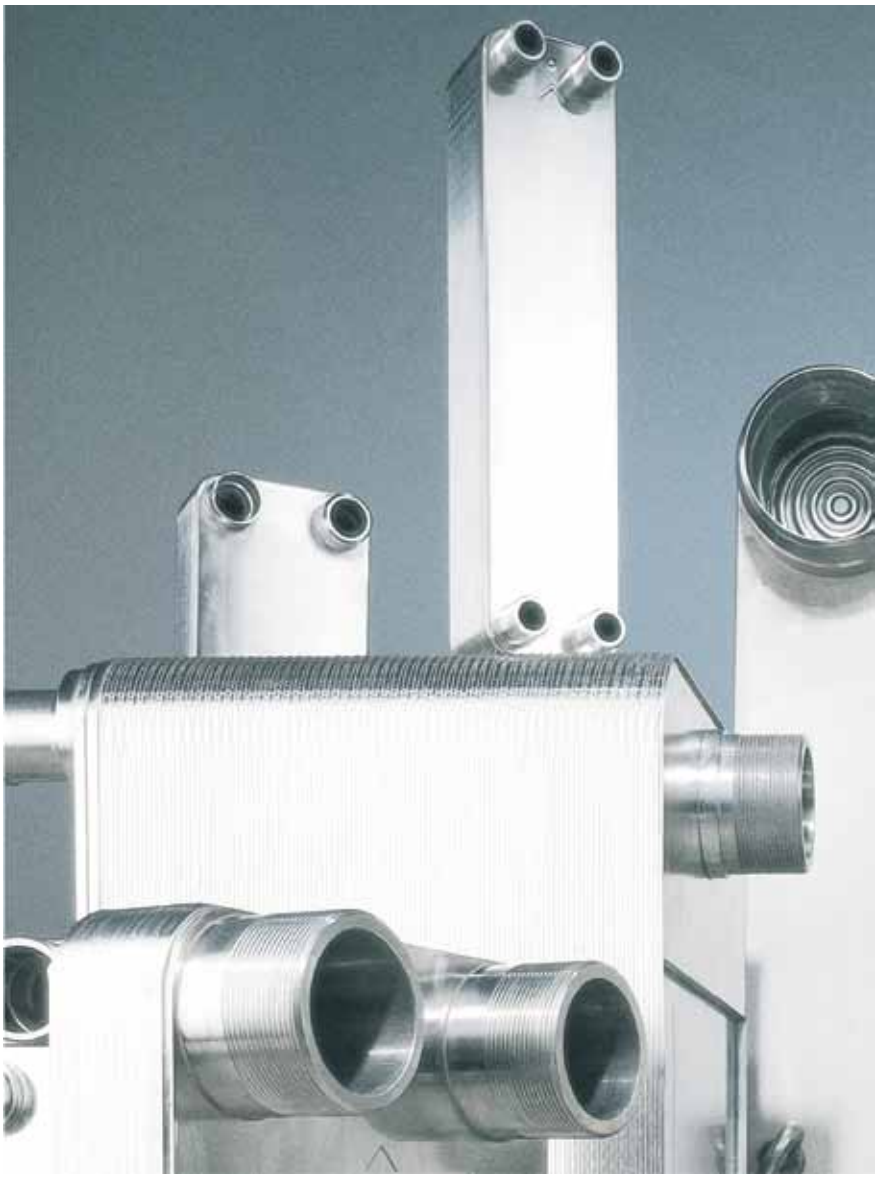
BRAZED PLATE HEAT EXCHANGERS

DHT
COMFORT SOLUTIONS



INSTALLATION AND MAINTENANCE MANUAL

DIVERSIFIED HEAT TRANSFER, INC. • Website: www.dhtnet.com • 1-800-221-1522

INSTALLATION AND MAINTENANCE FOR BPHEs

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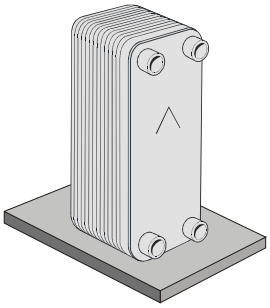
Installation and Maintenance Manual For BPHEs

Mounting

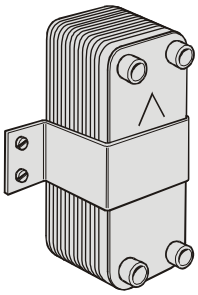
Never expose the unit to pulsations or excessive cyclic pressure or temperature changes. It is also important that no vibrations are transferred to the heat exchanger. If there is a risk of this, install vibration absorbers. In the case of larger connection diameters, we advise you to use an expanding device in the pipeline. Use e.g. a rubber mounting strip as a buffer between the BPHE and the mounting clamp.

In single-phase applications such as e.g. water to water or water to oil, the mounting direction has little or no effect on the performance of the heat exchanger, but in two-phase applications, the orientation of the heat exchanger becomes very important. In two-phase applications, DHT's BPHEs should be mounted vertically, with the arrow on the front plate pointing upwards.

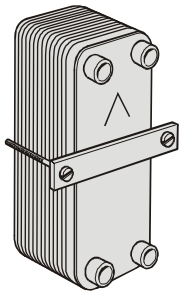
Several mounting suggestions for DHT BPHEs are shown below. Mounting stud bolts, in different versions and locations, are available on the BPHEs as an option.



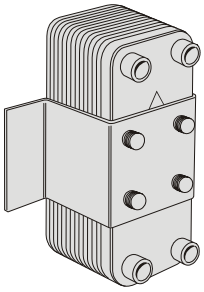
Supported from the bottom



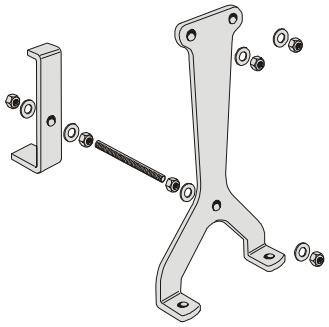
Sheet metal bracket (rubber insert between bracket and exchanger)



Crossbar and bolts (rubber insert between the crossbar and exchanger)



Equipped with mounting stud bolts on the front or back cover plate



Support legs are available for some BPHEs

For smaller BPHEs it is also possible to mount the unit by simply suspending it from the pipes/ connections.

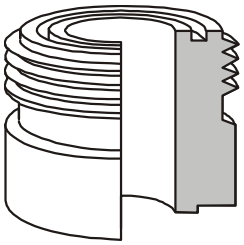
Connections

General

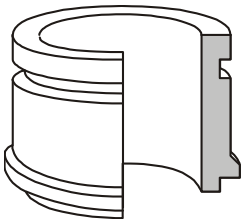
All connections are brazed to the heat exchanger in the general vacuum brazing cycle, a process which gives a very strong seal between the connection and the cover plate. However, take care not to join the counterpart with such force that the connection is damaged.

Depending on application, there are a lot of options available for the connections, different versions and locations, e.g. Compac® flanges, SAE flanges, Rotalock, Victualic, threaded connections and welding connections. It is important to have the right international or local standard of connection, as they not always are compatible.

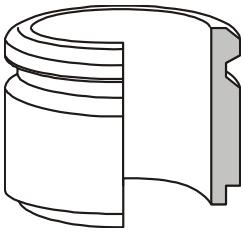
Rotalock Connections



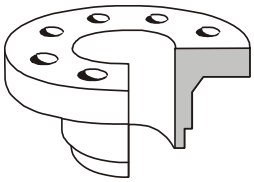
Victualic Connections



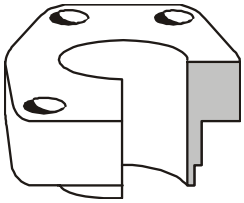
Welding Connections



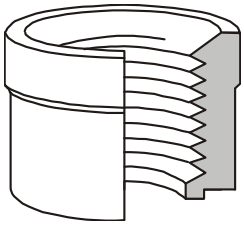
Flanges of DIN Type, Compac® flanges

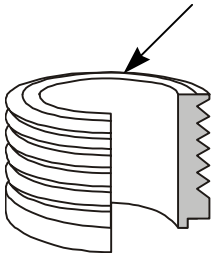


Flanges of SAE Type



SAE O-Ring Connections





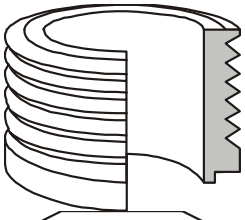
Some connections have an external heel. The purpose of the heel is to simplify the pressure and leakage testing of the BPHE in production.

Some connections are equipped with a special plastic cap to protect the threads and sealing surface of the connection and to prevent dirt and dust from entering the BPHE. This plastic cap should be removed with care, in order not to damage the thread or any other part of the connection. Use a screwdriver, pliers or knife.

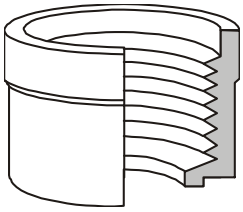
Threaded connections

Threaded connections can be female or male of well-known standards such as, ISO-G, NPT and ISO 7/1. The exterior can also be hexagonal which is shown below.

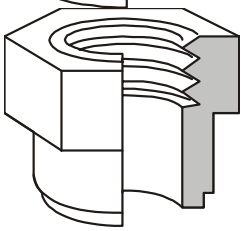
Externally Threaded Connections (Male)



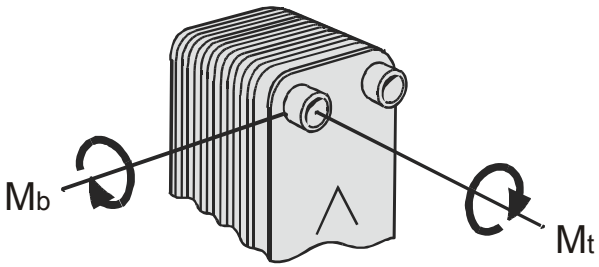
Internally Threaded Connections (Female) of Standard Type



Internally Threaded Connections (Female) with a Hexagonal Exterior



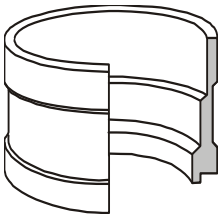
Allowable Connection Loads for Pipe Assembly Conditions



The maximum allowable connection loads given below are valid for low-cycle fatigue. The maximum allowable connection loads given below are valid for low cycle fatigue. If high cycle fatigue is involved special analysis should be made

Pipe Size	Shear Force	Tension Force	Bending Moment	Torque
inches	FS (lbs)	FT (lbs)	MB (ft.lb)	MT (ft.lb)
1/2	1573.6	1124	29.2	51.1
3/4	5395.2	1124	29.2	167.9
1	5170.4	1798.4	65.7	226.3
1 1/4	6519.2	2922.4	127.75	386.9
1 1/2	7418.4	4271.2	226.3	511
2	9666.4	6069.6	372.3	876
2 1/2	20007.2	8092.8	569.4	2117
4	32820.8	18374.56	1971	5913

Soldering Connections



The soldering connections (sweat connections) are in principle designed for pipes with dimensions in mm or inches. The measurements correspond to the internal diameter of the connections. Some of DHT's soldering connections are universal, i.e. fit both the mm and inch pipes. These are denominated xxU, such as the 28U which fits both the 1 1/8" and 28.75 mm.

All BPHEs are vacuum-brazed with either a pure copper filler or a nickel-based filler. Under normal soldering conditions (no vacuum), the temperature should not exceed 1470°F (800°C). Too much heat could change the material structure resulting in internal or external leakage at the connection. Because of this we recommend that all soldering is made with silver solder containing min. 45% silver. This type of solder has a relatively low soldering temperature and high moistening and fluidity properties.

When soldering flux is used in order to remove oxides from the metal surface. This property makes the flux potentially very aggressive. Consequently, it is very important to use the correct amount of flux. Too much, might lead to severe corrosion, so no flux should be allowed to enter the BPHE.

Soldering Procedure

The hard silver soldering procedure for all BPHE connections can be carried out without any use of cooling water, neither by dimpling under water nor e.g. water flow through the waterside of the exchanger.

1. Clean the joints to be soldered. Clean the inside of the connection on the BPHE and the outside of the pipe. Degrease the connection properly with some kind of solvent, e.g. Tri.
2. Apply flux to the inside of the connection and the outside of the pipe.
3. Center the pipe into the connection.
4. Avoid oxidation on the inside of the pipe by sending a flow of nitrogen through the pipe and the BPHE during the soldering process.
5. It is important that the connection and the pipe are evenly heated.
6. At the correct soldering temperature (1112° F) the connection has a slightly red color.
7. The first part of the collings is done by keeping the nitrogen flowing through the exchanger. The final cooling could be done with water which removes the last hardened flux on the inside and outside around the solder.

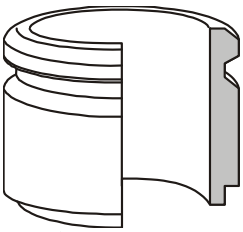
The minimal compound of silver must be at least 45%. Below you find an example of such a solder.

Tab. 2 Solder and flux

	Compound (%)				Melting range °F
	Ag	Cu	Cd	Zn	
Hard silver solder: 454 Flux: 800 F	45	15	24	16	1148-1175 1112-1472

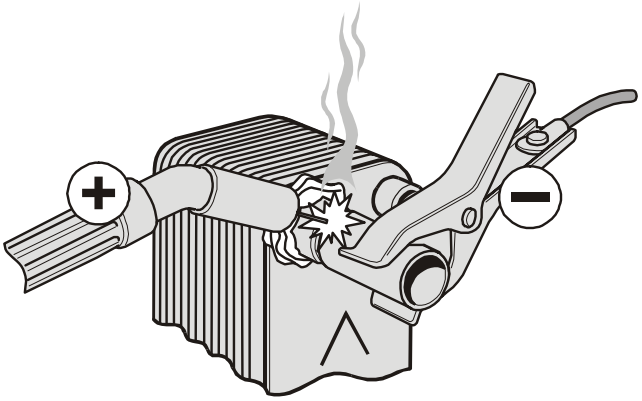
Welding Connections

Welding is only recommended on specially designed welding connections. All DHT's welding connections are executed with a 30° chamfer on top of the connection. Do not weld on pipes on other types of connections. The measurement in mm corresponds to the external diameter of the connection.



Welding Procedure

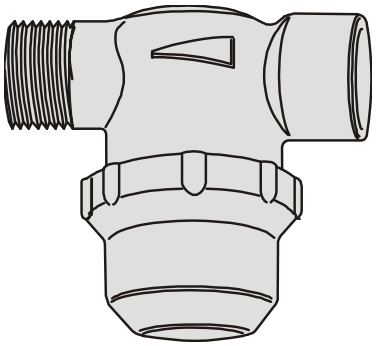
Protect the unit from excessive heating by:
a) using a wet cloth around the connection.
b) making a chamfer on the joining tube and connection edges as shown.

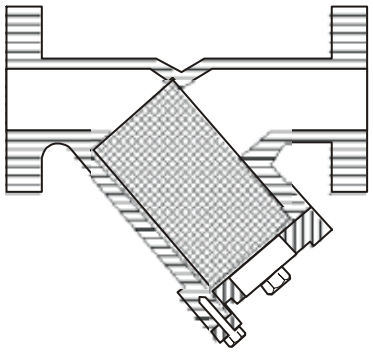


Use TIG or MIG/MAG welding. When using electrical welding circuits, connect the ground terminal to the joining tube, not to the back of the plate package.
Internal oxidation can be reduced by a small nitrogen flow.

Strainers

If any of the media contains particles larger than 1 mm, we recommend that a strainer be installed before the exchanger with a size of 16-20 mesh (number of openings per inch). The particles could otherwise block the channels, causing bad performance, increased pressure drop and risk of freezing. Some strainers can be ordered as BPHE accessories.

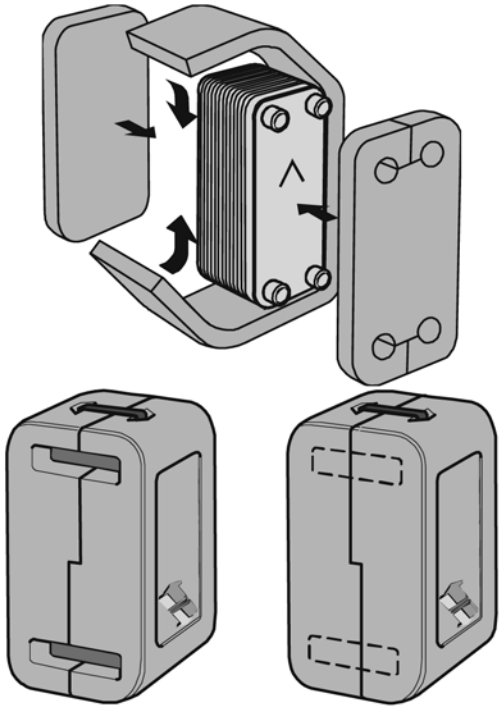




Insulation

Insulation for Refrigerant Applications

BPHE insulation is recommended for evaporators, condensers or district heating applications, etc. For refrigeration, use extruded insulation sheets, e.g. Armaflex or equivalent which also can be supplied by DHT.



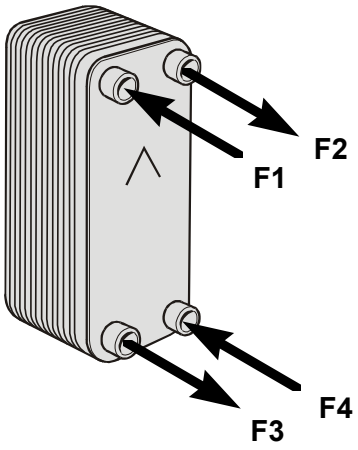
Insulation for Heating Applications

For heating applications, various types of insulation boxes can be used. The working temperature range defines which insulation is recommended. DHT can supply some of these insulation types as optional accessories.

Installation of BPHEs in Different Applications

Single-Phase Applications, e.g. Water/Water or Water/Oil

Normally, the circuit with the highest temperature and/or pressure should be connected on the left side of the heat exchanger when the arrow is pointing upwards. For example, in a typical water-to-water application, the two fluids are connected in a counter-current flow, i.e. the hot water inlet in connection F1, outlet F3, cold water inlet F4, outlet F2. This is because the right-hand side of the heat exchanger contains one channel more than the left-hand side, and the hot medium is thus surrounded by the cold medium to prevent heat loss.



Refrigerant Applications in General

In all refrigerant applications it is very important that every refrigerant channel is surrounded by a water/brine channel on both-hand sides. Normally the refrigerant side must be connected to the left-hand side and the water/brine circuit to the right side of the BPHE. If the refrigerant is incorrectly connected, to the first and last channel, instead of water/brine, the evaporation temperature will drop, with the risk of freezing and very bad performance. DHT BPHEs used as condensers or evaporators should always be fitted with adequate connections on the refrigerant side.

Condenser: The refrigerant (gas) is connected to the upper left connection and the condensate to the lower left connection. The water/brine circuit inlet is connected to the lower right connection and the outlet to the upper right connection. DHT BPHEs used as condensers should always be fitted with soldering connections on the refrigerant side.

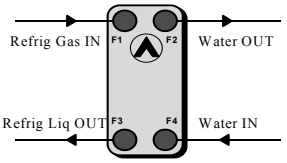


Fig. 4 Connection location: Condenser

Evaporator: The refrigerant (liquid) is connected to the lower left connection and the gas to the upper left connection. The water/ brine circuit inlet is connected to the upper right connection and the outlet to the lower right connection. DHT BPHEs used as condensers should always be fitted with soldering connections on the refrigerant side.

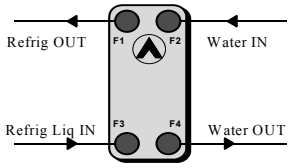
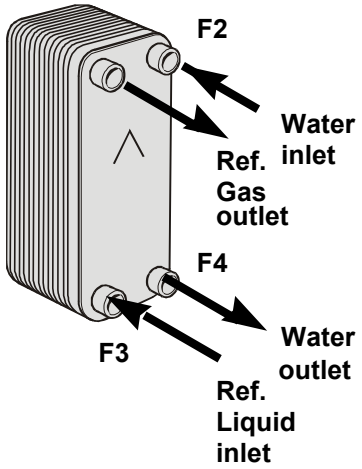


Fig. 5 Connection location: Evaporator

Refrigerant Applications and Evaporators; V-Type BPHEs, e.g. V27 or V45

The V-type BPHEs are equipped with a special distribution device at the refrigerant inlet, i.e. normally port F3. The purpose of the distribution device is to evenly distribute the refrigerant in the channel

The refrigerant liquid should be connected to the lower left connection (F3) and the refrigerant gas outlet to the upper left connection (F1). The water/brine circuit inlet should be connected to the upper right connection (F2) and the outlet to the lower right connection (F4).



Refrigerant Applications and Expansion Valves

The expansion valve should be placed close to the inlet connection, whereas the bulb should be mounted about 19.7 inches from the vaporized refrigerant outlet connection. The pipe diameter between the expansion valve and the BPHE should be the same as the diameter of the refrigerant liquid line.

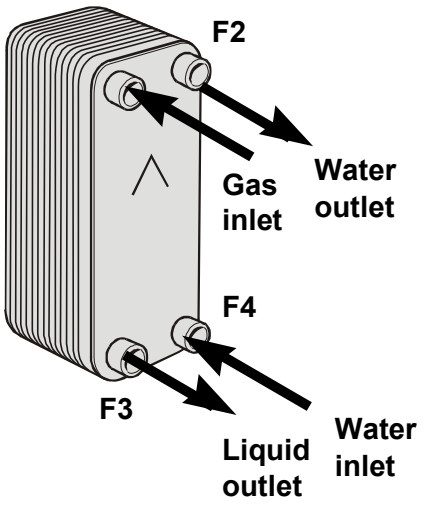
For V-type BPHEs, the pressure drop in the internal distribution system must be added to the pressure drop in the expansion valve to arrive at the total pressure drop. Normally, selecting the next larger size valve will give satisfactory performance.

Refrigerant Applications and Freezing Protection - To prevent freezing

a) Use a filter < 1 mm, 16 mesh (see previous chapter on Strainers).
b) Use an antifreeze when the evaporation temperature is close to liquid-side freezing.
c) Use a freeze protection thermostat and flow switch to guarantee a constant water flow before, during and after compressor operation.
d) Avoid the "pump-down" function.
e) When starting up a system, wait a moment before starting the condenser (or have reduced flow through it).

Refrigerant Applications and Condensers

The refrigerant (gas) should be connected to the upper left connection, F1, and the condensate to the lower left connection, F3. The water/brine circuit inlet should be connected to the lower right connection, F4, and the outlet to the upper right connection, F2.



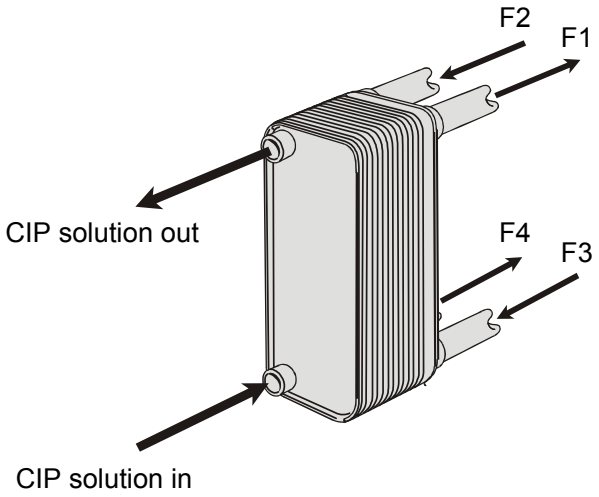
Cleaning of the BPHEs

Thanks to the normally very high degree of turbulence in BPHEs there is a self-cleaning effect in the channels. However, in some applications the fouling tendency can be very high, e.g. when using extremely hard water at high temperatures. In such cases it is always possible to clean the exchanger by circulating a cleaning liquid (CIP - Cleaning In Place). Use a tank with weak acid, 5% phosphoric acid or, if the exchanger is frequently cleaned, 5% oxalic acid. Pump the cleaning liquid through the exchanger.

For tough installations we recommend factory-installed CIP connections/valves for easy maintenance.

For optimum cleaning, the cleaning solution flow rate should be a minimum of 1.5 times the normal flow rate, preferably in a back-flush mode. After use, do not forget to rinse the heat exchanger carefully with clean water. A solution of 1-2% sodium hydroxide (NaOH) or sodium bicarbonate (NaHCO3) before the last rinse ensures that all acid is neutralized. Clean at regular intervals

For further information about cleaning of the BPHEs, please consult DHT.



Warranty

DHT offers a 12-month warranty from the date of installation, but in no case longer than 15 months from the date of delivery. The warranty covers only manufacturing and material defects.

Disclaimer

DHT's BPHE performance is based on installation, maintenance and operating conditions done in conformance with this manual. DHT cannot assume any liability for BPHEs that do not meet these criteria.

For further information, please consult DHT's technical information, local DHT distributor or the factory directly.

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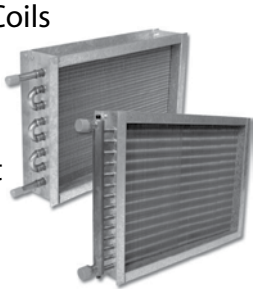

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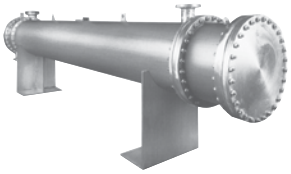

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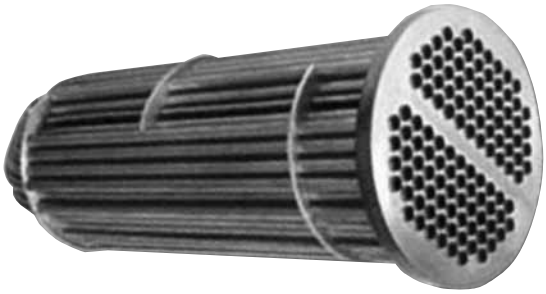
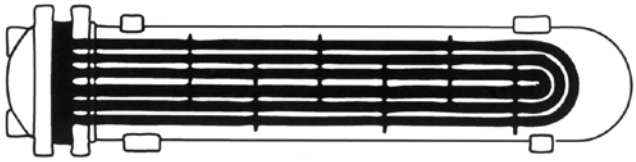


FAST RESPONSE

In most cases when we are given the Manufacturer and Model Number we can supply you with a Quotation and a Duplicate Unit



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