of this manual, do not hesitate to turn to your WCR Representative. We can help you, wherever you are in the world.



A data plate is fixed to the PHE and gives the following information

		ITEM NO.	
		DAYTON, OHIO	
MODEL			
SHOP ORDER NO.		PLATE PACK DIM. (INCHES)	
SERIAL NO.		SURFACE AREA (SQ. FT.)	
MAX ALLOW W.P.		NET WEIGHT (LBS.)	
MAX. TEMP.		TEST PRESS. (PSIG)	
YEAR BUILT		DRAWING NO.	



This instruction manual has been issued for one particular PHE and carries the model number and Serial Number on the front cover.

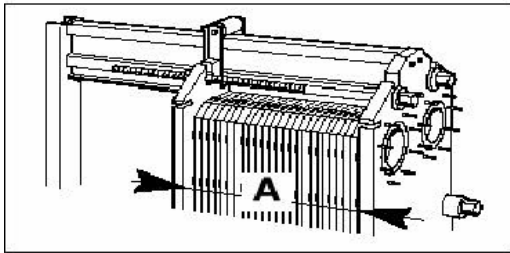
A design drawing and plate arrangement are located at the back of this manual.

Whenever using this manual, check first that the Serial Number on the front cover is identical to that on the data plate of the PHE.

In all correspondence with WCR, please refer to the Serial Number for true identification of the Heat Exchanger.

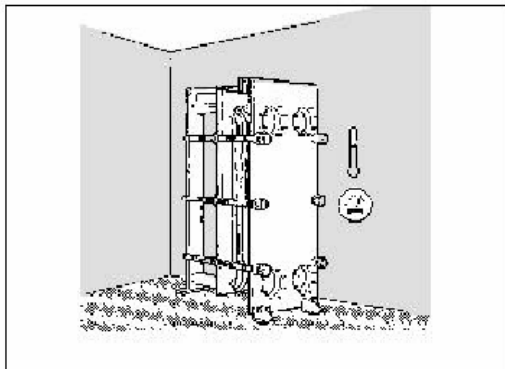
Storage

In this section, names of heat exchanger parts are mentioned for the first time. For more information, see Section 4.



Unless otherwise agreed, WCR delivers the plate heat exchanger ready to be put in service. This means the plate package is tightened to its correct measurement A.

Should it be necessary to store the PHE for a long period (1 month or more) certain precautions should be made in order to prevent unnecessary damages of the equipment.



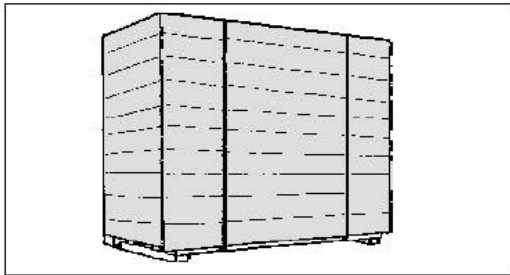
Preferably, the heat exchanger should be stored inside at room temperatures of 60- 70F (15-20C) and humidity around 70%

NOTE!

There should absolutely not be any ozone- producing equipment in the room, like electric motors or arc-welding equipment, since ozone destroys many rubber materials (cracking).

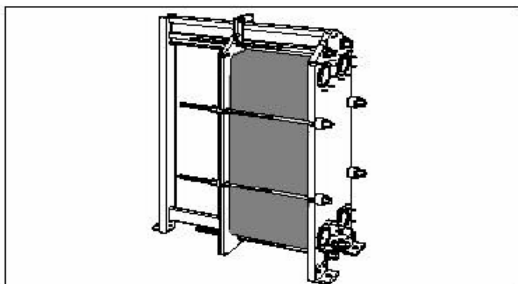
Do not store organic solvents or acids in the room and avoid heat or ultraviolet radiation. These may destroy the rubber materials.

Storage (Cont'd)



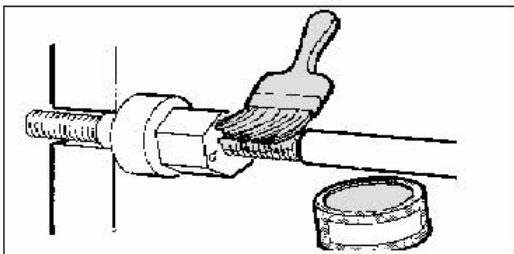
The best solution is often to leave the heat exchanger in the packing case until it is time for installation

In this case, WCR should be informed in order that proper preparation can be done prior to packing.

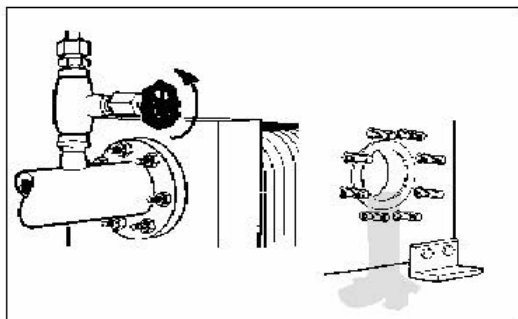


To wrap the plate package with a non-transparent plastic film is a good precaution.

The tightening bolts should be well covered with a rust preventing coating and if not connected to the pipe system, the connections should be covered as well.



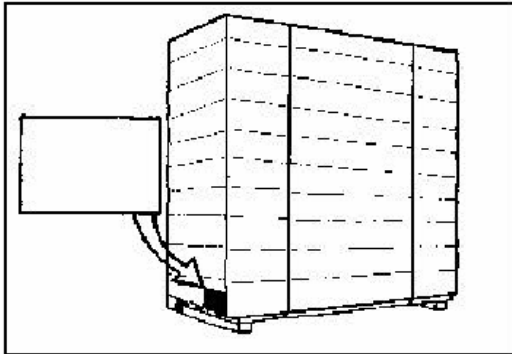
If the heat exchanger must be stored outdoors, the precautions mentioned above should be taken as far as practical. The need for protection against the climate is of course even more important in this case.



Also, if for any reason the heat exchanger is shut down and taken out of service for a long period, it is recommended to follow the advice above, even if the apparatus is not moved from the location.

The heat exchanger should be drained and depending on the media processed, it is recommended to rinse and dry it before it is left for storage.

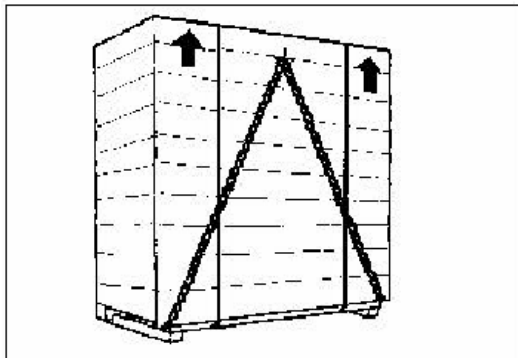
**Packing List, Unpacking and
Lifting Packing list and unpacking**



The packing list is attached to the goods.

For safe transport it is necessary to deliver instruments, valves, etc. unmounted. Please check all parts against packing list. Handle fragile parts with care.

Lifting



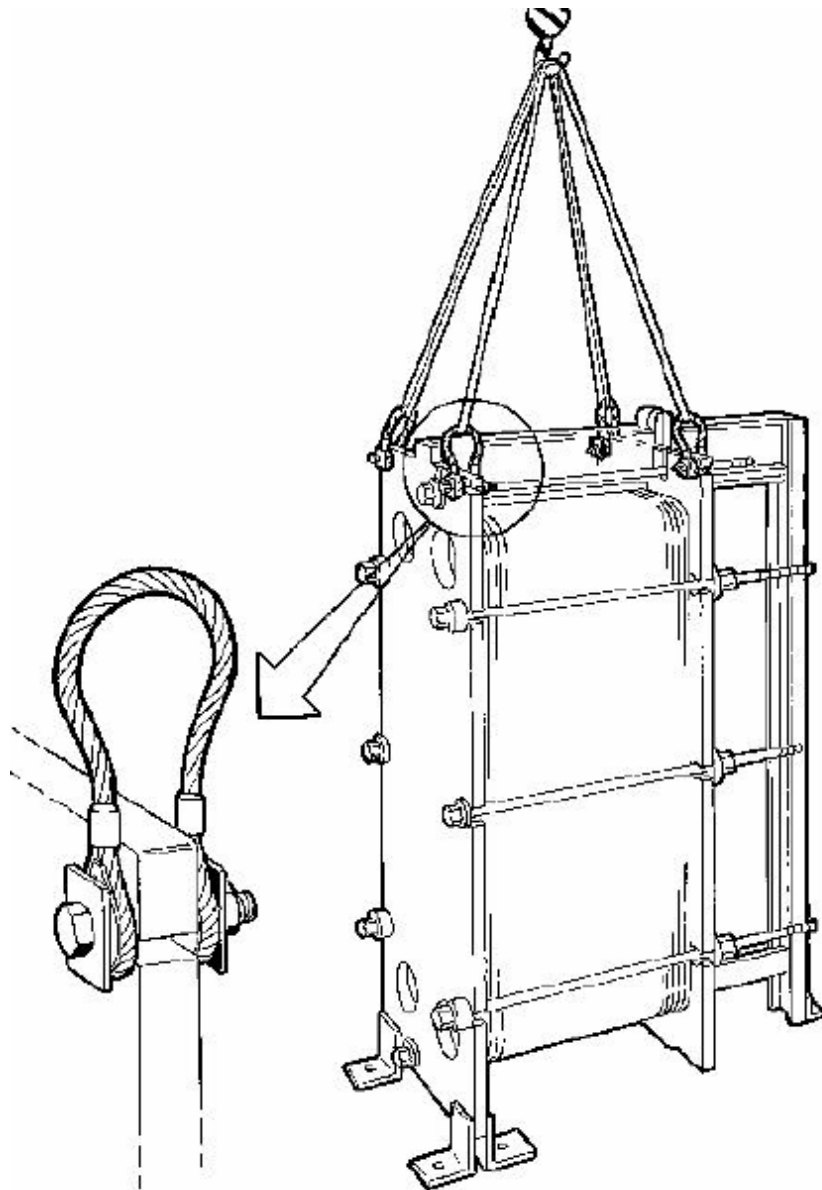
When lifting the unopened packing case (or skid) please observe the markings on the case indicating where to place lifting hooks. The center of gravity is important and is marked on the topside of the case. The actual center of gravity is located on the vertical line directly below this mark. WCR generally advises customers in advance on how the heat exchanger has been placed inside the crate.

Lifting

PHE Models: WCR-P8116, WCR-T761, WCR-T782, WCR-A1016B, WCR-A1420

If you are to lift the heat exchanger itself, straps should be used. They should be placed as shown in the below picture.

WARNING! Never lift by the connections or the studs around them.

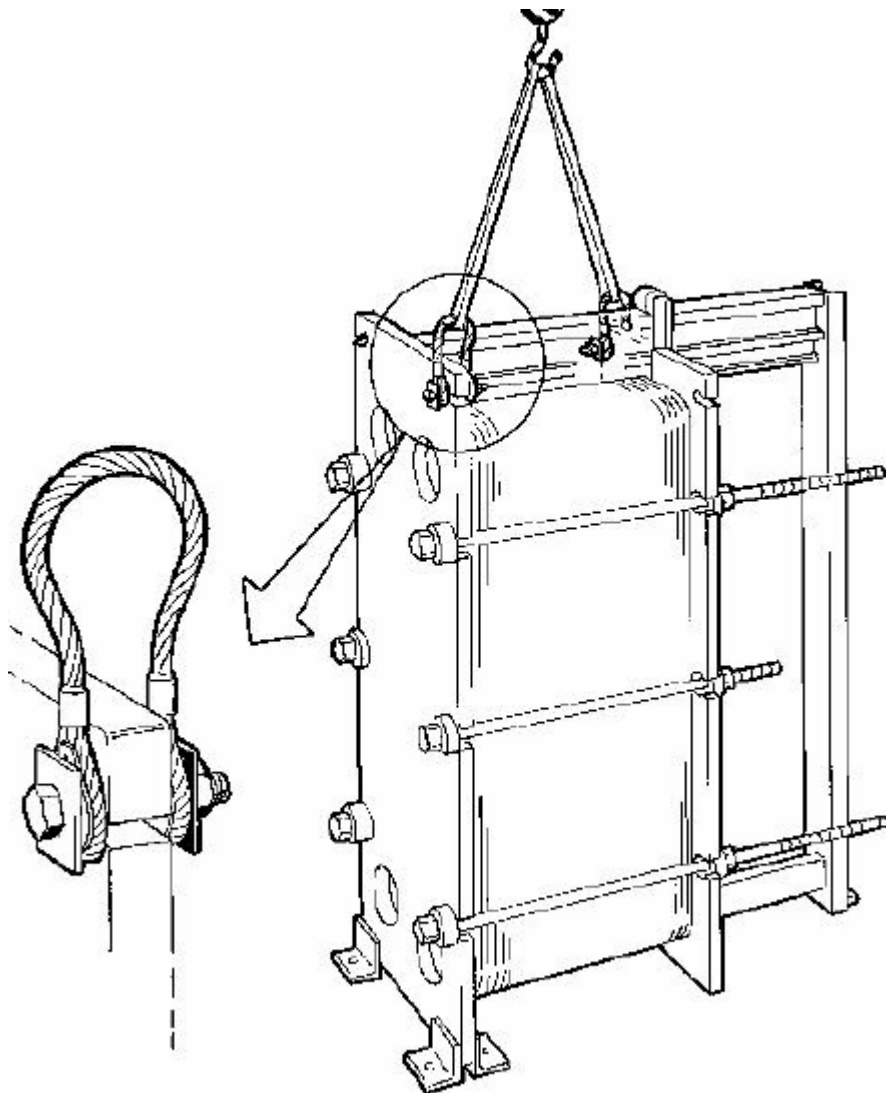


Lifting

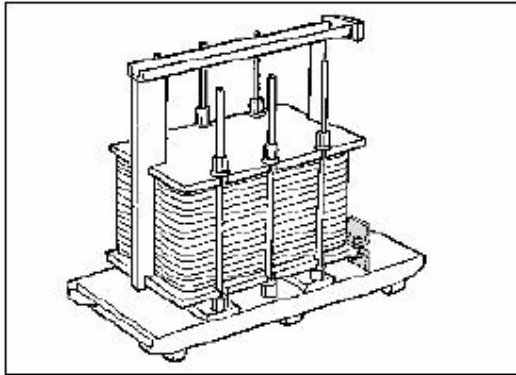
PHE Models: WCR-A103, WCR-A216, WCR-A425, WCR-A667, WCR-P456

If you are to lift the heat exchanger itself, straps should be used. They should be placed as shown in the below picture.

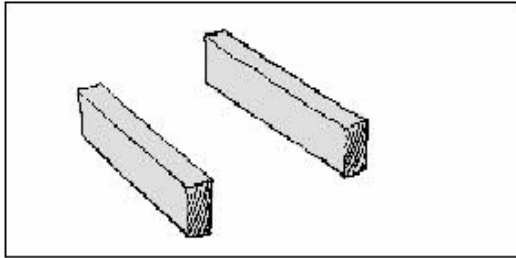
WARNING! Never lift by the connections or the studs around them.



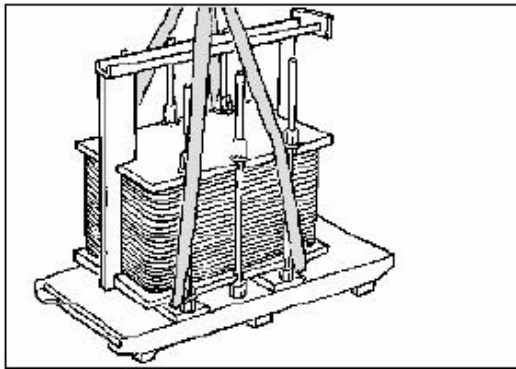
Raising of the PHE



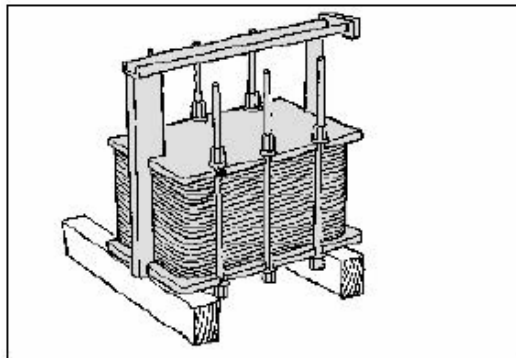
Remove the support feet.



Place two timber beams on the floor.

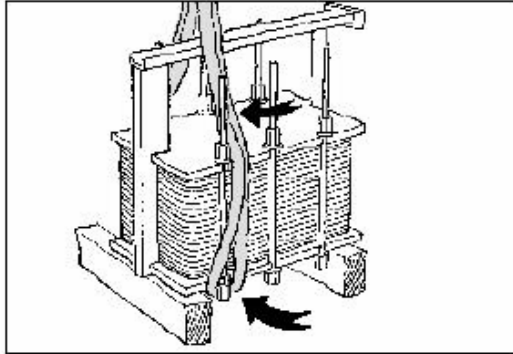


Lift the heat exchanger off the pallet using straps or chains.

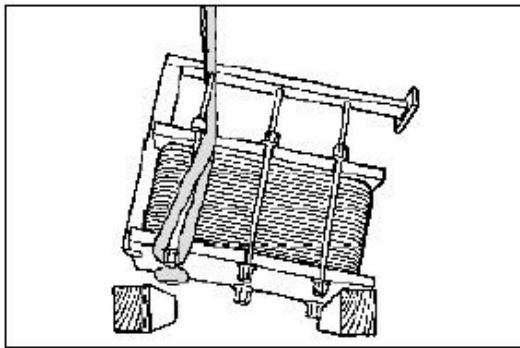


Place the heat exchanger on the timber beams.

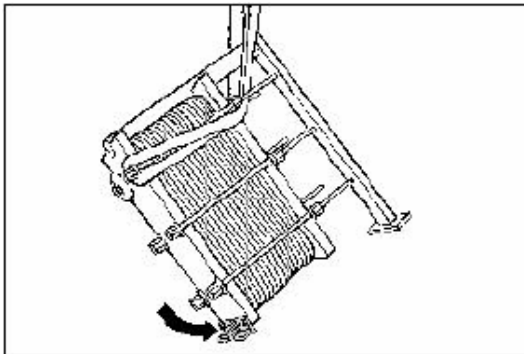
Raising of the PHE (Cont'd)



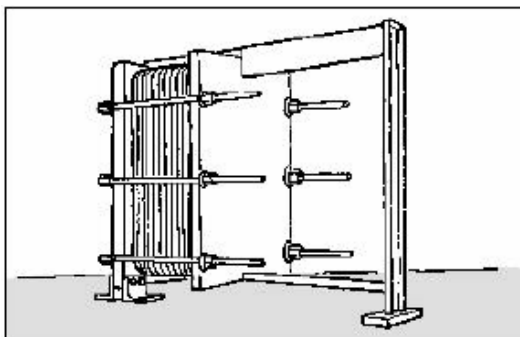
Place straps around one bolt on each side.



Lift the heat exchanger from the timber beams.



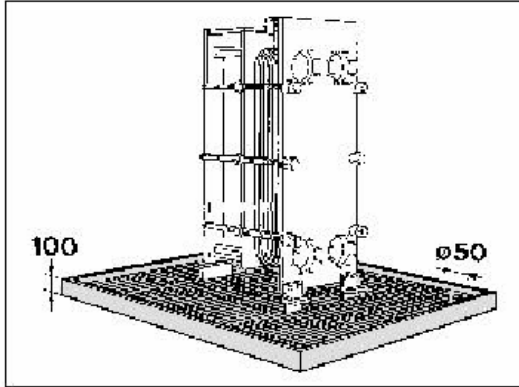
Bolt on the support feet.



Lower the heat exchanger to horizontal and place on floor.

Foundations

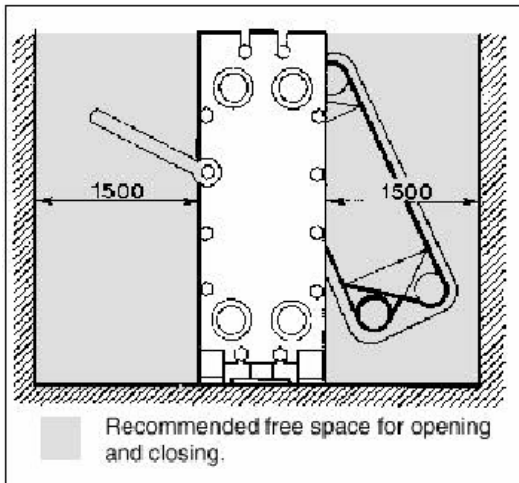
All information necessary for the preparation of the foundation can be found on the data sheet provided by WCR.



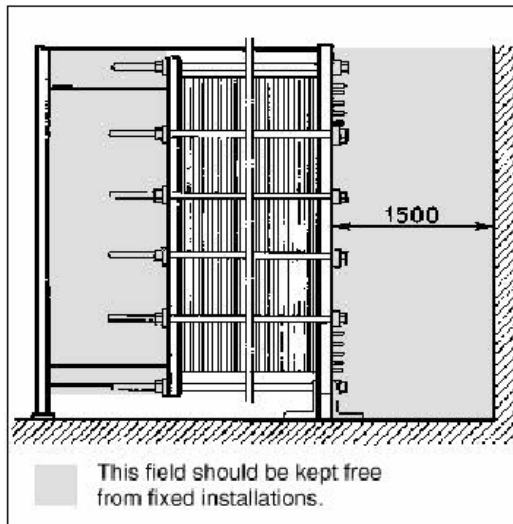
In some cases it may be practical to place the heat exchanger in a drainage box, with capacity for the total volume of the heat exchanger (installation onboard a ship, when processing corrosive liquids, etc.). The outlet of the drainage box should be generously dimensioned, not less than 2" (50mm) diameter.

Installation

Before connecting any piping to the heat exchanger, make sure that all foreign objects have been rinsed out of the system!



As will appear from the dimension drawing provided by WCR, and from the picture to the left, it is necessary to leave free space around the apparatus to give access and make future service possible. Except for a place to put the plates after removal from the heat exchanger, no further space is required for servicing the PHE.

**NOTE!**

The measurements given in the picture are recommended by WCR to provide reasonably good working conditions during the installation of the heat exchanger as well as for future maintenance and service. If floor space is restricted then the dimensions suggested can be reduced and it is left to the purchaser to decide just how much access space can be left.

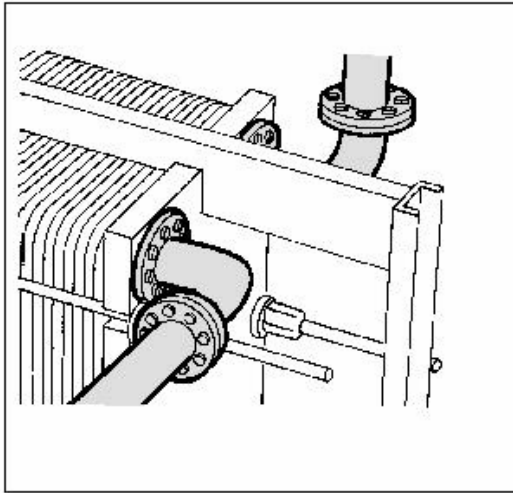
Pipes

When connecting the pipe system to the heat exchanger, make sure that no stress or strain is imposed by the pipe system on the heat exchanger

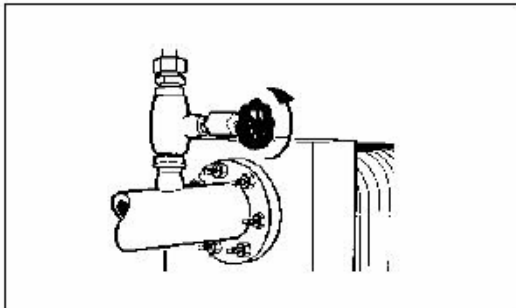
Shut Off Valves

To enable the heat exchanger to be opened when necessary, shut off valves should be provided in all connections.

Connections on the Pressure Plate



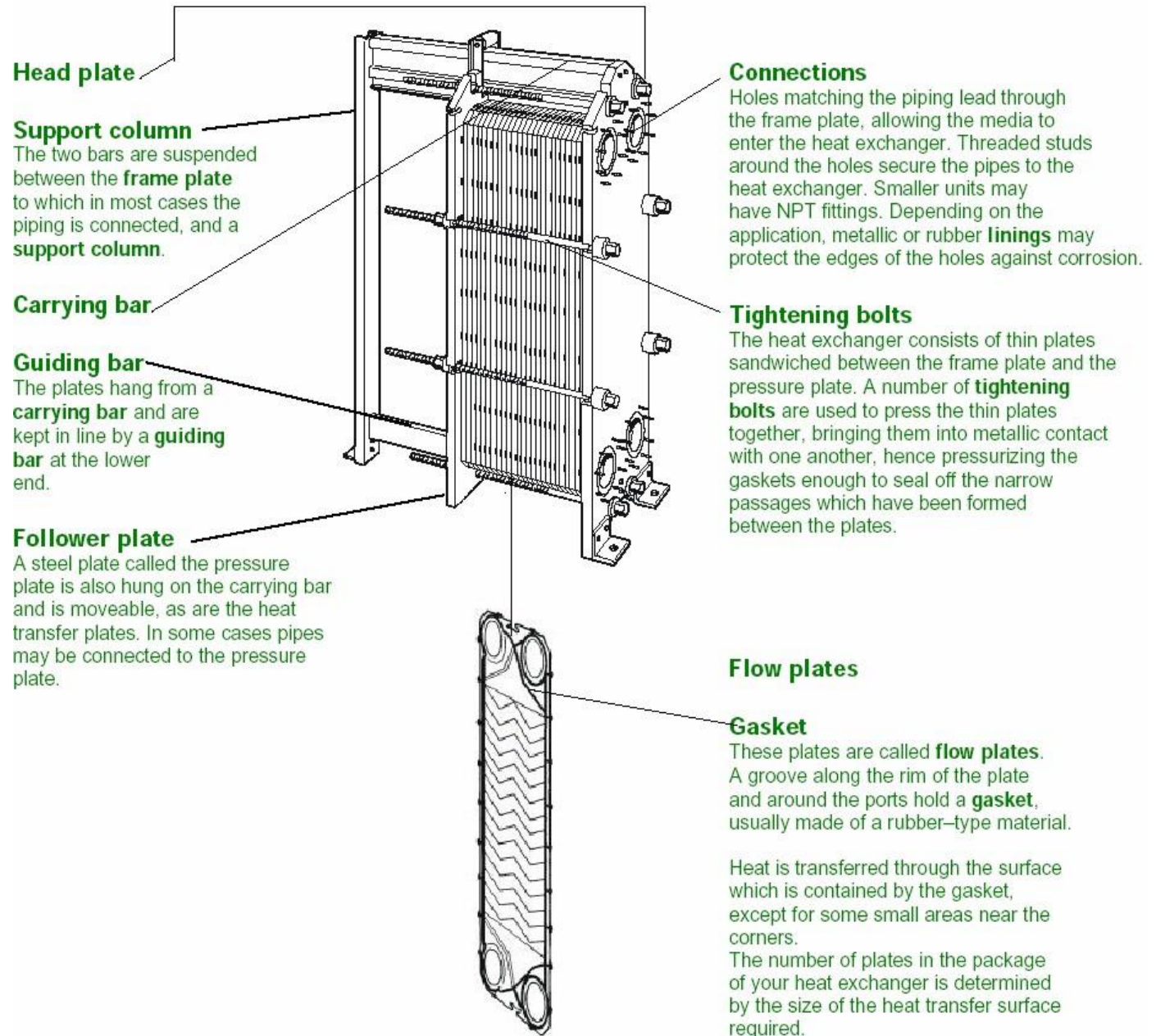
Some plate heat exchangers may have connections in both the head and movable plates. In such cases, it is important to check the drawing or the data print and make sure the plat pack has been tightened to the correct measurement before any pipes are connected. Flanged elbows should be connected to the movable plate, directed upwards or sideways. A second flange located just outside the contour of the heat exchanger can then be connected to the incoming and outgoing pipes. It is then convenient to disconnect this section and not the one attached to the movable plate when the heat exchanger is to be opened.



Venting of both sides of the heat exchanger must be provided. This is important and enables air to be drawn from the system during commissioning. It also enables air or gas to be removed during operation.

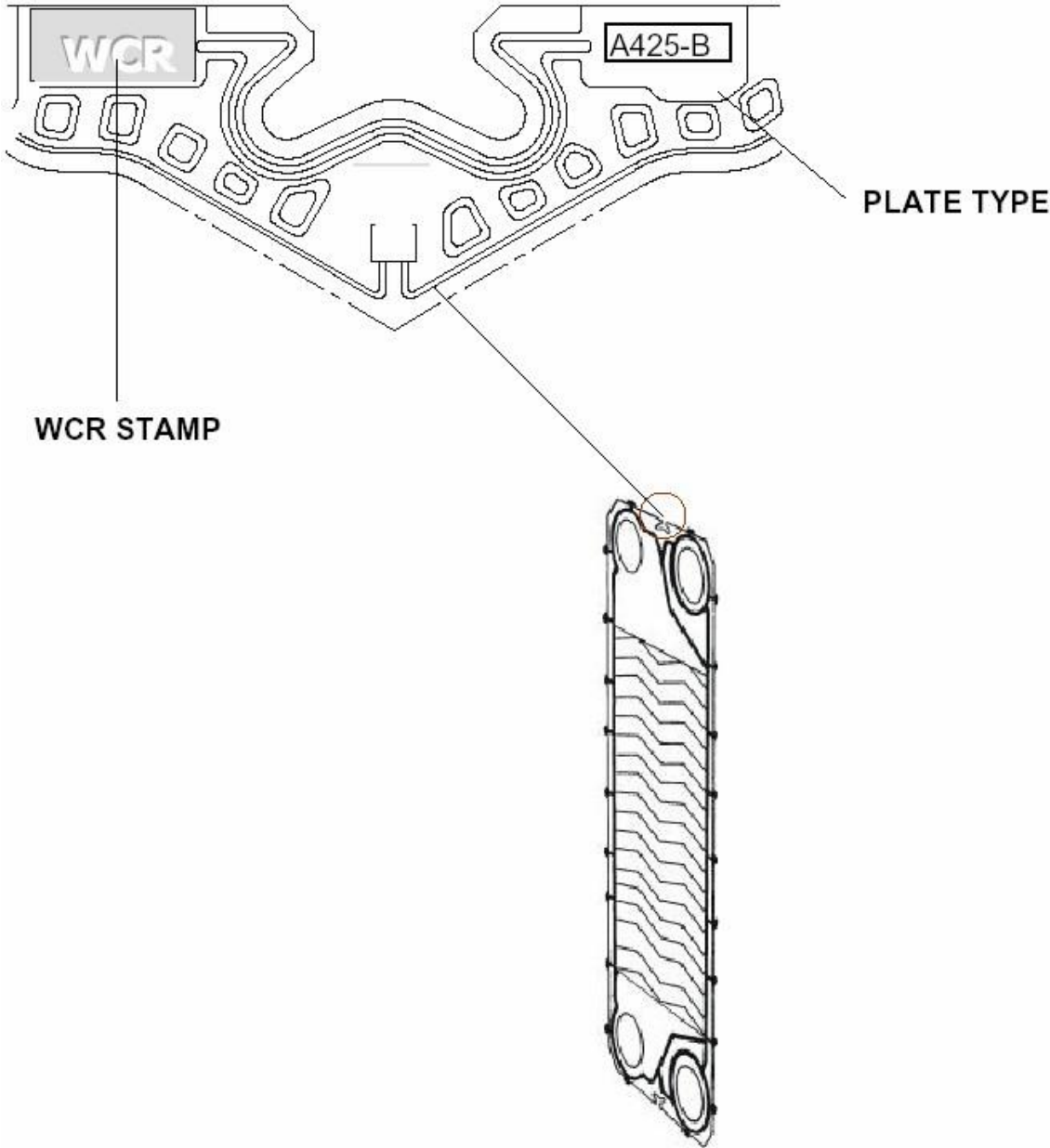
Function

In WCR Plate Heat Exchangers, heat is transferred from one medium to another through thin metal plates which have been pressed into a very special pattern.



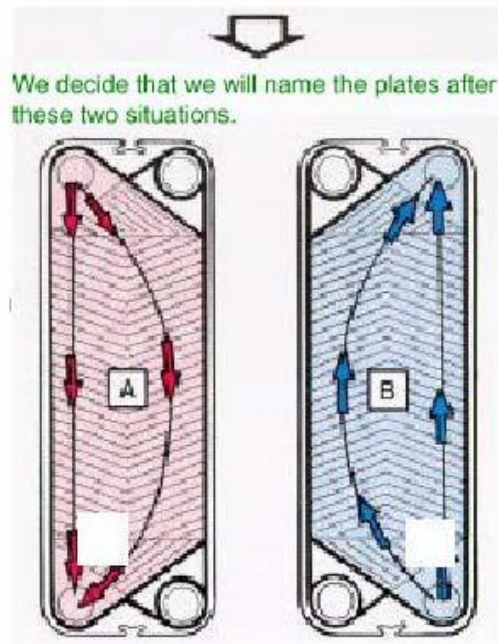
Marking of Plates

Seen as A-plate from the gasket side.



Plates

Studying the pictures, you will observe that on a plate hanging vertically, the gasket rests in a groove which includes the heat transfer area

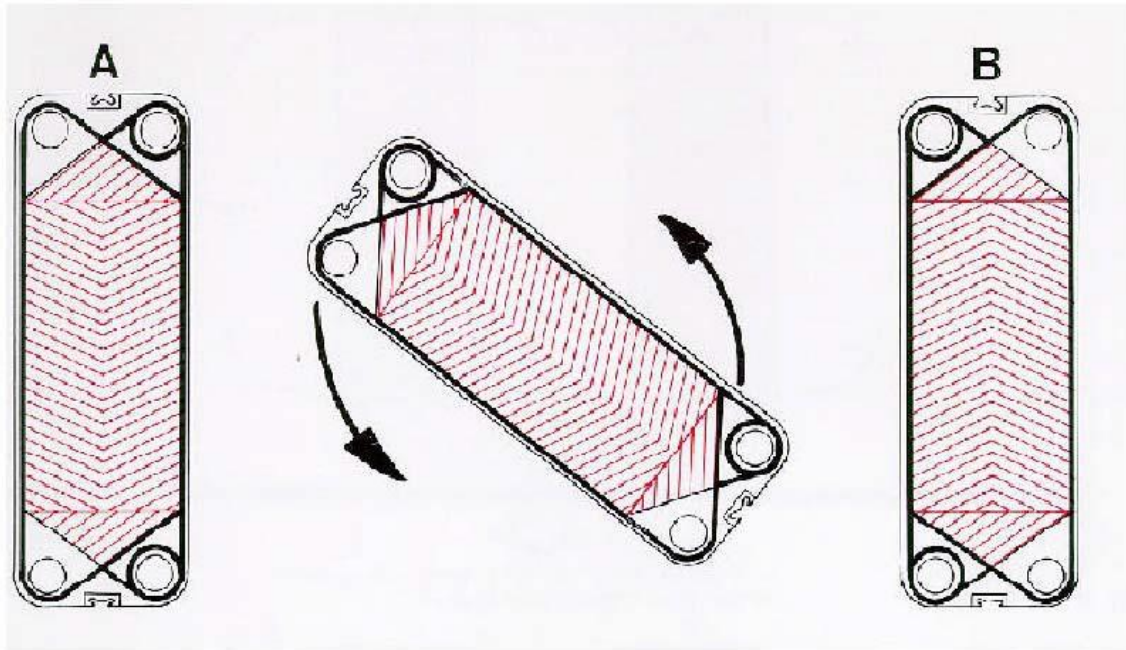


An A-plate is a plate hanging with the chevron pointing downwards.

A B-plate is a plate hanging with the chevron pointing upwards.

Plates

It also appears that if we turn an A-plate upside down we will have a B-plate.



Section 4

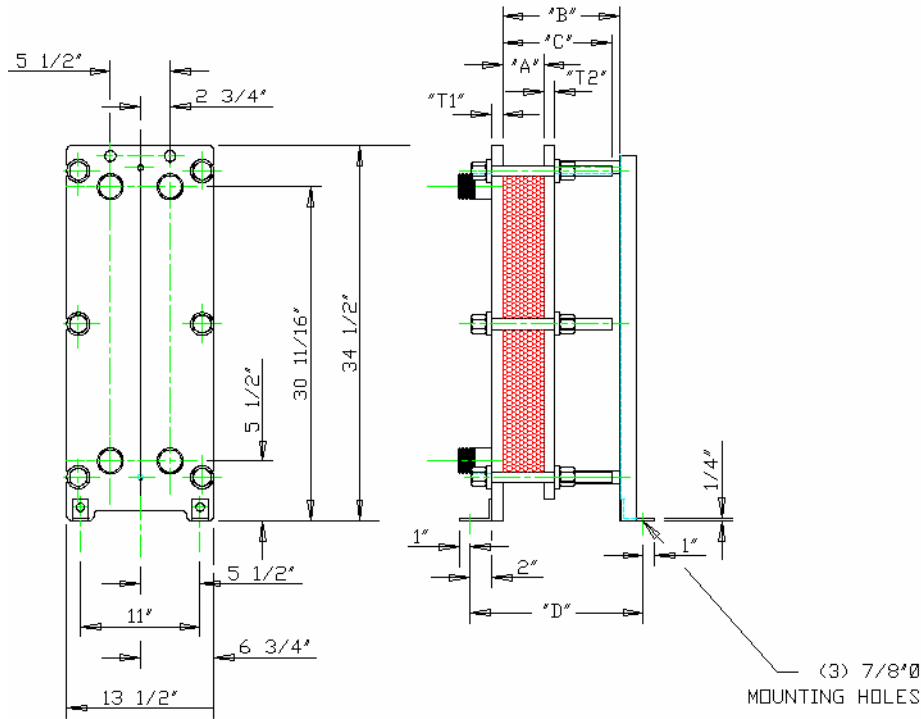
The Main Components and their Functions

Drawing

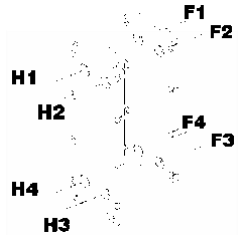
The drawing is at the back of this manual. It gives specific information about the plate heat exchanger.

Type: A216B

A216_S_SAE516_12"



B:	12. in
C:	12. in
D:	17. in
T1:	1. in
T2:	1. in
A max:	5.572 in
A min:	5.401 in
Weight	433 lbs



Location	Nominal width	Connection type	Media	In	Out
H2	2"	NPT-F ANSI150	Oil	x	-
H1	2"	NPT-F ANSI150	Water	-	x
H4	2"	NPT-F ANSI150	Water	x	-
H3	2"	NPT-F ANSI150	Oil	-	x

NPT-F			
H2;H1;H4;H3			

Additional information WCR

Section 4

The Main Components and their Functions

Plate Arrangement

The plate arrangement specifies each plate in sequence from the HEAD PLATE to the MOVEABLE PLATE.

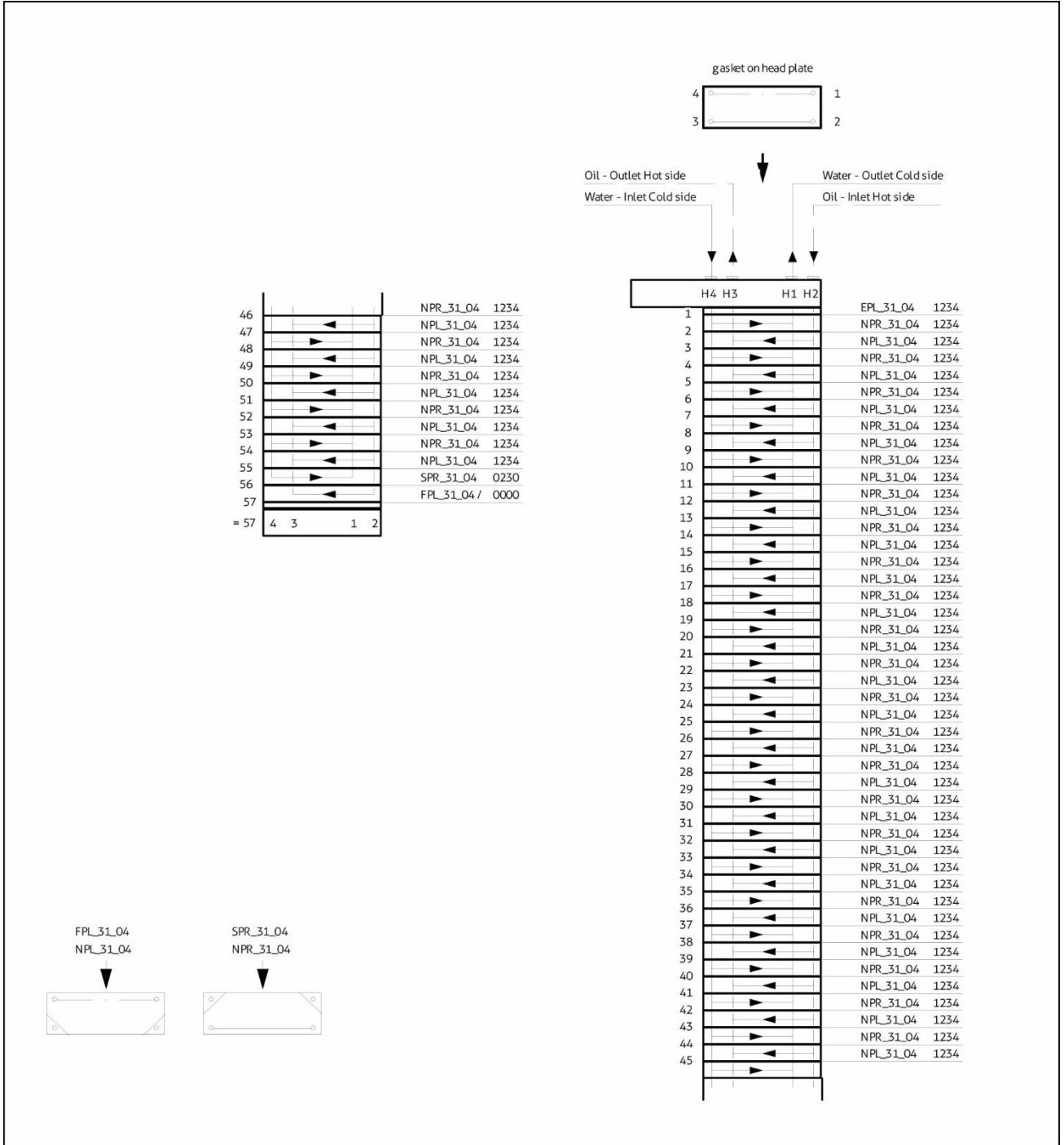
Plate Amt
57

Plate Type
A216B_AISI304_04

Plate Material
AISI3047

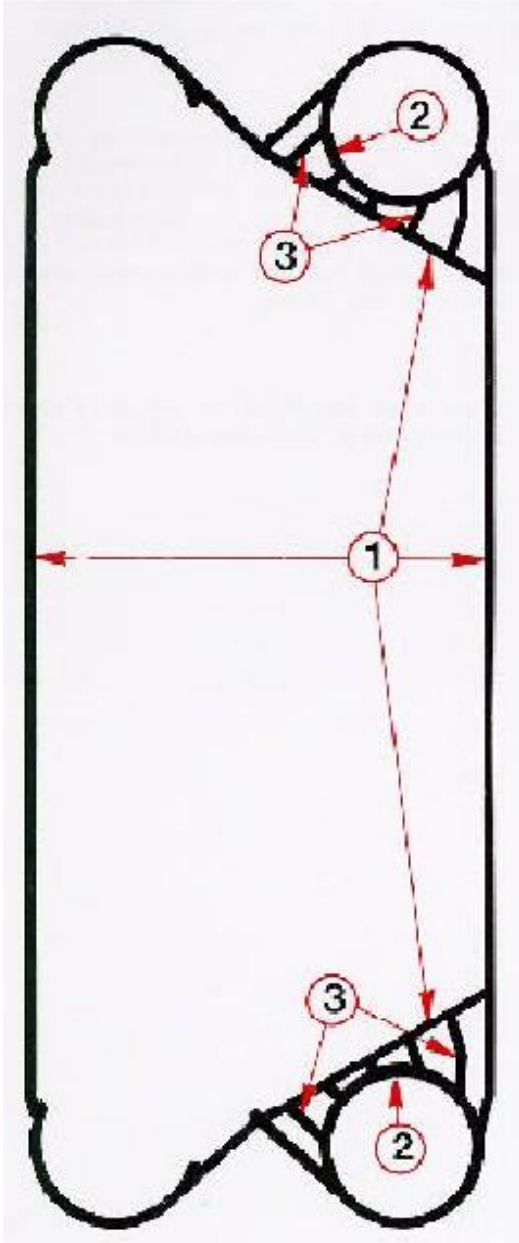
Gasket Material
STDNBR

Flow Scheme
1 x 28 / 1 x 28



Gaskets

The gasket is moulded in one piece. The material is normally an elastomer selected to suite the actual combination of temperature, chemical environment and possibly other conditions.



Gasket types:

- Glue in
- Clip on

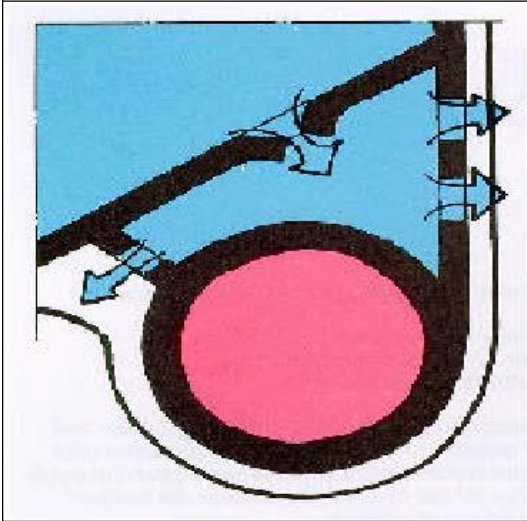
The one-piece gasket is described as consisting of:

- 1 Field Gasket
- 2 Ring Gaskets
- 3 Links

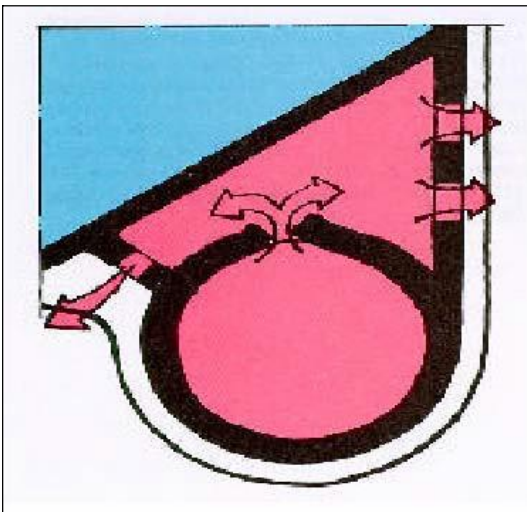
The field gasket is by far the largest part containing the whole heat transfer area and the two corners connected to it, while the ring gaskets seal off the remaining two corners.

These three pieces are held together by a few short links which have no sealing function at all. Their purpose is simply to tie the pieces together and add some support in certain areas.

Gaskets



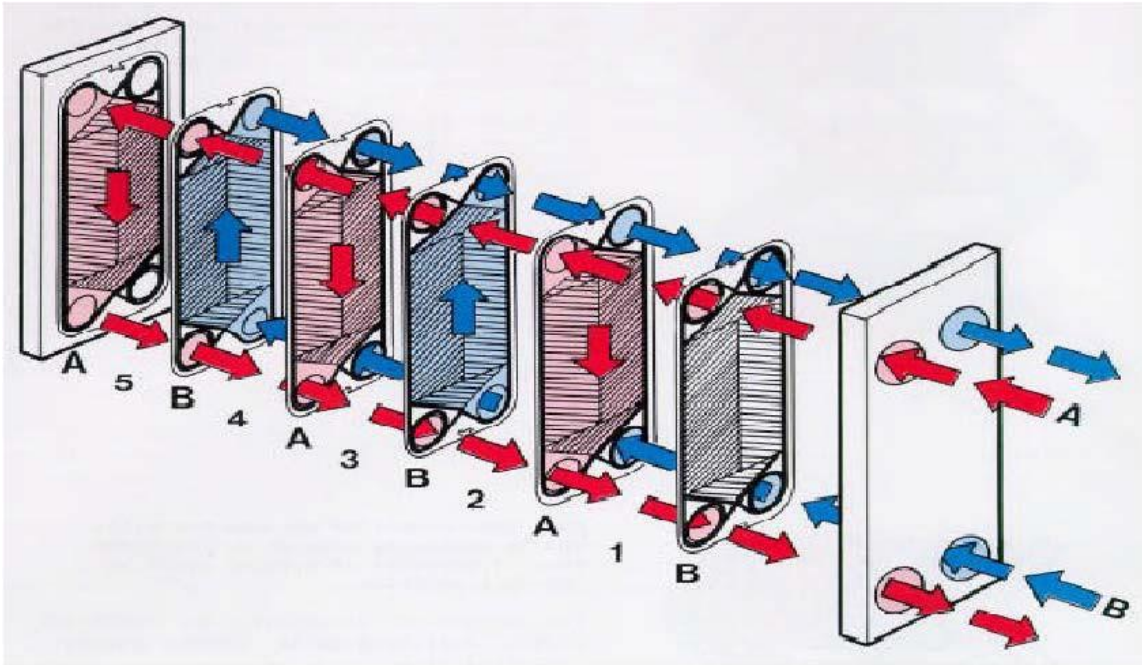
As already demonstrated, the two media are kept separated by the ring and field gaskets. To prevent intermixing of the media in the corner areas where field and ring gaskets are very close to each other, the linking pieces have a number of slots, opening the area between the field and ring gaskets to the atmosphere. Any leakage of media across either gasket therefore escapes from the heat exchanger through the slots.



It is important that these openings are not permitted to clog. If clogging of these slots should occur, there exists a risk during a leakage of a local pressure build-up in the clogged region of the plate which could let one medium leak over and mix with the other.

Care should be taken not to cut or scratch the gaskets while handling plates.

How it Works



When a package of plates is pressed together, the holes at the corners form continuous tunnels or manifolds leading the media from the inlets into the plate package, where they are distributed into the narrow passages between the plates.

Because of the gasket arrangement on the plates and the placing of A and B plates alternately, the two liquids enter alternate passages, e.g. the warm liquid between the odd number passages and the cold liquid between the even number passages.

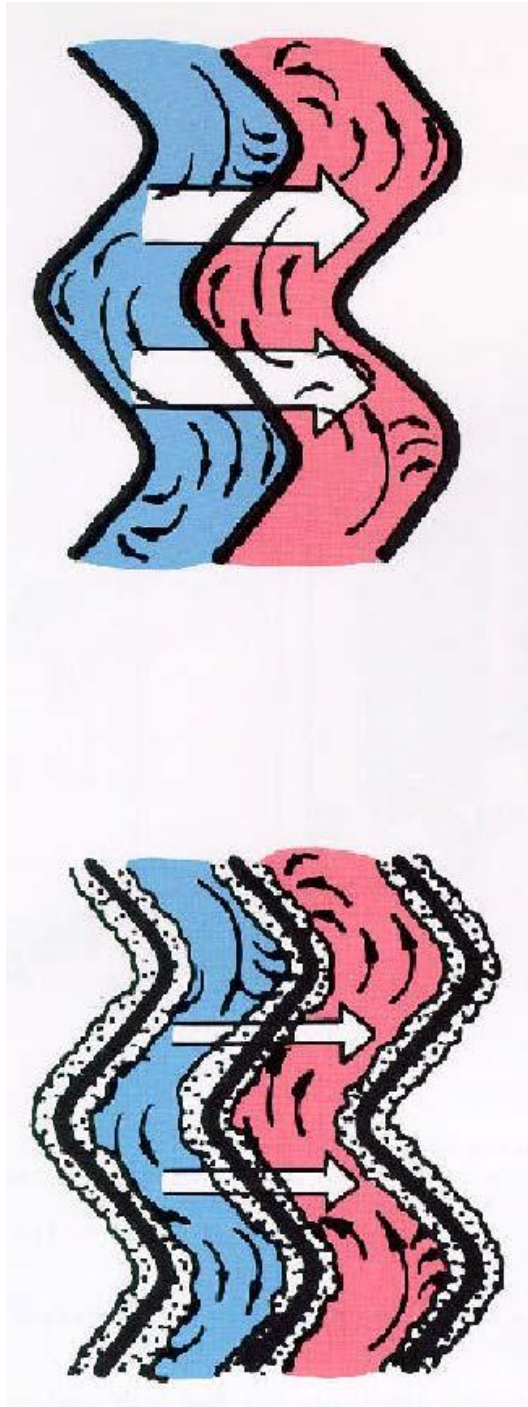
Thus the media are separated by a thin metal wall. In most cases, the liquids flow in opposite directions.

During the passage through the PHE, the warmer media will give some of its heat energy to the thin wall, which instantly loses it again to the colder medium on the other side.

The warmer medium drops in temperature while the colder one is heated up.

Finally, the media is channeled through similar hole-tunnels at the other end of the plates and discharged from the heat exchanger.

Heat Transfer



The purpose of the PHE is to transfer heat from one medium to another and the heat passes very easily through the thin wall separating the two media from each other.

The novel pattern into which the plate material has been formed not only gives strength and rigidity, but greatly increases the rate of heat transfer from the warmer medium to the metal wall and from the wall to the cooler medium.

This high heat flow through the walls can be seriously reduced by the formation of deposits of various kinds on the wall surfaces.

The pattern of corrugation on WCR plates mentioned above induces highly turbulent flow. The turbulence gives strong resistance to the formation of deposits on the plate surface. However, it cannot always eliminate fouling.

The deposits may increase the total "wall thickness" of the metal plate substantially. These deposits consist of materials that have a much lower thermal conductivity than that of the metal plate. Consequently a layer of deposits can severely reduce the overall heat transfer rate.

The deposits will be considered under the section of Maintenance and Cleaning. At this point we will only establish that this fouling is unwanted and can under certain circumstances be harmful to the heat exchanger because corrosion may occur under the deposits.

Pressure Drop

Pressure drops are wasted energy. All pipe systems, and equipment included in them, offer resistance to media flowing through them.

Some pressure drop is unavoidable, but for a given apparatus it should be kept as close as possible to the designed value.

The formation of deposits on the heat transfer surfaces instantly leads to a reduction of the free space between the plates. This means that more energy is needed to get the desired flow through the apparatus.

It is clear that the fouling of the surfaces is undesirable. Larger particles and fibers may also be drawn into the heat exchanger and clog it if strainers or other means of protection have not been provided for.

A reduced ability by the heat exchanger to hold the desired temperatures in combination with an increased pressure drop on any of the media indicates that fouling or clogging is taking place.

For corrective action, study the Section on Maintenance and Cleaning.

In the unlikely event of leakage for any cause, one of the two media will appear externally. Should a failure occur, whether it is related to the plate, gasket or seal weld, the ensuing leak will be easily visible on the outside of the heat exchanger.

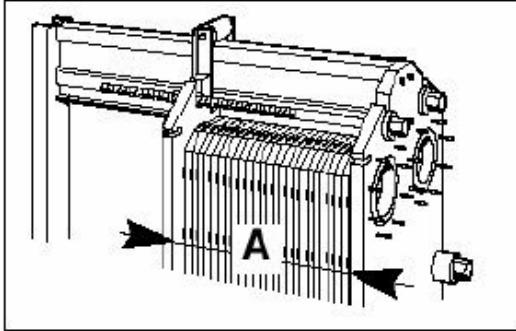
For example:

A hole in one of the double plates will result in external leakage from between the double plate pair.

A gasket defect will cause an external leak, either directly from the peripheral gasket or from the gasket vents open to the atmosphere.

A defect weld will cause external leakage to appear either from the gasket vents or from between the plates at the site of the failure.

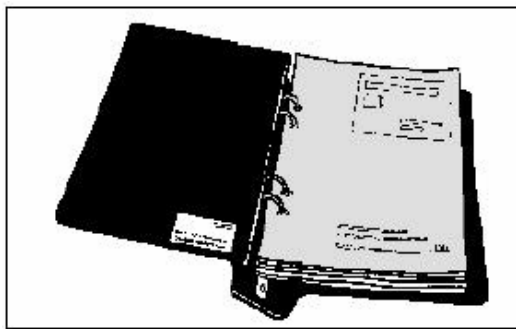
Starting Up



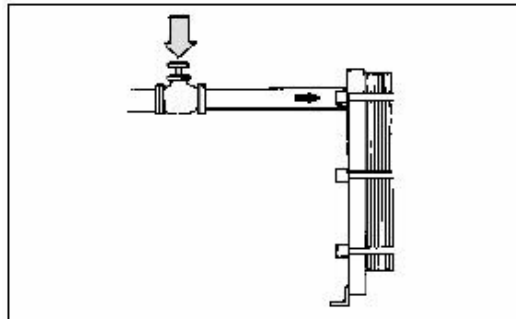
Before starting up for the first time or after a long time of close-down, make sure that the plate pack is compressed to the correct measurement "A"! Check the drawing that is located at the back of this manual.

NOTE!

It is very important that the system to which the heat exchanger is connected is protected against sudden and extreme variations of temperature and pressure to avoid damage. This applies not only for the heat exchanger but also for the pipe system itself and every piece of equipment included in it.

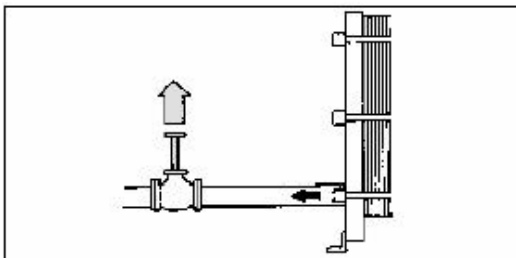


This should be kept in mind whenever a maneuver is to be carried out, including starting up of the pumps in the system.



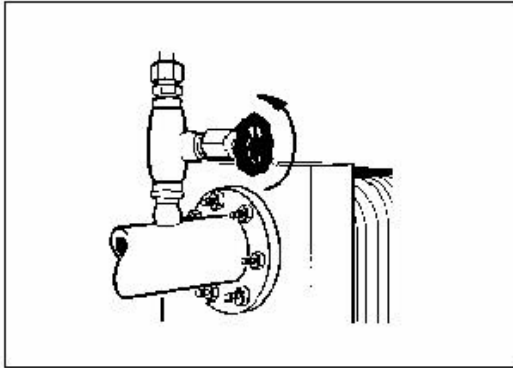
Before starting any pump, check whether instructions exist telling you which pump should be started first.

Check that the valve between the pump and the apparatus controlling the flow rate of the system which you are about to start up is closed.

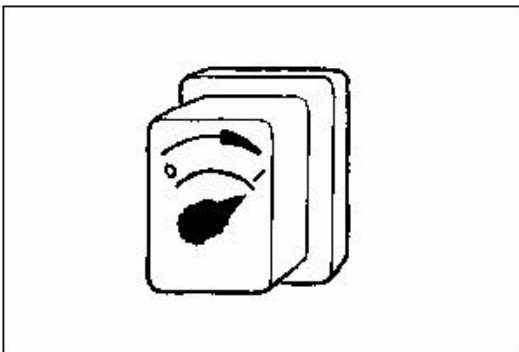


Check that the valve at the exit, if there is one, is fully open.

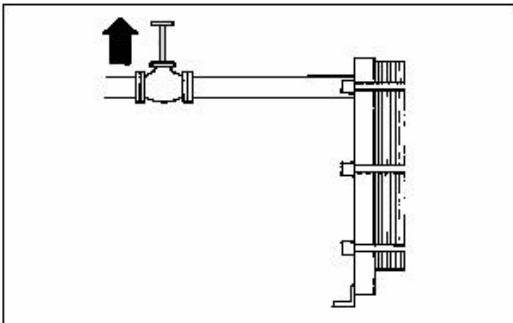
Starting Up (Cont'd)



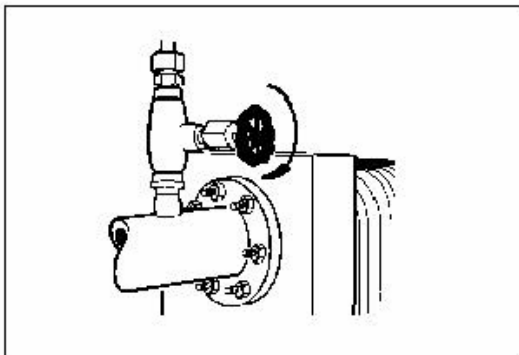
Open the vent.



Start the pump.



Open the valve slowly.



When all air is out, close the vent.
Repeat the procedure for the other media.

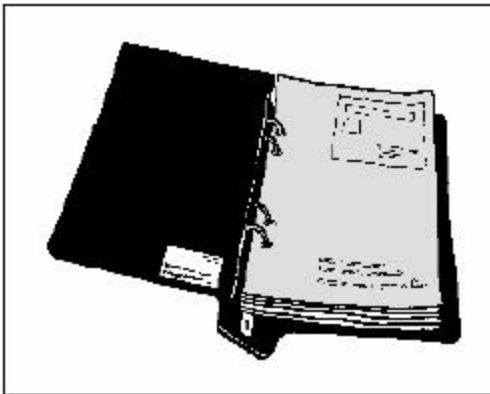
Unit in Operation

Any adjustment of the flow rates required to maintain correct temperatures or pressure drops should be made slowly in order to prevent shocks to the system.

Problems in keeping up the performance of the heat exchanger may be caused by a change of some of the temperature conditions, the heat load or by fouling. As long as the apparatus is operating to satisfaction, it should be left without any interference.

Shut-Down

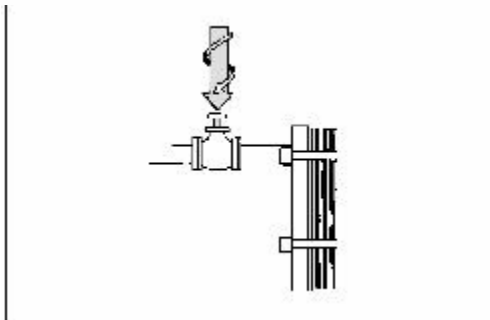
If the heat exchanger is going to be shut-down, or if for any reason the pumps are to be stopped, the following procedure should be followed.



First establish whether instructions exist as to which side should be stopped first.

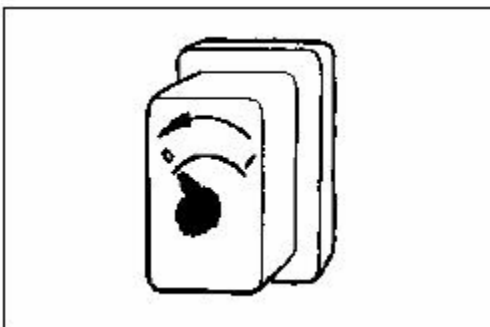
Slowly close the valve controlling the flow rate of the pump you are about to stop.

When the valve is closed, stop the pump.



Repeat the procedure for the other side.

Poor quality cooling water may be hazardous to metallic materials. Typical examples are corrosion of stainless steels and nickel alloys. If for any reason the heat exchanger is shut down for a longer period (more than a number of days), it should be drained, and depending on the media processed, it is recommended to rinse and dry it.



The Risks of not complying with the start-up and shut-down procedures

A liquid in motion in a pipe system represents a lot of energy and it must be very carefully dealt with.

Particularly when the fluid is stopped it is imperative that this is done smoothly. Valves must be operated gradually. The longer the pipes and the higher the flow rate, the more important this becomes.

NOTE! For this reason, fast-closing valves should not be used unless the pipes of the system are very short.

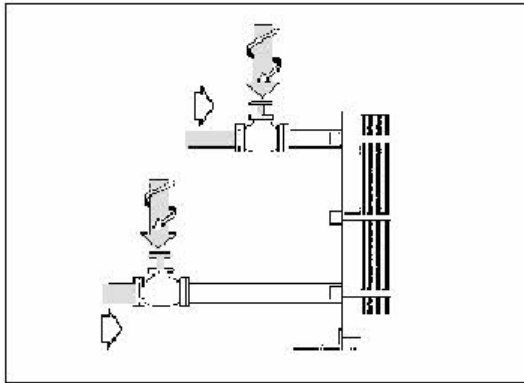
WATER HAMMER is the name given to a short lasting pressure peak traveling along the pipe as a wave at the speed of sound and resulting from a sudden deceleration of the motion of the fluid in a closed system.

Thus, it is usually related to the shutting down of a system. However, when starting up a system with open valves and empty pipes, the fluid may burst into some obstacle, like a fine mesh strainer, a flow meter or a heat exchanger, causing a sudden reduction of the flow velocity, if not a complete halt. This is the conditions of a Water Hammer.

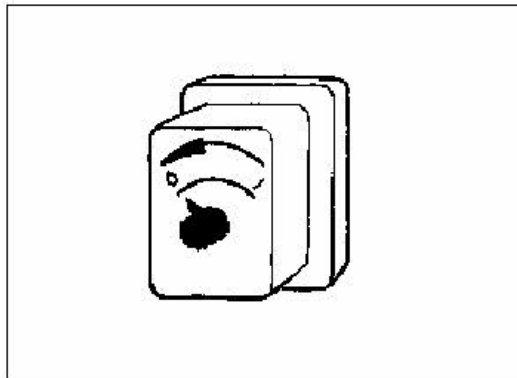
In the worst case scenario, the pressure surge caused by such a sudden stop of the motion of a fluid can be several times the normal pressure of the system.

Therefore, it is very important for the protection of the whole installation that start-ups and shut-downs are carried out with great care.

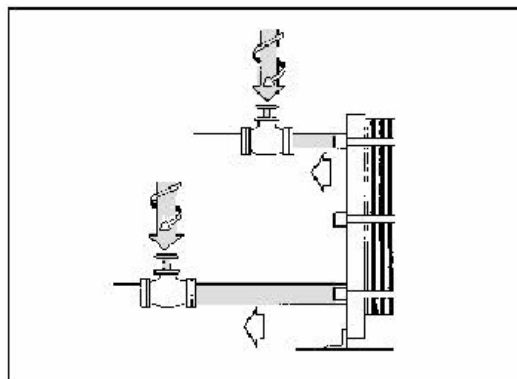
Opening



Slowly close the valves on the inlets. Shut off the inlet side closing the highest pressure first.

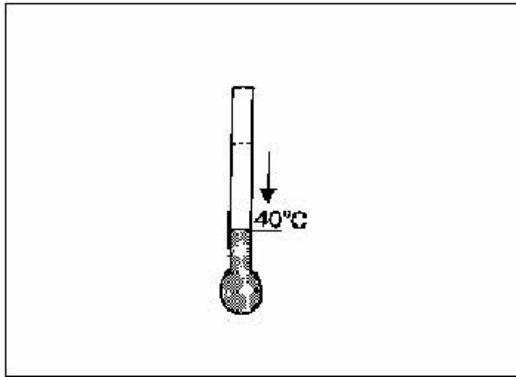


Switch off pumps.

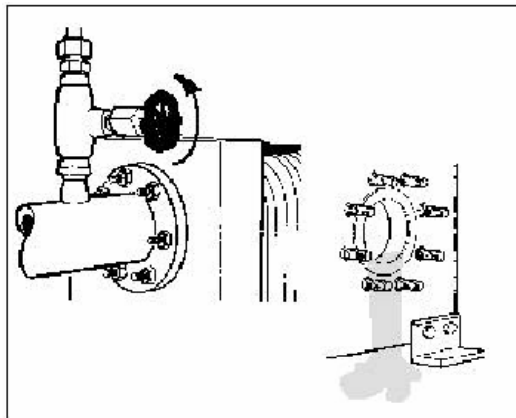


Close the valves on both outlets.

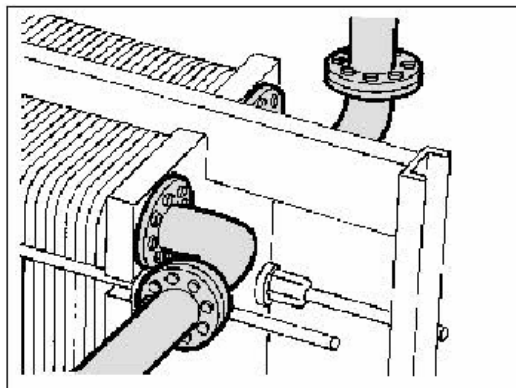
Opening (Cont'd)



If the heat exchanger is hot, wait until it has cooled down to about 104F (40C).

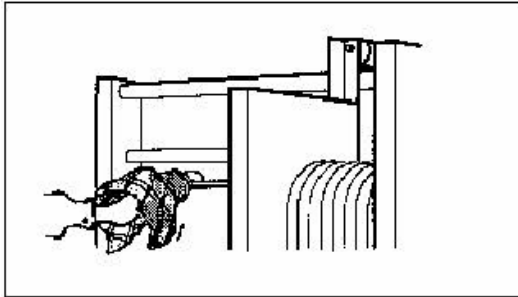


Drain.

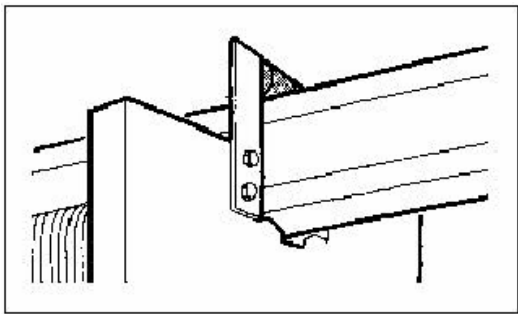


Dismantle any pipe bends connected to the movable plate so that it can be moved freely along the carrying bar.

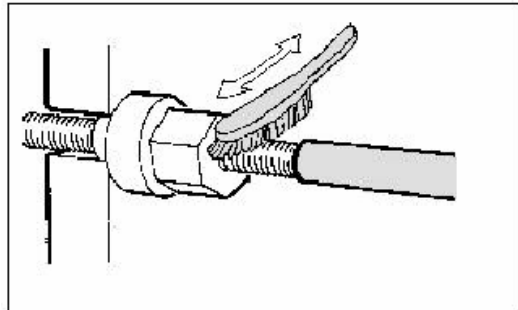
Opening (Cont'd)



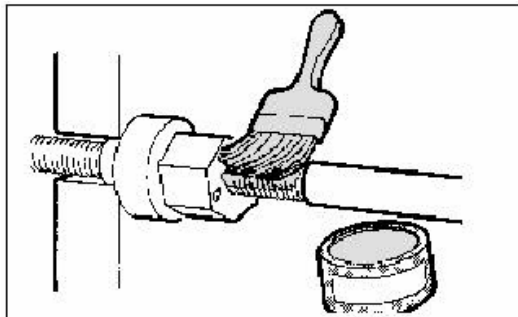
Inspect the sliding surfaces of the carrying bar and wipe clean.



Inspect pressure plate roller.

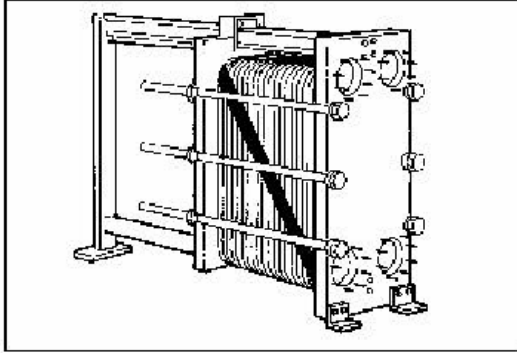


Pull back the plastic covers on the tightening bolts. Brush the threads clean with a steel wire brush.

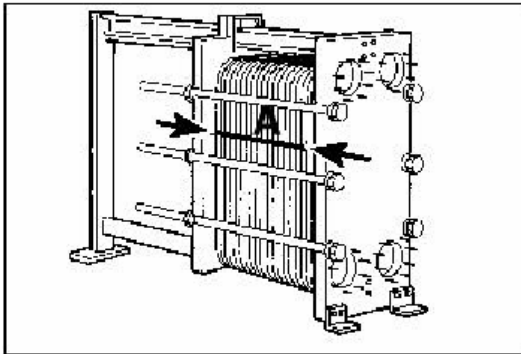


Lubricate the threads with a thin layer of grease.

Opening (Cont'd)

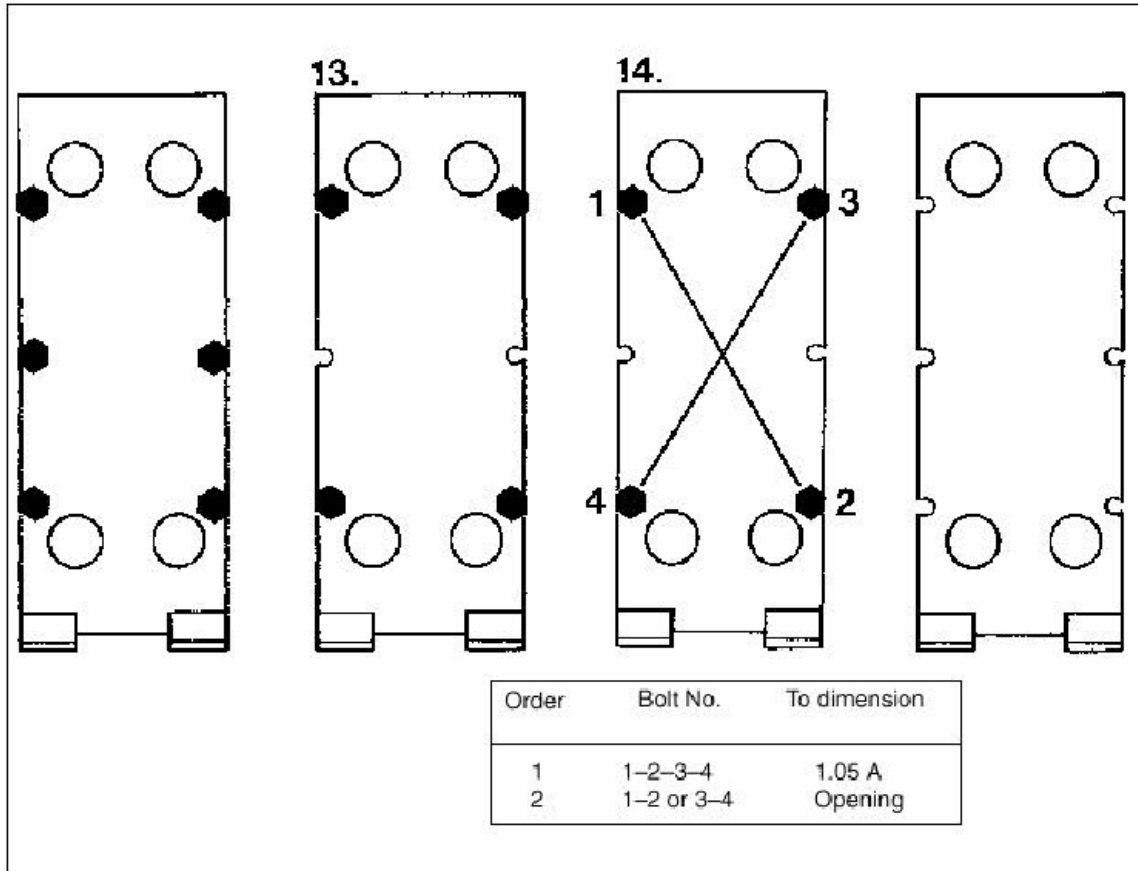


Mark the plate assembly by drawing a diagonal line as shown, or number the plates in order.



Measure and note down the "A" dimension.

Opening PHE Models: 6 Tightening Bolts

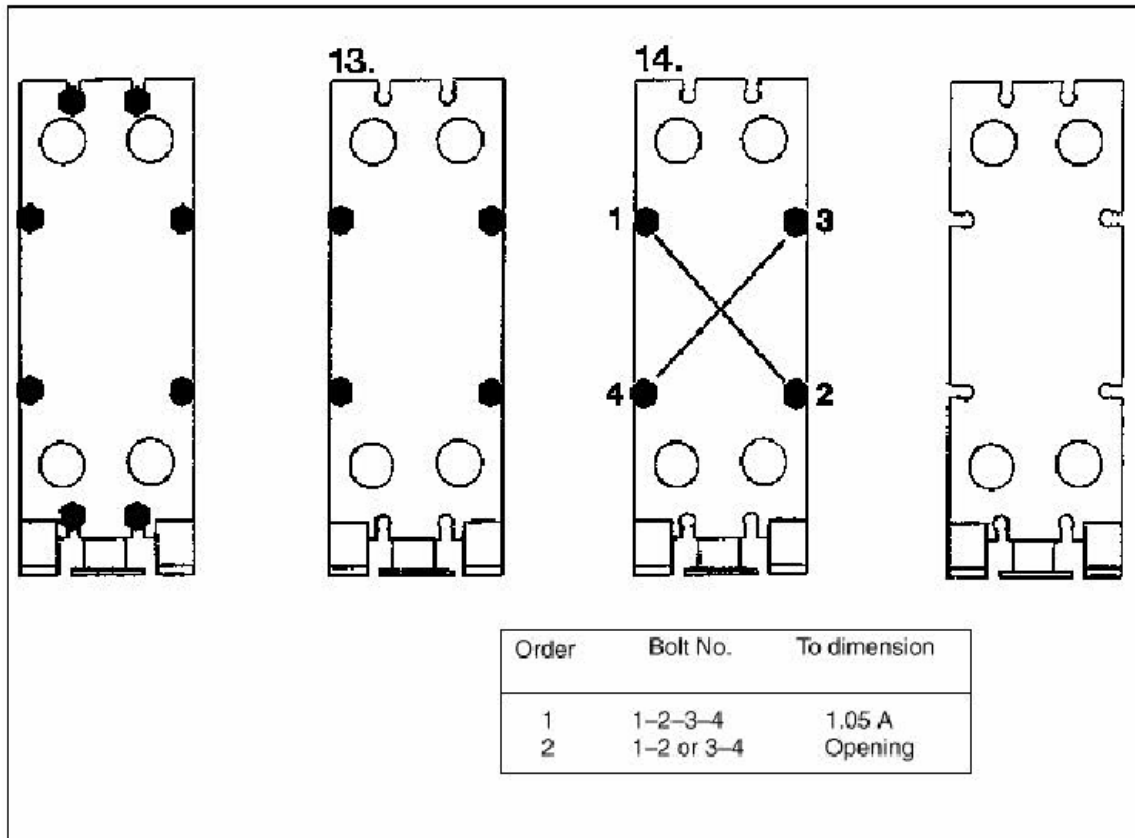


Bolts which are not fitted with bearing boxes are loosened and removed.

The pairs of bolts that are fitted with bearing boxes are opened alternately and diagonally as shown in the figure above.

Skewing of the pressure plate during opening must not exceed 10mm (2 turns per bolt) across the width and 25mm (5 turns per bolt) vertically.

Opening PHE Models: 8 Tightening Bolts

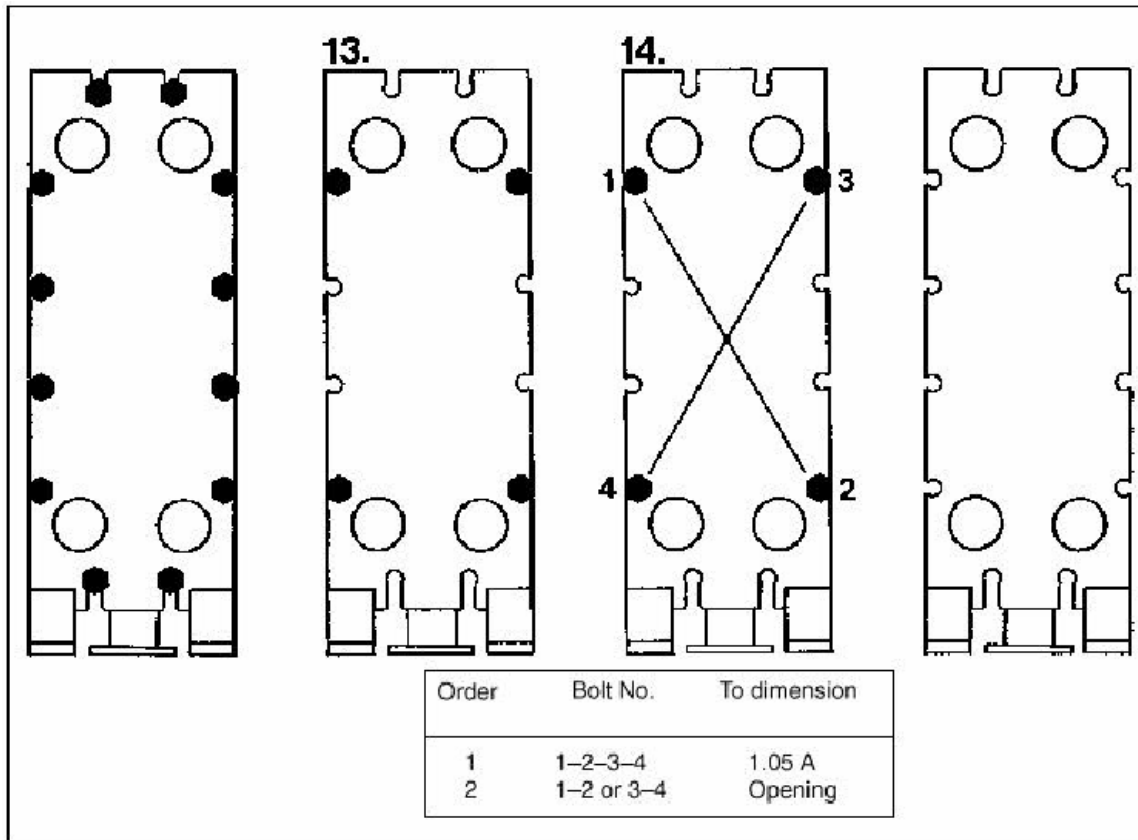


Bolts which are not fitted with bearing boxes are loosened and removed.

The pairs of bolts that are fitted with bearing boxes are opened alternately and diagonally as shown in the figure above.

Skewing of the pressure plate during opening must not exceed 10mm (2 turns per bolt) across the width and 25mm (5 turns per bolt) vertically.

Opening PHE Models: 12 Tightening Bolts

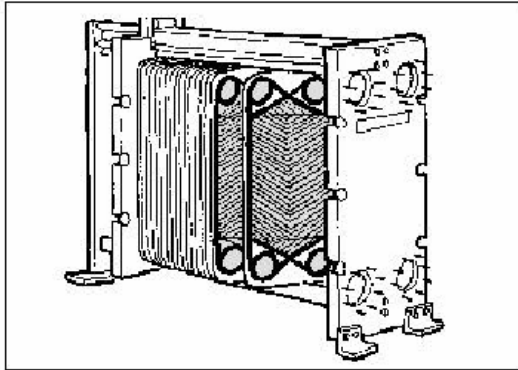


Bolts which are not fitted with bearing boxes are loosened and removed.

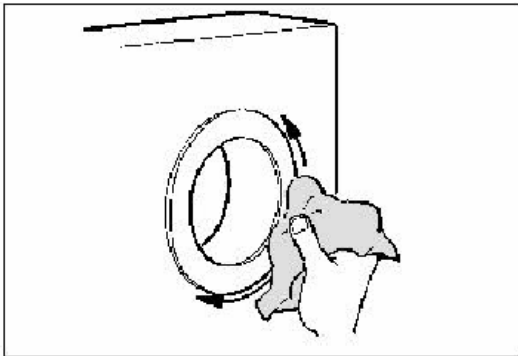
The pairs of bolts that are fitted with bearing boxes are opened alternately and diagonally as shown in the figure above.

Skewing of the pressure plate during opening must not exceed 10mm (2 turns per bolt) across the width and 25mm (5 turns per bolt) vertically.

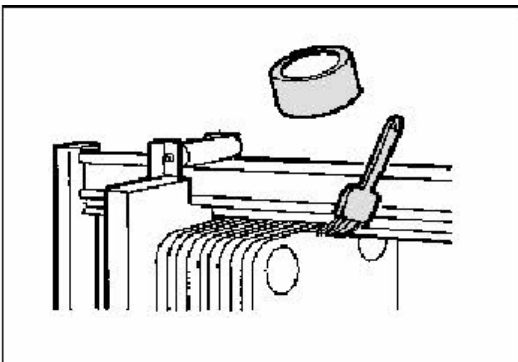
Closing



Check that all the sealing surfaces (i.e. surfaces in contact with the heat transfer medium) are clean.

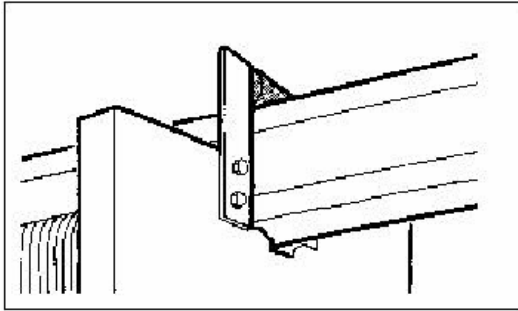


Check that the ring gaskets, when fitted in connections, are in position and are in good condition.



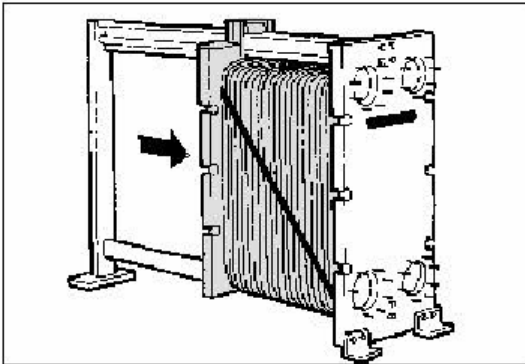
Clean and lubricate the sliding surfaces of the carrying bar.

Closing (Cont'd)

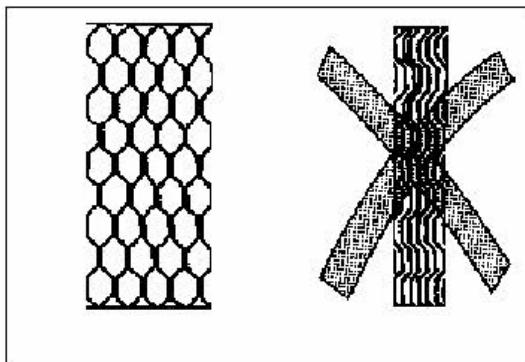


Inspect the pressure plate roller.

Check against the plate arrangement drawing (located at the back of this manual) to make sure that the plates are hanging in the correct order.

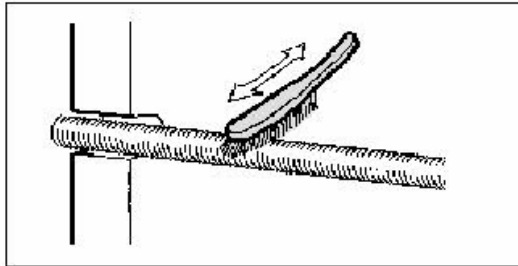
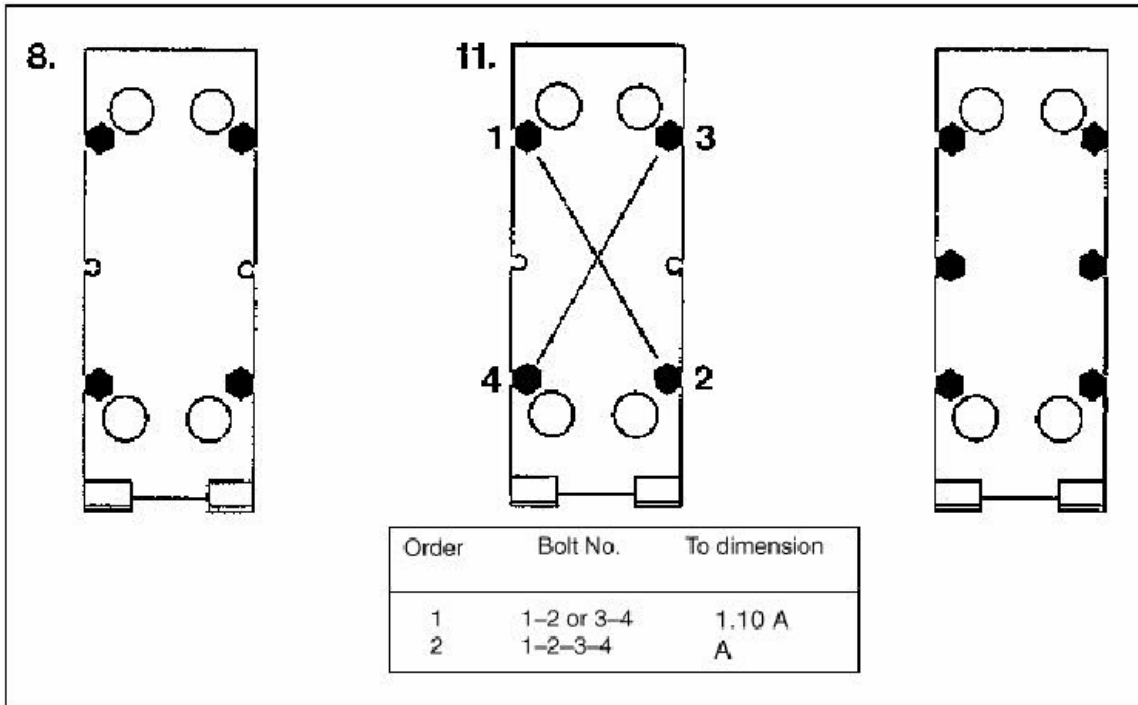


Press the plate assembly together. If the plate pack was marked on the outside double check the plate sequence.



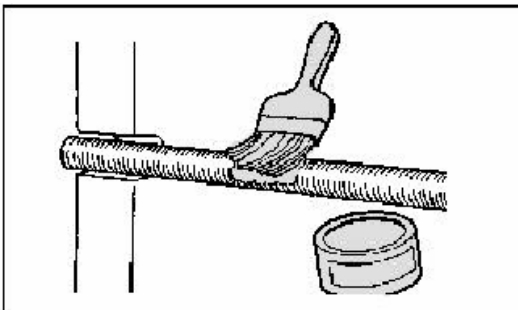
Make sure the plates are correctly assembled. The edges should form a "honeycomb" pattern.

Closing PHE Models: 6 Tightening Bolts



Place the bolts that are fitted with bearing boxes in position.

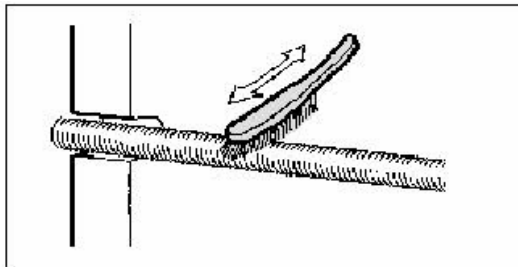
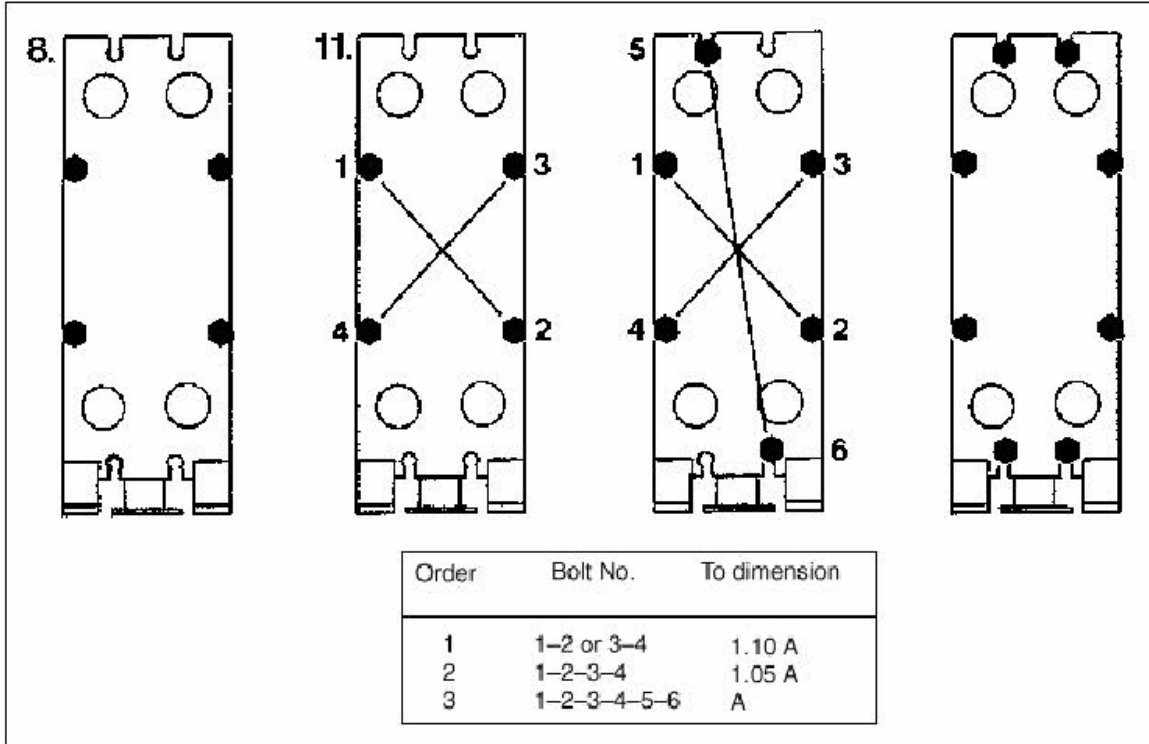
Brush the threads of the bolts clean using a steel wire brush.



Lubricate the threads with a thin layer of grease.

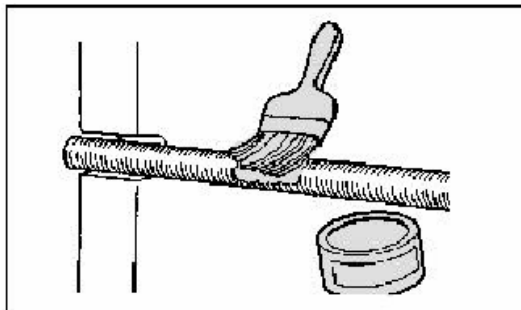
Tightening is carried out alternately and diagonally as shown on the figure above.

Closing PHE Models: 8 Tightening Bolts



Place the bolts that are fitted with bearing boxes in position.

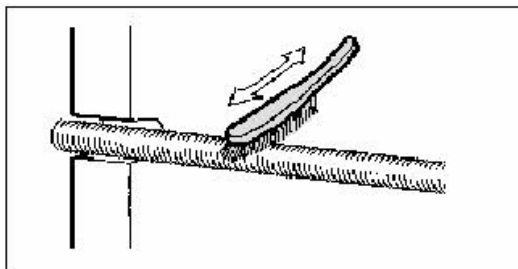
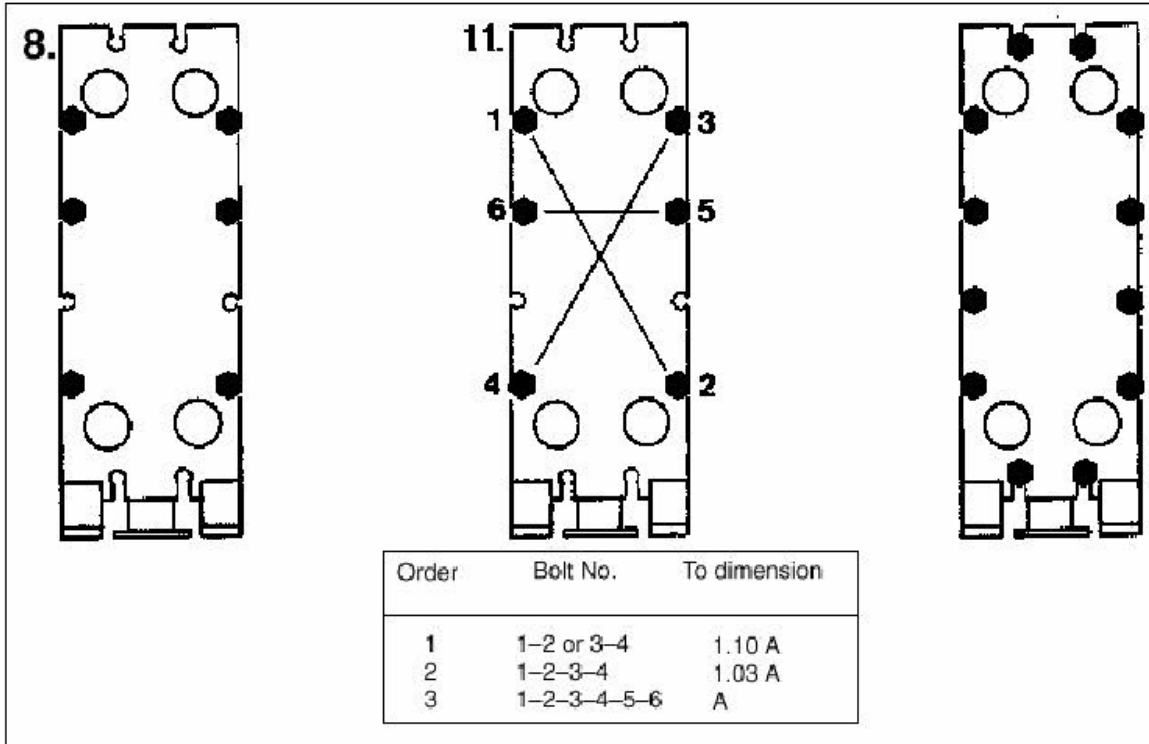
Brush the threads of the bolts clean using a steel wire brush.



Lubricate the threads with a thin layer of grease.

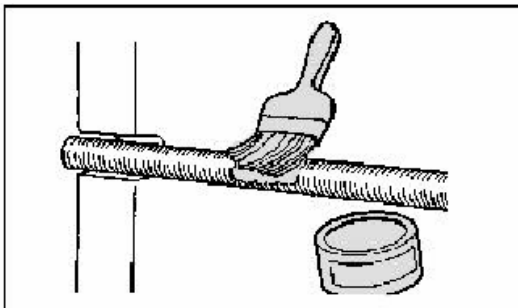
Tightening is carried out alternately and diagonally as shown on the figure above.

Closing PHE Models: 12 Tightening Bolts



Place the bolts that are fitted with bearing boxes in position.

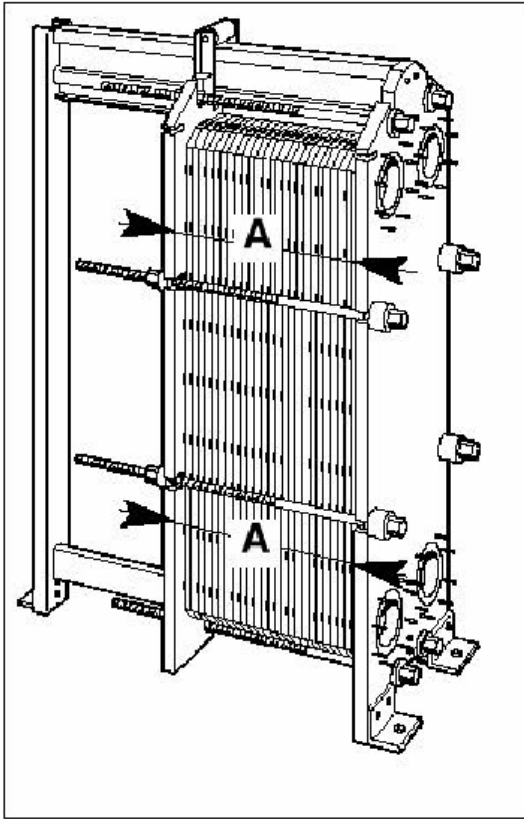
Brush the threads of the bolts clean using a steel wire brush.



Lubricate the threads with a thin layer of grease.

Tightening is carried out alternately and diagonally as shown on the figure above.

Closing



Check the “A” dimension during tightening next to the positions of the tie rods being used. Skewing of the pressure plate during tightening must not exceed 10 mm (2 turns per bolt) across the width and 25 mm (5 turns per bolt) vertically.

Nominal plate pack length “A” can be exceeded in exceptional cases. The tightening can be stopped at the following dimensions:

Plate pack length/plate length	Plate pack length
>4mm	A + 1%
>3mm <4mm	A + 1.5%
<3mm	A + 2%

NOTE!

When a pneumatic tightening device is used, it should be set at the maximum torque according to the table on the next page. Dimension “A” must, however, still be measured during tightening.

Closing (Cont'd)

Max tightening torque

Bolt size	Bolt with bearing box		Bolt with washers	
	Nm	Kpm	Nm	Kpm
M24			450	45
M30			900	90
M39	1300	130	2000	200
M48	2100	210	3300	330

If dimension "A" is not reached with application of maximum tightening torque:

Check the number of plates and dimension "A".

Check that all the nuts and bearing boxes are running freely. If not, clean and lubricate or replace.

Fit all the bolts and tighten alternately.

When the bolts are tightened by hand using a wrench, the tightening moment is estimated.

Place the other bolts in position.

Inspect the washers.

When fully tightened, the bolts should all be equally tensioned.

The difference between the plate pack lengths measured at adjacent bolts should not exceed:

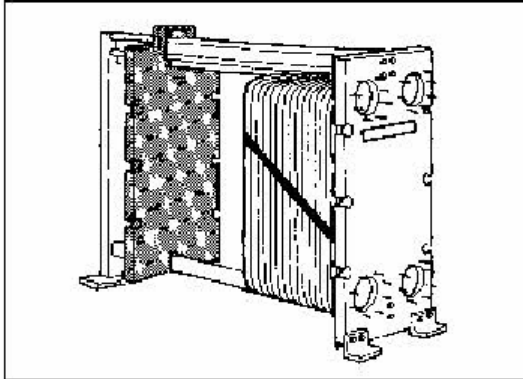
- 2 mm when dim "A" is <1000 mm
- 4 mm when dim "A" is >1000mm

The plate pack length at all bolts must not differ by more than 1%

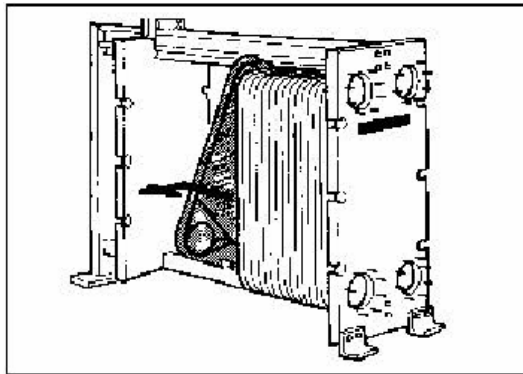
If the unit does not seal fully, it can be over-tightened to a dimension of "A" - 1% however, the maximum tightening torque must not be exceeded.

Removal and Insertion of

Plates Removal of plates

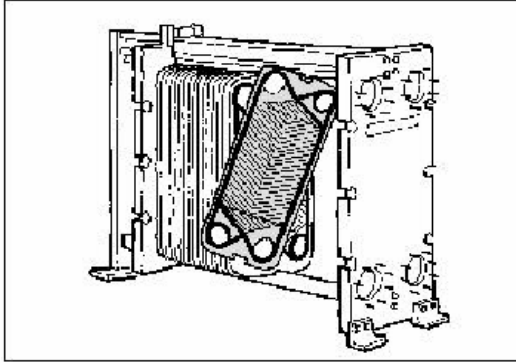


Push the movable plate against the support column.



Remove the plates.

Insertion of Plates



Hang the plates with their backs (the side without gasket) towards the movable plate.

Read the Plate Arrangement at the back of this manual to determine the correct order of the plates.

CAUTION!

Chlorine as growth inhibitor

Chlorine, commonly used as growth inhibitor in cooling water systems, reduces the corrosion resistance of stainless steels (including Hastelloy, Incoloy, Inconel and SMO).

Chlorine weakens the protection layer of these steels making them more susceptible to corrosion attacks than they otherwise should be. It is a matter of time of exposure and concentration. In every case where chlorination of non-titanium equipment cannot be avoided, WCR must be consulted.

Contact the following address: www.WCRhx.com or Sales@WCRhx.com

NOTE! Titanium is not affected by chlorine.

Cleaning gross fouling

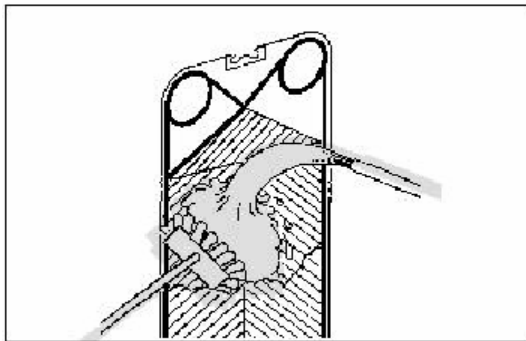


Seaweeds

Wood chips / fibers Mussels

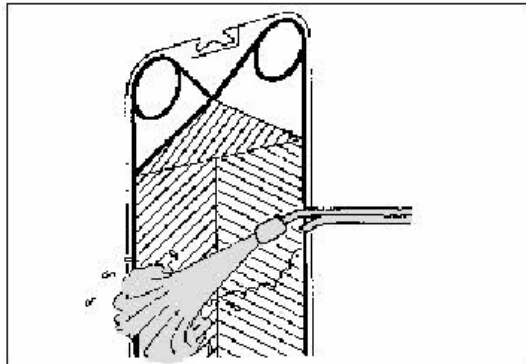
Barnacles

Mechanical cleaning after opening



Soft brush and running water

NOTE! Avoid gasket damage.



High pressure hose

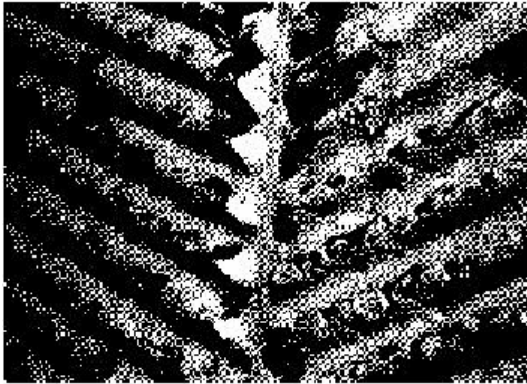
Back-flushing of the unopened heat exchanger can sometimes be sufficiently effective.

NOTE!

Under no circumstances should hydrochloric acid be used with stainless steel plates. Water of more than 300 ppm Cl may not be used for the preparation of cleaning solutions. It is very important that carrying bars and support columns in aluminum are protected against chemicals.

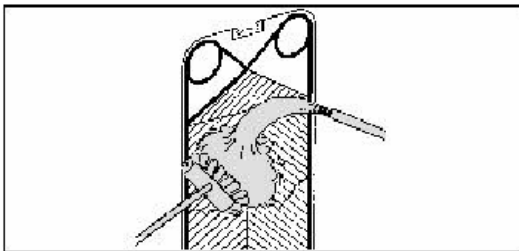
Cleaning

Biological Growth - Slime



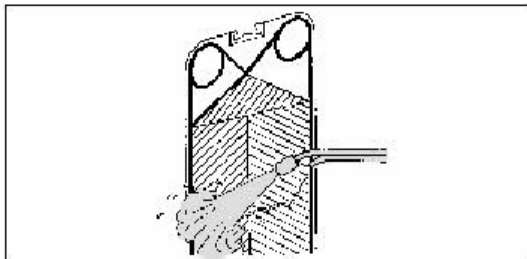
Bacteria Nematodes Protozoa

Mechanical cleaning after opening



Soft brush and running water

NOTE! Avoid gasket damage.



High pressure hose

Chemically clean using alkaline cleaning agents:

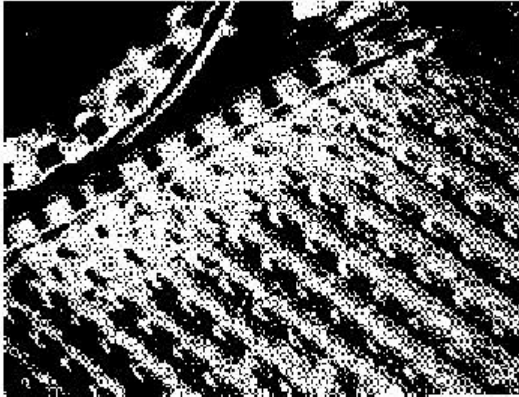
- Sodium hydroxide
- Sodium carbonate

Cleaning effect can be considerably increased by the addition of small quantities of hypochlorite or agents for the formation of complexes and surfactants.

Concentration max 4% Temperature max 176°F (80°C).

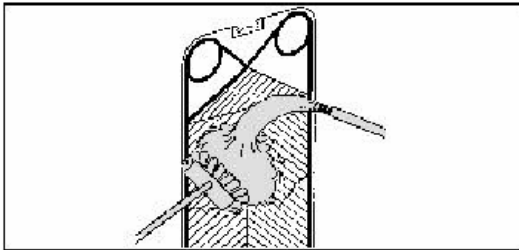
NOTE! Under no circumstances should hydrochloric acid be used with stainless steel plates. Water of more than 300 ppm Cl may not be used for the preparation of cleaning solutions. It is very important that carrying bars and support columns in aluminum are protected against chemicals.

Cleaning Incrustation - Scaling



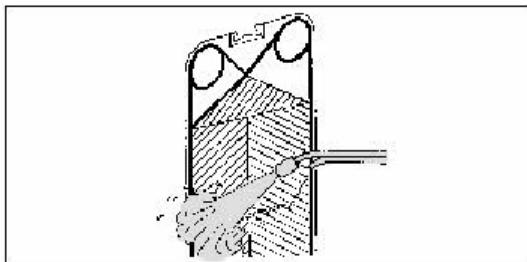
Calcium carbonate
Calcium sulphate
Silicates

Mechanical cleaning after opening



Soft brush and running water

NOTE! Avoid gasket damage.



High pressure hose

Chemically clean by using:

Nitric acid Sulfuric acid
Citric acid Phosphoric acid
Complexing agents (EDTA, NTA)
Sodium polyphosphates

Concentration max 4% Temperature max 140°F (60°C).

NOTE! Under no circumstances should hydrochloric acid be used with stainless steel plates. Water of more than 300 ppm Cl may not be used for the preparation of cleaning solutions. It is very important that carrying bars and support columns in aluminum are protected against chemicals.

Cleaning Sediment



Corrosion products

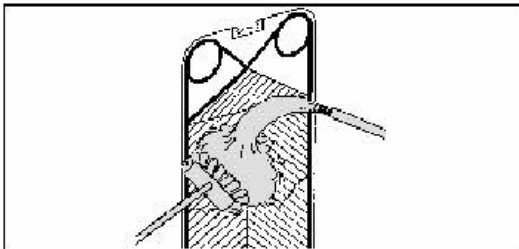
Metal oxides

Silt

Alumina

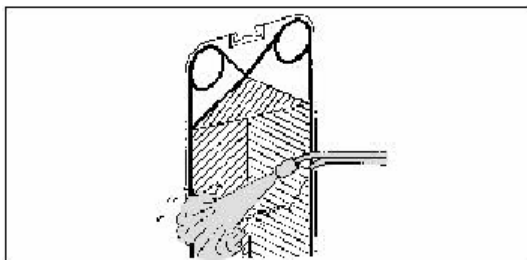
Diatomaceous organisms and their excrement of various colors.

Mechanical cleaning after opening



Soft brush and running water

NOTE! Avoid gasket damage.



High pressure hose

Chemically clean by using:

Nitric acid	Sulfuric acid
Citric acid	Phosphoric acid
Complexing agents (EDTA, NTA)	
Sodium polyphosphates	

Concentration max 4% Temperature max 140°F (60°C).

NOTE! Under no circumstances should hydrochloric acid be used with stainless steel plates. Water of more than 300 ppm Cl may not be used for the preparation of cleaning solutions. It is very important that carrying bars and support columns in aluminum are protected against chemicals.

Cleaning

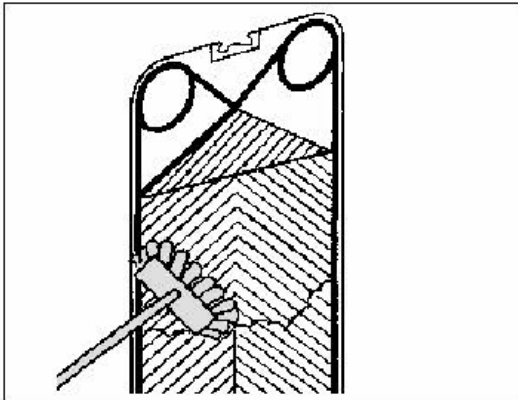
Oil residues, asphalt and fats

Oil residues

Asphalt

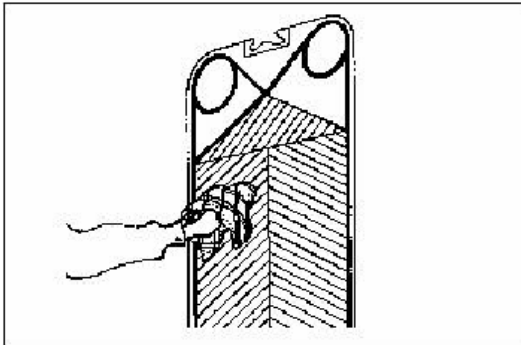
Fats

Mechanical cleaning after opening



Hydrocarbon-based deposits may be removed by using a soft brush and a Paraffinic or Naphta-based solvent (e.g. Kerosene).

NOTE! Gaskets in natural, butyl and EPDM rubber material swell in these media. Contact time should be limited to 0.5 hour.



The following solvents should not be used:

Ketones (e.g. Acetone, Methyl ethyl ketone, Methyl isobutyl ketone)

Esters (e.g. Ethyl acetate, Butyl acetate)

Halogenated hydrocarbons (e.g. Chloro-thene, Carbon tetrachloride, Freons)

Aromatics (e.g. Benzene, Toluene)

Dry with a cloth or rinse with water.

Regasketing

WCR has two types of glue – for repairs and exchange of gaskets in plates. A special glue is recommended for Viton and silicone gaskets.

Epoxy two component

A two component, heat curing epoxy glue which gives a strong joint for higher temperatures.

Future removal of gaskets usually requires heating or freezing of the joint. The shelf life is limited to approx. 1 year when stored at room temperature but can be prolonged when kept in a refrigerator.

Rubber based glue

A single component rubber based solvent adhesive. Normally used for repair work in an uncured condition.

Can be used for operating temperatures below 203°F (95°C).

For operating temperatures above 203°F (95°C) and oil coolers/heaters, the glued joints should be cured at 248°F (120°C) for one hour.

Future removal of the gasket can usually be carried out without heating of the cement joint.

The storage life at room temperature is about two years. This period can be extended after checking the glue.

WCR Regasketing Service

In addition to supplying gaskets for your plate heat exchanger, we are able to provide a Specialized Regasketing Service to fulfill your service requirements quickly and efficiently.

Our regasketing service includes chemical cleaning, crack detection and regasketing using adhesive.

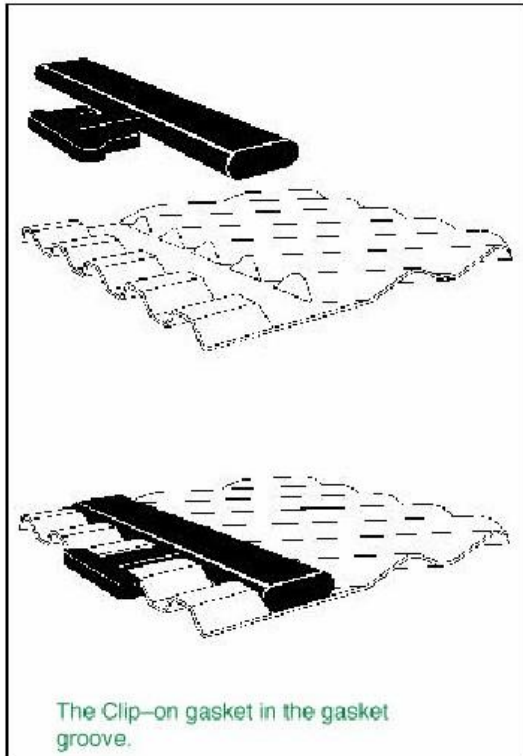
This regasketing process requires special oven curing of the cement to ensure the strongest possible bond strength between both plate and gasket, similar to the process used during manufacture. This is one reason why our service is guaranteed.

In most cases our regasketing service has proved more economical and much faster when compared with on-site regasketing methods.

For further details please contact WCR by calling 937.223.0703 or Sales@WCRhx.com.

Regasketing

The Clip-on gasket: a glue-free gasket system



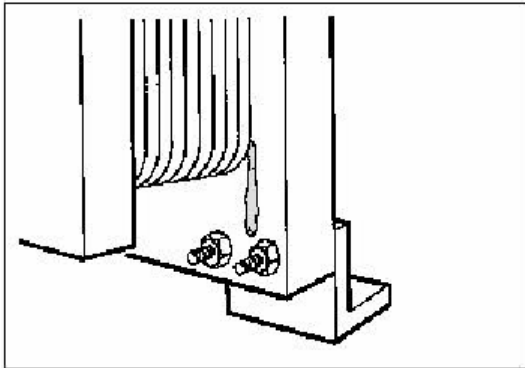
The Clip-on gasket is attached to the plate by two gasket prongs which slip under the edge of the plate to hold the gasket securely in alignment in the gasket groove.

The prongs are situated at regular intervals around the periphery of the gasket.

When the plate heat exchanger is assembled and tightened, the gasket provides a tight seal around the plate.

NOTE! Before closing of the PHE, check that the two gasket prongs are in the correct position.

Leakage between Plate Pack and Frame

**Action**

Mark with a felt tip marker, or similar, the area where the leakage seems to be and open the heat exchanger.

Investigate the gasket condition of the end plate and the connection if applicable, look for dislocation, foreign objects, scars and other damage to the gasket surfaces.

Check the surface of the pressure plate for unevenness, foreign objects sticking to it, etc. that might spoil the joint between the gasket and the adjacent surface.

Check the plate itself for cracks or holes.

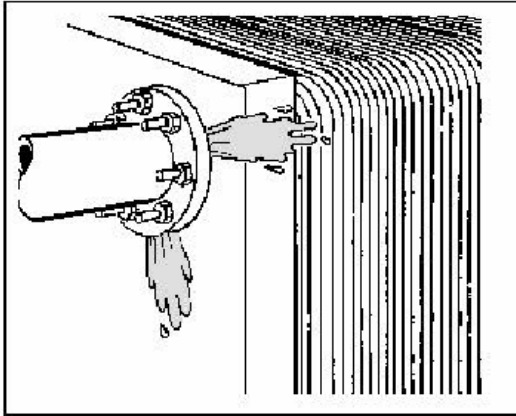
Correction

Relocate the gasket
 Remove foreign matter
 Replace damaged gasket
 Replace connection lining if applicable

Remove anything disturbing the joint between the gasket and pressure plate surfaces.

A perforated end plate must be replaced.

Leakage between Flange and Frame

**Action**

Disconnect the flange and look for misalignment between flange and connection, dislocation or damaged gaskets, foreign objects on the surface of the gasket or flange

Correction

Rearrange the pipe in order to eliminate stress and to correct alignment

Relocate gasket

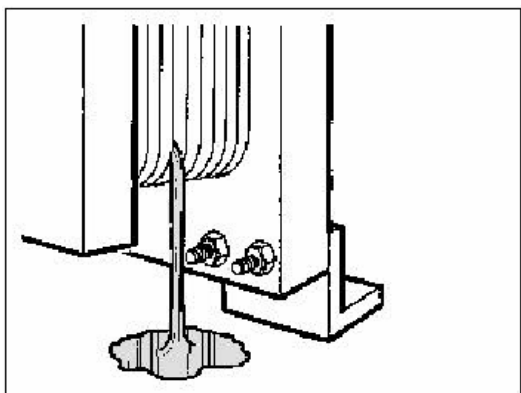
Replace damaged gasket

Replace connection lining if applicable

Remove foreign matter from flange and gasket

Reassemble taking care to avoid misalignment

Leakage between Plates to the Outside



NOTE! On a plate heat exchanger specially designed for high temperature duties, extreme sudden temperature drops may cause a temporary leakage. A typical example is a sudden shutting-off of the hot medium flow. The heat exchanger will normally seal again as soon as the temperatures of the apparatus have stabilized.

Action

Mark the leakage area with a felt tip marker on the two plates next to the leakage. Check and note the length of the plate pack between the inside of the head plate and the inside of the movable plate and then open the heat exchanger.

Check for loose, dislocated or damaged gaskets.

Check for plate damage in the area. Check plate pack length against drawing to see if possible plate or gasket damage could be caused by over-tightening of the plate pack, or if the leakage is simply caused by insufficient tightening.

Correction

Relocate gasket
Re-cement loose gasket
Replace damaged gasket

A damaged plate must, in most cases, be taken out for repair or replacement. If it is a regular flow plate with 4 holes, take the damaged plate and the 4 hole plate just in front or just behind it out of the plate pack. The heat exchanger can now be reassembled and put back in service provided the plate pack is tightened to a new measurement, which is equal to the one on the drawing reduced by two times the space required per plate. The small reduction of the heat transfer area is normally of no importance, at least not for a short period of time.

Insufficient tightening must be corrected.

Leakage between Plates to the Outside (Cont'd)

Action

Check hanger recess at both plate ends for deformations which could cause misalignment between plates

Make sure that the plates are hanging correctly as A - B - A (see Section 4)

Check for perforation of the plate (corrosion).

Correction

Damaged hanger recesses must be repaired if possible or the plate replaced. For temporary arrangement with reduced number of plates, see paragraph above.

Incorrect sequence of plates must be corrected. Make sure that no plate has been damaged before reassembling the plate pack

Perforated plates must be replaced. For a temporary solution, see above paragraphs.

Mixing of Media**Action**

Check that the piping is connected to the heat exchanger at correct locations.

Open the lower connection on one side, raise pressure on the other side and by looking through the open connection try to detect any liquid from the pressured side leaking in, and if so, approximately how far into the plate pack the leakage is located. If no leakage is detected, the reason for the mixing of media must be sought elsewhere.

If a leakage was detected, note the position of the leakage along the plate pack and then open the plate heat exchanger.

Before starting on the plates themselves, check that the corner areas between the ring and the field gaskets are clear and that the leakage slots are open. This ensures that any leakage is out of the plate heat exchanger and in to the atmosphere. Therefore, no pressure can build up to force the media across the gasket sealing off the other liquid.

If it has not been possible to locate the leakage as described in paragraph 2 above, it will be necessary to check each single plate for possible perforations using any of the following methods:

- put a strong light behind the plate and watch for light coming through fine holes or cracks
- use a magnifying glass to check area
- use a chemical penetrant after having cleaned the plates well

Correction

Relocate piping to correct connections.

All deposits or material which can block the free exit from the area must be removed. If the leak channels of the gasket have been destroyed, they must be reopened with a suitable tool, or the gasket replaced.

Plates with holes are, generally speaking, destroyed and should be replaced. For a temporary solution, reduce the number of plates. See "Leakage between Plates to the Outside."

Pressure Drop Problems

Pressure drop has increased.

Action

Check that all valves are open including non-return valves. Measure the pressure just before and just after the heat exchanger and the flow rates. For viscous media a membrane manometer with a diameter of at least 30mm should be used. Measure or estimate the flow rate if possible. A bucket and a watch showing seconds may be sufficient for small flow rates. For larger flow rates, some type of flow meter is required.

Compare the pressure drop observed with the one specified for the actual flow rate.

If the pressure drop is higher than specified, the temperature program should also be checked.

If the thermometer readings correspond to those specified, the heat transfer surface is probably clean enough, but the inlet to the heat exchanger may be clogged by some objects.

If the thermometer readings are not corresponding to the specified, heat transfer is obviously dropping below specifications because of deposits on the heat transfer surface, which at the same time also increase the pressure drop since the passage becomes narrower.

If the pressure drop is corresponding to the specifications there is no need for any action.

If the pressure drop is lower than specified, the pump capacity is too small or the observation is wrong.

Correction

See next paragraph

Open the apparatus and take out whatever is clogging the passage or use the back- flush system, if there is one, to rinse out the deposits.

If a Cleaning-In-Place System is available, follow the instructions and use it to wash out the deposits. If not, open the apparatus and clean the plates.

See pump instruction manual.

Heat Transfer Problems

The heat transfer capacity is dropping.

Action

Measure temperatures and flow rates at inlets and outlets on both media, if possible.

At least on one of the media, both temperatures and the flow rate must be measured.

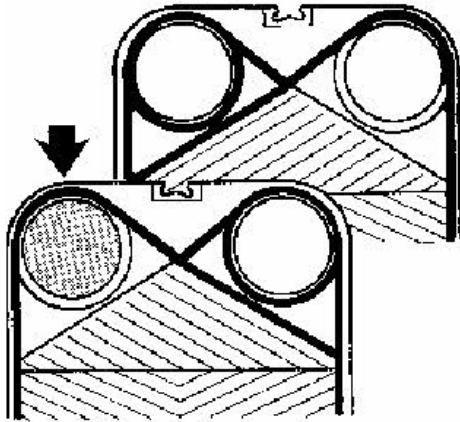
Check to see if the transferred amount of heat energy corresponds to the specifications.

If great precision is important, it will be necessary to use laboratory thermometers with an accuracy of 0.1°C, and also to use the best equipment available for flow measurement.

Correction

If the heat transfer capacity of the apparatus has dropped below specified values, the heat transfer surface must be cleaned. Either use the Clean-In-Place System or open the heat exchanger for visual inspection and manual cleaning.

The Partition Plate - *For Special Cases Only*



If for instance the thermal program requires that one source of media be lead through more than one group of plates in the plate pack, there will be heat transfer plates with fewer than four holes. In order to prevent the plate from collapsing under the differential pressure, un-punched corners on large plates require extra strong support while the smaller plates are sufficiently strong as stamped.

The extra support is provided by the partition plate - approximately the size of a channel plate - made of about 15mm thick carbon steel, solid at the corners in need of support, and with lines holes at those where a free passage is required.

The partition plate is suspended from the carrying bar. Where partition plates are required, there will be one at every turning point in the multi-grouped plate package.

NOTE!

Safety Shrouds

Depending on the nature of your process or circumstances related to it, you may be responsible under the law or other regulations for adequate protective measures at your plant. WCR provides safety shrouds for all of our Plate Heat Exchangers for the prevention of possible harmful effects caused by a sudden leakage from the plate package.



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