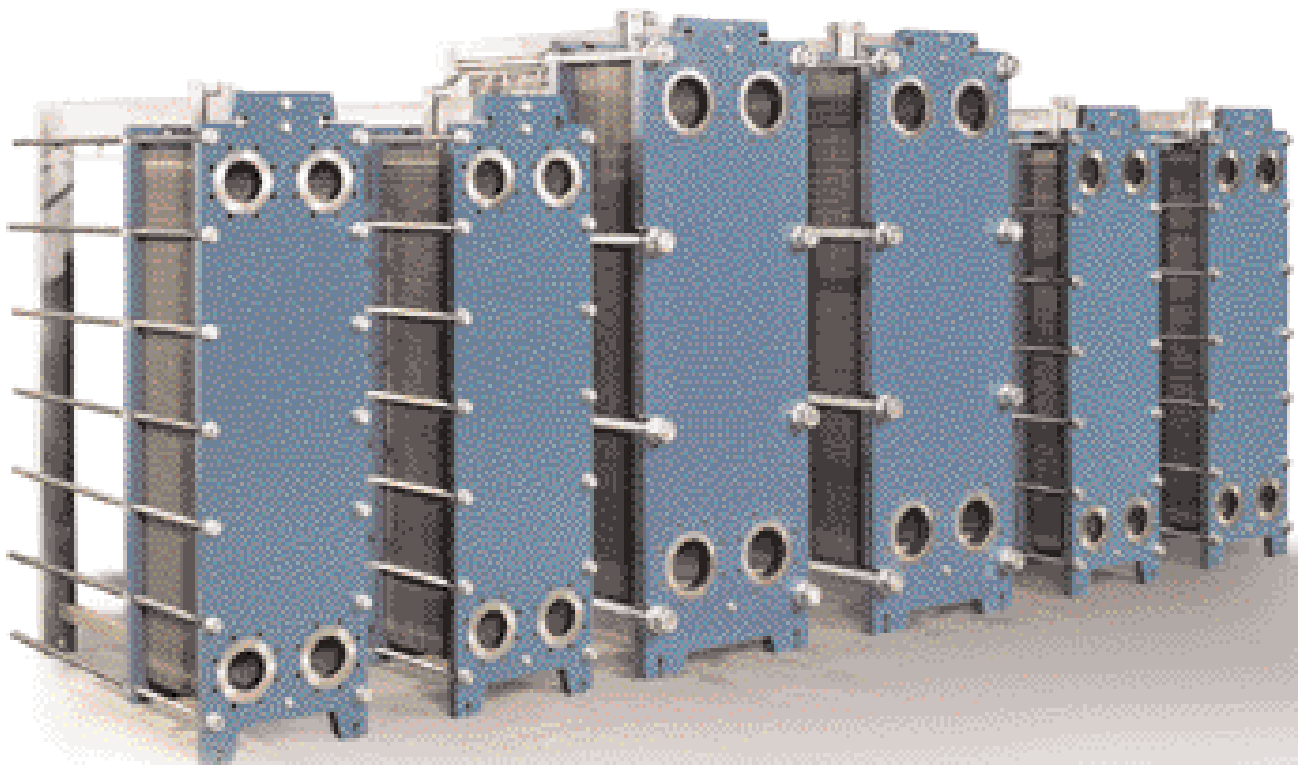


# SUPAPAC PLATE HEAT EXCHANGERS

GASKETED PLATE HEAT EXCHANGERS HAVE BEEN USED FOR PROCESS APPLICATION SINCE THE 1930's. PRIMARILY USED IN THE DAIRY SECTOR THE PRACTICAL ADVANTAGES OF THIS TYPE OF EXCHANGER SOON BECAME APPARENT. THE SUCCESS OF PLATE HEAT EXCHANGER TECHNOLOGY GREW AS NEW INDUSTRIAL APPLICATIONS WERE FOUND. MODERN PLATE HEAT EXCHANGERS PROVIDE A RELIABLE AND HIGHLY EFFICIENT MEANS OF HEAT EXCHANGE. A WIDE RANGE OF PLATE PRESSINGS AND GASKET ARRANGEMENTS ARE AVAILABLE ENSURING AN ECONOMICAL SOLUTION CAN BE OBTAINED. TODAY MOST PROCESS SYSTEMS WILL INCLUDE A PLATE HEAT EXCHANGER WITHIN THE DESIGN.

The Supapac family of plates offer an extremely versatile solution to plate heat exchanger requirements. All plate heat exchangers are sized utilising the latest Computer design software.

Plate Heat Exchanger selection can be classified as pressure or surface area limiting. That is the maximum allowable pressure drop has been met with a surface area greater than the calculated minimum or the design requires a minimum surface area resulting in an exchanger with a pressure drop well within specification. The best fit design is an exchanger with the maximum allowable pressure drop and minimum surface area. Most Rycroft Supapac exchangers allow for six thermal permutations from a single plate. This feature ensures Supapac exchangers offer an economic solution whose performance matches the original design criteria.



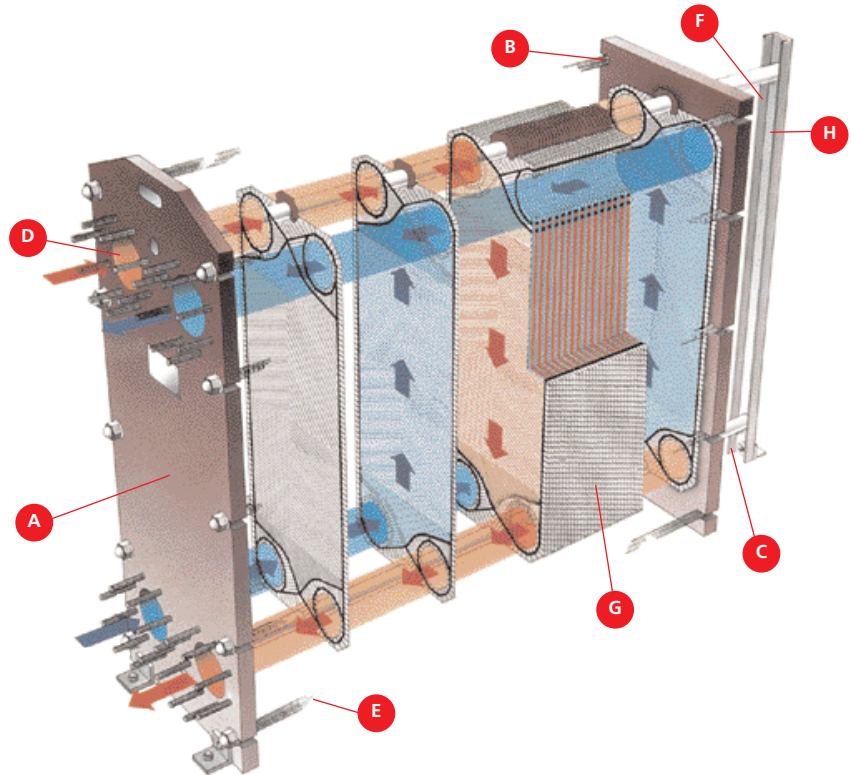
# SUPAPAC PHE

The heat exchanger consists of:

- A Fixed End Plate**
- B Loose End Plate**
- C Support Bar**
- D Connections**
- E Stud Bolts**
- F Guide Bar**
- G Plate Pack**
- H Support Column**

The cooling and heating mediums do not mix. Each plate is sealed around the edges by a gasket. The heating medium flows on opposite sides of the plate to the cooling medium.

Standard plate material is stainless steel and the standard gasket materials are NBR and EPDM. Other materials for plates and gaskets are available. Standard connections are either stainless steel threaded, stainless steel lined or titanium lined.



SUPAPAC PHE PLATES HAVE UNIQUELY PRESSED PROFILES TO ACHIEVE HIGH THERMAL COEFFICIENTS AND STRENGTH. BY COMBINING PLATES WITH DIFFERENT ANGLES IN THE SAME PACK, THE ULTIMATE SOLUTION FOR ANY HEAT TRANSFER CAN BE FOUND.

THE MOST POPULAR FLUIDS USED FOR HEATING APPLICATIONS IN SUPAPAC PHE UNITS ARE HOT WATER, STEAM CONDENSATE AND HEAT TRANSFER OILS. FOR COOLING APPLICATIONS IT IS USUALLY CHILLED WATER CONTAINING GLYCOL OR SIMILAR ANTI-FREEZE; IN SOME INSTANCES SEA WATER IS ALSO USED.

## SUPAPAC Features

- Compact design ensures the Supapac surface area is kept to a minimum. The overall required plant room area is significantly smaller than a shell and tube exchanger of the same duty.
- True counterflow conditions obtain the maximum possible mean temperature difference.
- High turbulence within the exchanger results in high heat transfer coefficients.
- A PHE does not require large maintenance areas unlike a shell and tube exchanger which requires a clear area for tube withdrawal.
- Close approach temperatures are achievable.
- Heavy lifting gear is not required for maintenance.
- By careful selection and high flow turbulence the risk of fouling is reduced to a minimum. Where the water quality makes fouling inevitable the deposit rate is much slower than a shell and tube heat exchanger.
- The plate edges exposed to the environment represent only a small fraction of the overall heat transfer area. Therefore the heat lost from the exchanger is very low, negating the need to insulate the exchanger.
- Supapac PHE exchangers are opened swiftly facilitating maintenance and inspection of plates.
- Flow reversal may be used to clean the exchanger. This requires additional pipework and valves but does not mean opening the Supapac PHE.
- Chemical cleaning can take place with the unit installed and as the storage volume is low, chemical usage is kept to a minimum.
- Supapac PHE are extremely flexible. Plates can be added or removed to alter the performance characteristics, beneficial when the design parameters of a system have to be changed after installation.

## Installation

Rycroft Plate Heat Exchangers are pressure tested at the factory according to the specification. As a result the heat exchanger is ready to use when it arrives on site. The nameplate shows the tightening distance between the fixed and loose end plate. The tightening dimension is the minimum distance that the plate pack may be tightened to. Due to manufacturing tolerances an exchanger may be shipped with a tightening dimension greater than the minimum shown on the nameplate. If leakage occurs after a period of time the exchanger can be tightened to the minimum dimension.

Bolt tightening must be conducted uniformly and the tightening dimension checked on all sides of the exchanger at the bolt locations. Exchangers must not be tightened when full of liquid, under pressure or operation.

Piping should be connected in accordance with the drawing. All connections should be fitted with isolating valves. Provision for accommodating expansion of interconnecting pipework must be made. Piping supports should be placed as close to the connections as possible.

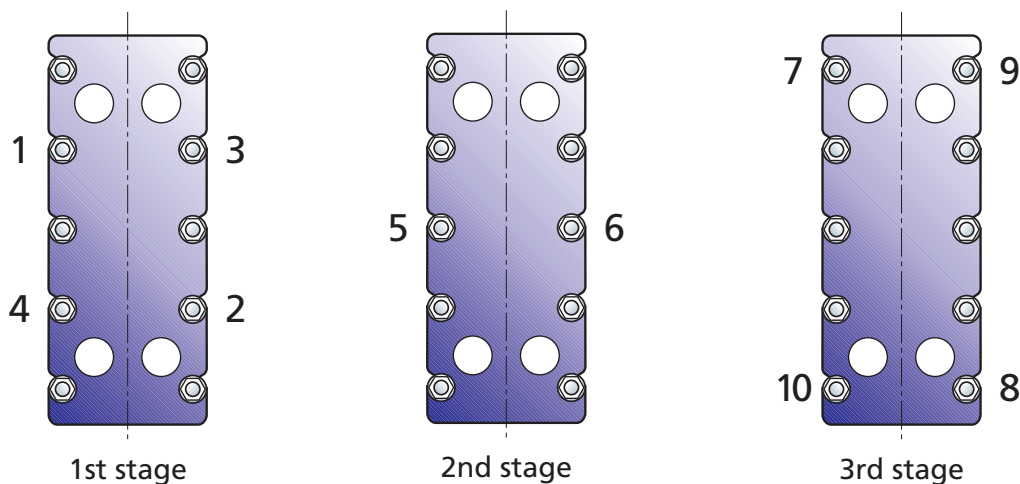
## Operation

In order to reduce the risk of damage during start up the following check list should be followed:

- Confirm the tightening dimension is correct.
- Open all the outlet valves.
- Close the pump discharge valves to the exchanger. (Ensure the pump close down procedure has been followed).
- Increase the static pressure slowly on to the exchanger.
- Vent both sides of the exchanger.
- Open the inlet valves simultaneously in order to prevent over pressure of one side.

## Maintenance

Disassembly should only commence once the pressure on both sides has been relieved and the exchanger isolated from the system. The exchanger should be allowed to cool down before opening. It is important to follow the correct sequence when loosening the tie bolts. Bolt tension should be reduced by gradually loosening each bolt by a small amount until the entire frame clamping force is removed. The following sequence should be followed:



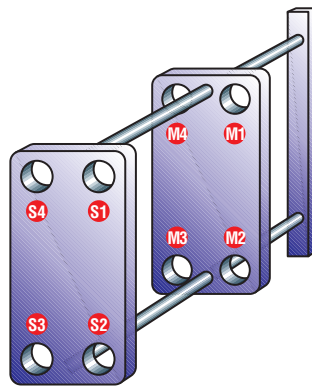
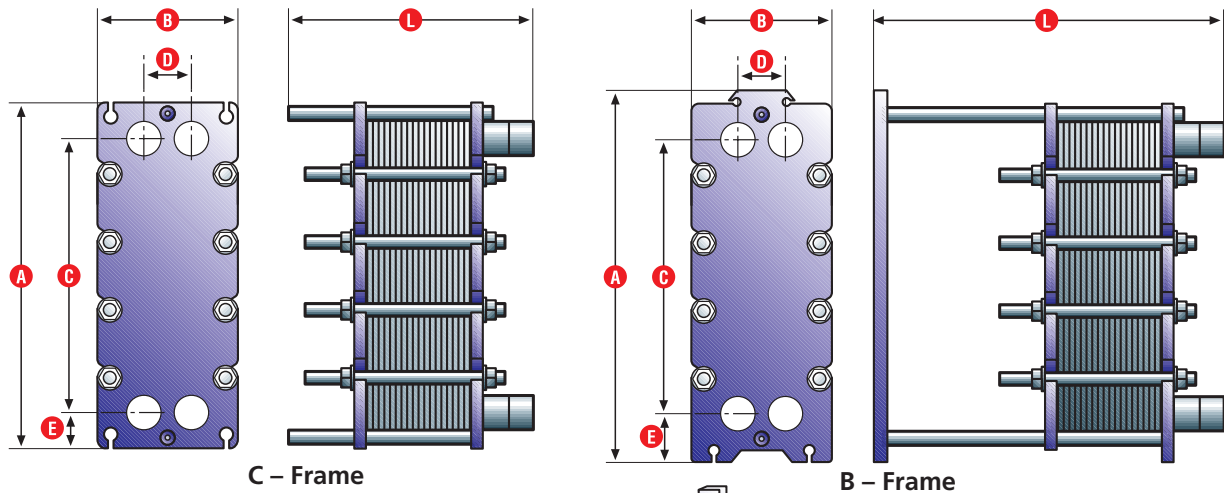
Tightening of the exchanger should be conducted in reverse order.

Once completed the loose end plate can be pulled away for inspection or cleaning. Dismantling of the plate pack must be carried out with care in order to prevent damage to the gaskets. Each plate must be cleaned individually. Ideally the plates should be kept in the frame. If this is not possible the plates should be numbered before removal. A powerful water jet is a preferred method of cleaning. Do not use steel brushes on the plate surfaces.

Cleaning plates may require the use of dilute acids. Rycroft Ltd can provide an off site cleaning process. Please contact our design department for further information.

Cleaning in place (CIP) techniques can be adopted. Please contact our design department for further details.

# PHE Dimensions



Connections

Unit	A	B	C	D	E	L (Max.)	Max. Area (m <sup>2</sup> )	Max. No. Of Plates	Max. Flow Rate (m <sup>3</sup> /h)	Connection (mm)
	(mm)									
SP4C	188	72	154	40	17	140	0.36	30	4	12
SP10C	287	115	243	72	22	205	1.92	60	12	25
SP12C	470	175	357	60	65	390	1.60	50	20	32
SP25C	783	160	640	60	89	390	7.00	100	12	25
SP28C	789	175	675	65	71	848	16.00	200	12	25
SP30C	705	240	555	100	92	390	4.25	50	30	40
SP30B	705	240	555	100	92	1200	8.50	100	30	40
SP52C	815	320	592	135	120	390	6.00	50	50	50
SP52B	815	320	592	135	120	1120	25.00	200	50	50
SP58C	1060	320	822	135	140	400	9.00	50	50	50
SP58B	1060	320	822	135	140	1050	27.00	150	50	50
SP102B	1266	460	779	226	221	2770	110.00	400	200	100
SP104B	1266	460	779	226	221	1500	55.00	200	200	100
SP108B	1675	460	1188	226	221	2770	180.00	400	200	100
SP153B	1730	630	1143	300	300	2800	220.00	400	450	150
SP155B	1730	630	1143	300	300	2800	209.00	400	450	150
SP157B	1905	630	1320	285	300	2800	260.00	400	450	150
SP158B	2385	630	1800	285	300	2800	360.00	400	450	150
SP159B	2865	630	2280	285	300	2800	470.00	400	450	150
SP214B	1605	830	910	420	350	3600	220.00	400	800	200
SP234B	2185	830	1490	420	350	3600	400.00	400	800	200
SP254B	2765	830	2070	420	350	3600	580.00	400	800	200
SP274B	3345	830	2650	420	350	3600	760.00	400	800	200
SP322B	1910	1060	1140	570	360	3700	340.00	400	1800	300
SP342B	2490	1060	1720	570	360	3700	580.00	400	1800	300
SP362B	3070	1060	2300	570	360	3700	820.00	400	1800	300
SP372B	3650	1060	2880	570	360	3700	1060.00	400	1800	300
SP392B	4390	1060	3460	570	360	3700	1300.00	400	1800	300

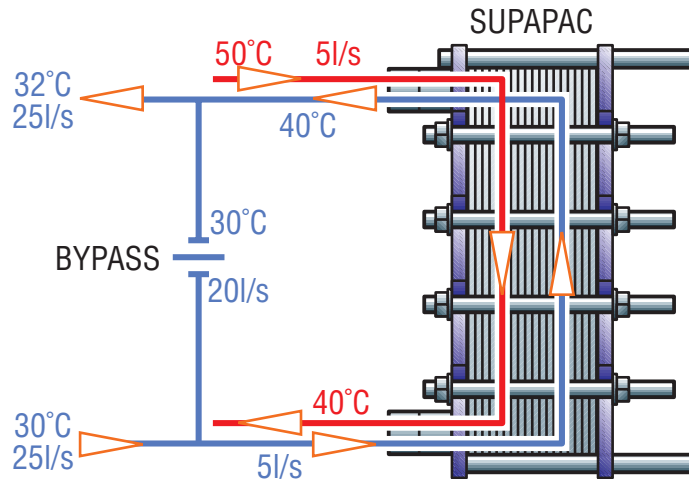
Available Materials: Plates – AISI 304, AISI 316, TITANIUM, 254, SMO Gaskets – NBR, EPDM, FLUOR G, VITON (G)

Connections – AISI 304, AISI 316, TITANIUM, NBR, EPDM

# Applications

## Swimming Pool Heaters

Swimming Pool applications usually involve relatively high flow rates with low temperature gains. In order to reduce the exchanger size a bypass arrangement can be offered. In this situation the pool water is heated to a higher temperature and is then subsequently mixed with cooler pool water before being returned to the swimming pool. Bypass ratios of 5:1 are common.



## Coolers

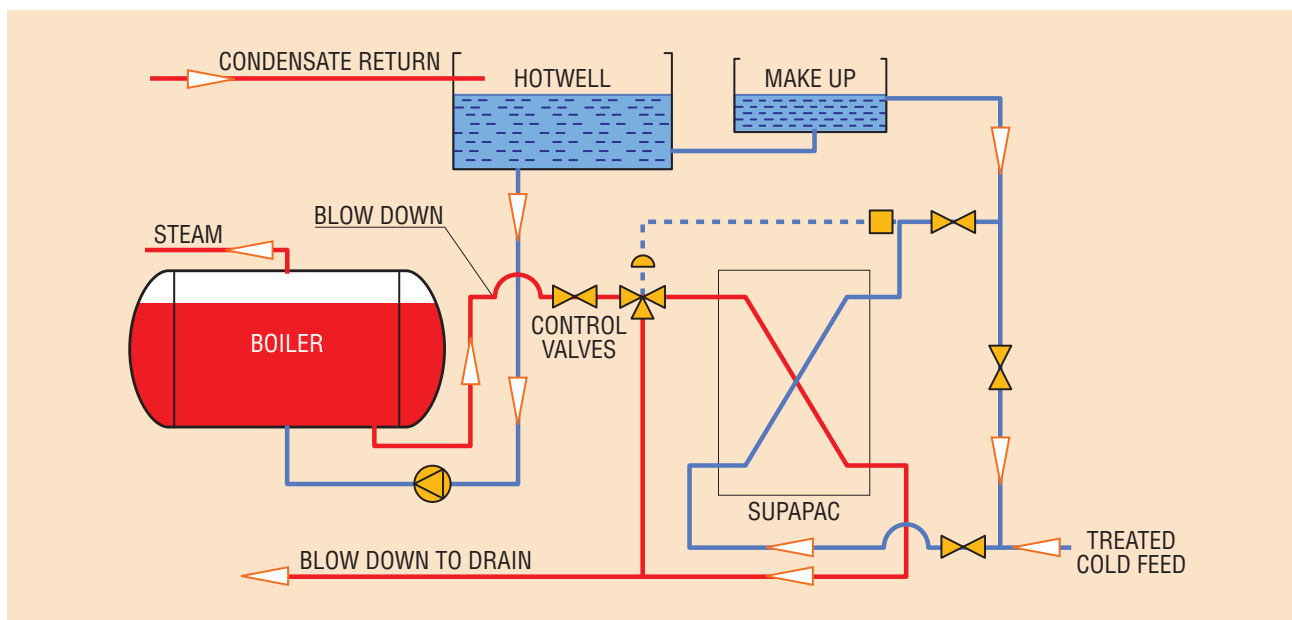
Gasketed Plate Heat Exchangers are frequently used for cooling water applications. Drip trays should be fitted beneath the exchangers to remove condensation.

## Heaters

Gasketed Plate Heat Exchangers are widely used for space heating applications. For most HVAC systems the maximum operating temperature is determined by the gasket material. Steam can be utilised for heating although careful consideration must be given to control valves and condensate removal systems. For further information please refer to our design department.

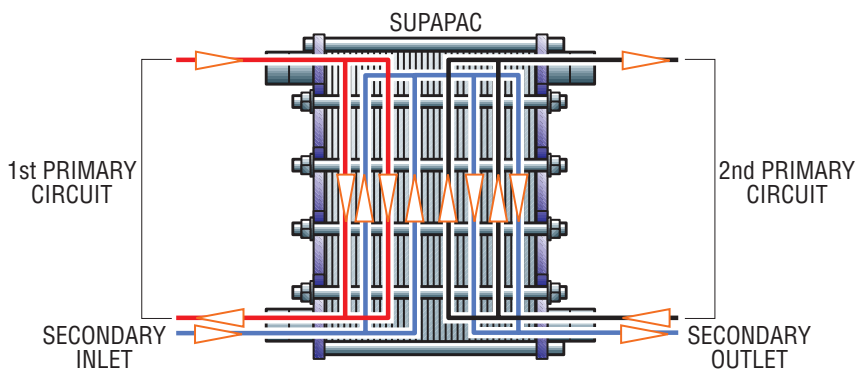
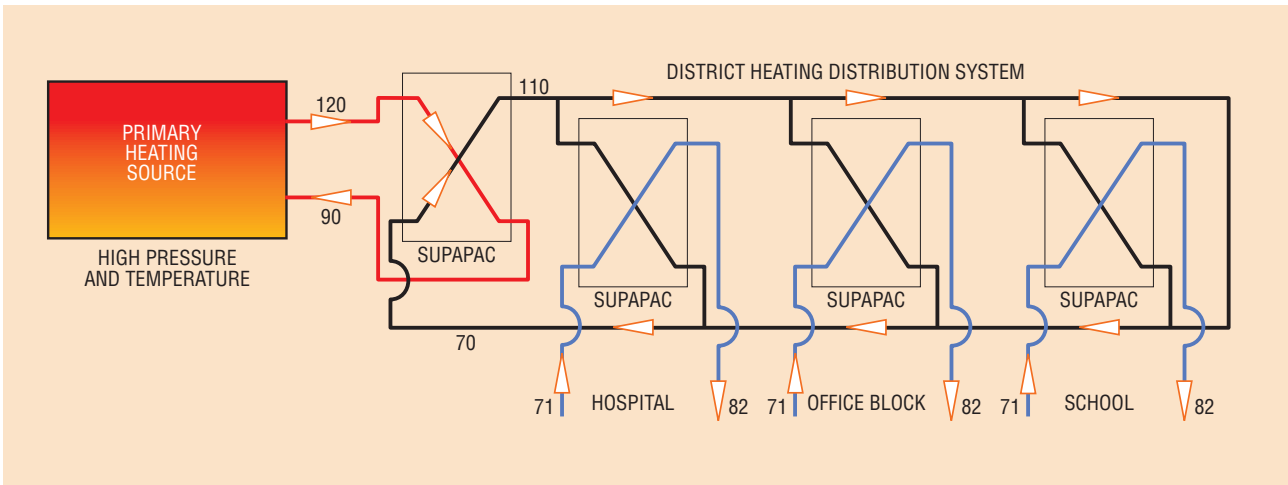
## Condensate Heat Recovery (Continuous Blow Down System)

Flash steam and condensate can be used for preheating applications. For example the steam demand for water heating may be reduced by approximately 10% by installing a condensate heat recovery exchanger.



## District Heating

Systems where the primary heating source is isolated from the distribution network frequently utilise plate heat exchangers. The exchangers also act as pressure breakers. The ability of achieving close approach temperatures have made plate heat exchangers the preferred option for this type of application.

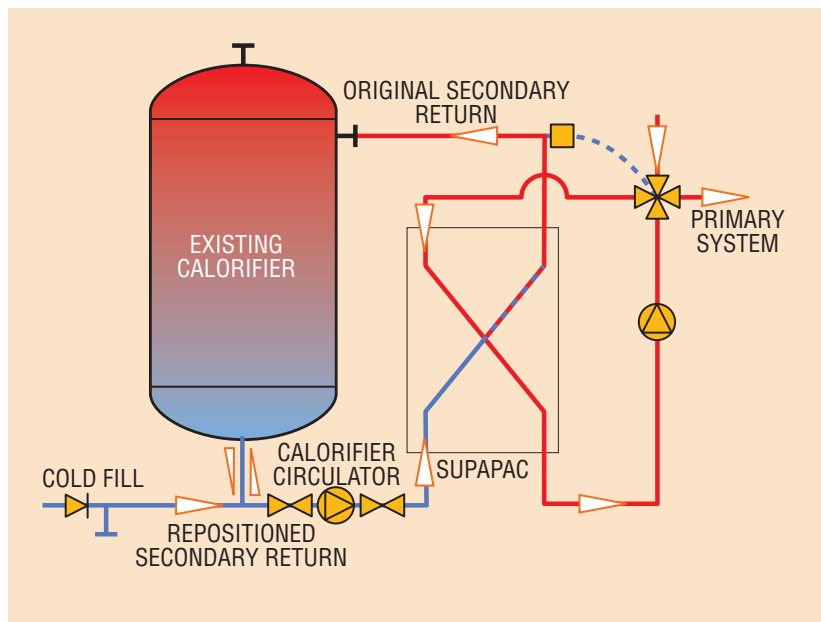


## Dual Primary Systems

Plate Heat Exchangers can be designed with two independent primary circuits. Heating or cooling designs can be incorporated into a single exchanger. This type of exchanger has connections fitted in both the fixed and loose ends. Careful consideration should be given to the maintenance area required for such an exchanger.

## Upgrading Existing Water Heating Systems

For applications where an existing system requires upgrading or a change from a high to a low temperature primary, plate heat exchangers can offer an ideal solution. Small and compact these exchangers can be easily manipulated.



# General PHE Specification

FRAME	Typically boiler plate BS 1501-161-430A (DIN Standard materials available)	
CONNECTIONS	Stainless Steel screwed Stainless Steel lined Titanium lined NBR or EPDM lined	
PLATES	<b>Materials</b> Stainless Steel 304 and 316 Titanium	<b>Common Uses</b> Water Sea Water
GASKETS	EPDM NBR FLUOR G	Water, Low Pressure Steam Water, Oils Oils, Chlorine Water, Steam
PAINT	Alkyd resin top coat and Alkyd primer with Zinc Phosphate undercoat. Total paint thickness 120 microns High temperature paint is also available	
STUD BOLTS	BS 4882 Grade B7	

Please note that the selection of gaskets is extremely critical when considering the suitability of a design. Gasket selection must involve Pressure, Temperature and Medium parameters. For Primary mediums other than water, our design department must be consulted in order to confirm material suitability.

Other plate materials such as AVESTA 254SLX, 254MO, HASTELLOYO B-2 and C-276 and Titanium are available for special process applications. Please contact our engineering department for further information.

## Pressure

Some gasketed heat exchangers are rated for 33 Bar g test pressure. Frame sizes are available in three test pressures namely 13, 21 and 33 Bar g. Most European standards call for a test pressure of 1.3 x the maximum working pressure. BS 5500 and ASME standards require a test pressure of 1.5 x the maximum working pressure.

To help us answer your enquiry in the fastest possible time the following information is required:

**1. Maximum primary and secondary working pressures.**

**2. Primary and secondary mediums.**

**3. Primary and secondary inlet and outlet temperatures.**

*It is sometimes necessary to design an exchanger to meet an undetermined maximum or minimum temperature. When such a design is called for we require at least one temperature and the available flow rate for both the primary and secondary sides.*

**4. Maximum allowable primary and secondary pressure drops.**

*If the pressure drop is unknown the most economic design will be offered. The pressure drop will normally range between 5 and 10 mwg.*

**5. Primary and secondary flow rates**

*If the temperatures and flow rates are known it is not necessary to supply the thermal rating.*

**6. Thermal Rating**

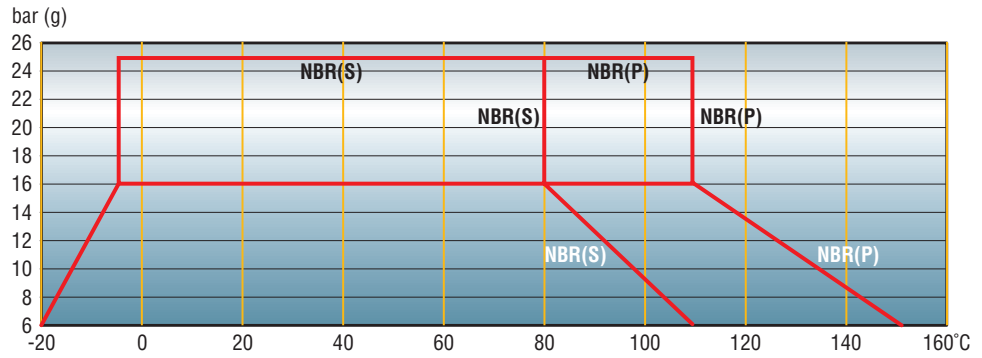
*Output required i.e. kW*

**7. Required material**

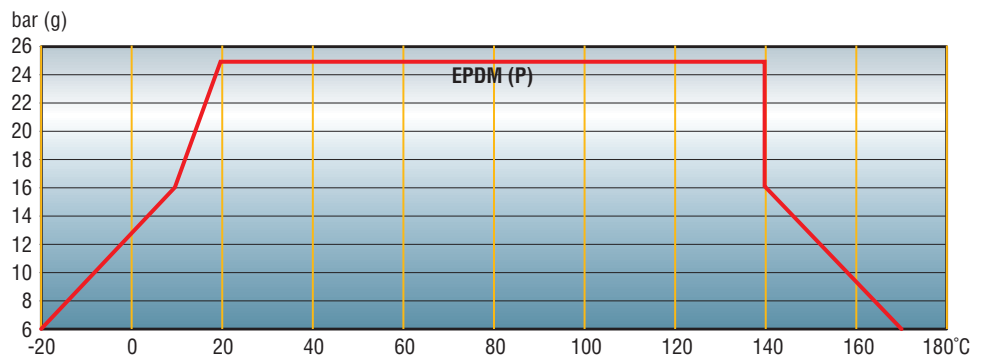
*Please refer to the specification sheet for a list of available materials. Our design department would be pleased to discuss and advise material selection. For potable hot water services we recommend stainless steel plates with EPDM gaskets.*

# Recommended Operating Temperatures and Pressure Limits for Gaskets

## Nitrile-NBR:

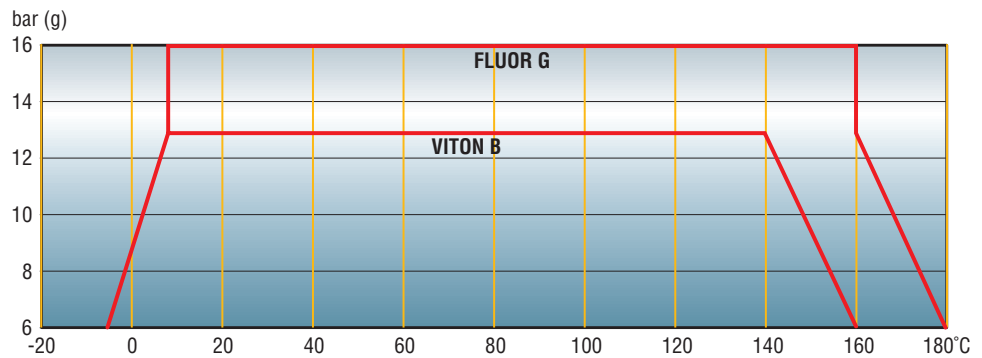


## EPDM:



## Fluorocarbon-FPM:

(See notes below)



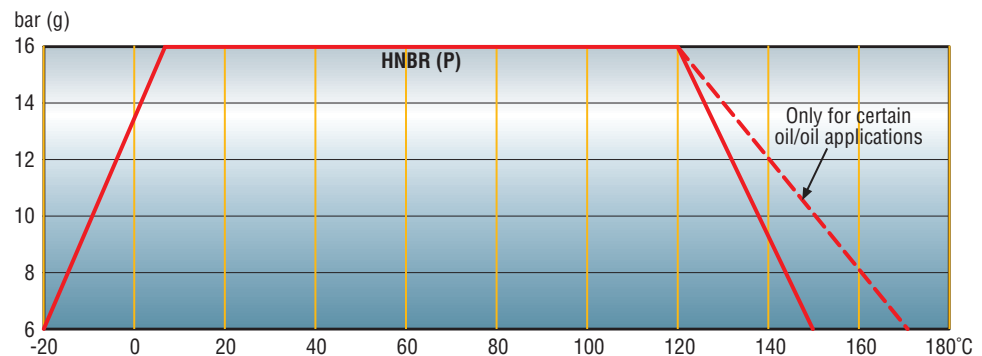
Do not use Viton B above 100°C in conjunction with steam, water or aqueous solutions.

The use of all fluorinated rubbers in conjunction with titanium plates is questionable. Fluor G is only available in certain sizes. Use Viton GF only for sulphuric acid with  $\geq 80\%$  conc.

Do not use Viton GF for steam, water or aqueous solutions above 130°C.

Do not use Fluor G for steam, water or aqueous solutions above 160°C.

## Hydrogenated nitrile-HNBR:





# Brazed Heat Exchangers

BRAZED HEAT EXCHANGERS OFFER AN ECONOMIC, COMPACT DESIGN SUITABLE FOR A WIDE RANGE OF APPLICATIONS INCLUDING WATER, STEAM AND REFRIGERANT MEDIUMS. HAVING NO GASKETED JOINTS BRAZED HEAT EXCHANGERS CAN BE SUPPLIED FOR RELATIVELY HIGH PRESSURE DUTIES. EXCHANGERS ARE AVAILABLE FOR WORKING PRESSURES OF UP TO 30 BAR G AND TEMPERATURES BETWEEN  $-195^{\circ}\text{C}$  AND  $185^{\circ}\text{C}$ .

The exchangers comprise of pressed stainless steel ribbed plates vacuum brazed under carefully controlled conditions. The exchanger design has been developed using the latest computer simulation techniques backed up by extensive test bed trials. The net result is an exchanger whose reliability is unquestionable.

## Features of Rycroft Brazed Heat Exchangers

- **Compactness** BHE occupy an extremely low volume when compared with a shell and tube heat exchanger of the same duty.
- **Thermal performance** As turbulent flow can be maintained at relatively low velocities high heat transfer coefficients can be achieved.
- **High working pressure** The unique construction technique allows the BHE to withstand high pressures and resistance to pressure pulses.
- **Low weight** As the exchanger volume is low when compared with alternative types of exchanger the wet weight of BHEs is considerably less than other types of heat exchangers.
- **Economic** The purchase price of a BHE will be lower than an equivalent shell and tube heat exchanger of the same specification duty. In addition the installation of BHE is easier and as a consequence the site installation costs are also reduced.

## Installation

A BHE can be mounted in any position providing that consideration is given to draining the exchanger. Smaller units can be mounted using a bracket around the exchanger. Larger units are supplied with fixed stud bolts.

It is important not to stress the connections of a BHE. All pipework should be completed in such a way that any vibration within the system is not transferred to the exchanger. A BHE should not be mounted directly to a rigid frame. A soft elastomer suitable for the working temperature should be used to cushion the exchanger.

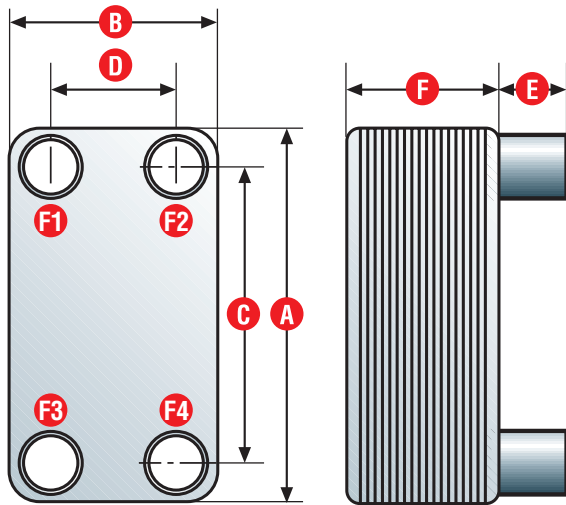
For BHEs supplied with connections suitable for soldering it is important that a hard silver solder is used. (Min. 45% silver). The use of this solder allows brazing temperatures to be kept to a minimum. Brazing temperature in excess of  $800^{\circ}\text{C}$  may cause damage to the copper brazed joints of the BHE.

## Cleaning

When the performance of the exchanger falls or the pressure drop across the BHE increases the unit will require cleaning. The simplest form of cleaning is to reverse the flow through the exchanger and thereby loosen any soft particulate matter. For best results the backflush flow rate should be at least 1.5 times the normal operating conditions.

If hard scales are present the BHE will require chemical cleaning with a dilute organic acid (5% oxalic acid or similar). After cleaning the exchanger must be flushed with large amounts of fresh water. When dealing with acids consideration must be given to the use, mixing and disposal. All Health and Safety requirements must be followed. Advice can be obtained from the HSE or local authority.

# BHE Technical Data



Unit	Threaded Connection*		E
	NB (mm)	NB (inch)	(mm)
SPB5	15 & 20	1/2 & 3/4	20
SPB8	15 & 20	1/2 & 3/4	20
SPB10	25	1	20
SPB15	15 & 20	1/2 & 3/4	20
SPB25	25	1	20
SPV25	25	1	20
SPB27	32	1 1/4	27
SPV27	32	1 1/4	27
SPB35	40	1 1/2	27
SPB45	40	1 1/2	27
SPV45	40	1 1/2	27
SPB50	65	2 1/2	54
SPV50	65	2 1/2	54
SPB65	FLANGED 65 OR 100		203

\* Soldered Connections are available.

Unit	A	B	C	D	F	Area/Plate	Max. No.	Max. Flow	Weight Empty
	(mm)				(mm)	(m <sup>2</sup> )	Of Plates	Rate (m <sup>3</sup> /h)	(kg)
SPB5	187	72	154	40	9 + 2.3 x NP	0.012	60	4	0.6 + 0.044 x NP
SPB8	310	72	278	40	9 + 2.3 x NP	0.023	60	4	0.9 + 0.070 x NP
SPB10	287	117	243	72	9 + 2.3 x NP	0.032	120	12	1.5 + 0.126 x NP
SPB15	465	72	432	40	9 + 2.3 x NP	0.035	60	4	1.3 + 0.106 x NP
SPB25	524	117	479	72	9 + 2.4 x NP	0.063	120	12	2.5 + 0.234 x NP
SPV25	524	117	479	72	9 + 2.4 x NP	0.063	120	12	2.5 + 0.254 x NP
SPB27	526	119	470	63	10 + 2.4 x NP	0.060	140	20	2 + 0.24 x NP
SPV27	526	119	470	63	10 + 2.4 x NP	0.060	140	20	2 + 0.26 x NP
SPB35	392	241	324	174	11 + 2.4 x NP	0.093	200	35	2.4 + 0.336 x NP
SPB45	524	241	456	174	11 + 2.4 x NP	0.128	200	35	5.5 + 0.427 x NP
SPV45	524	241	456	174	11 + 2.4 x NP	0.128	200	35	4.4 + 0.447 x NP
SPB50	524	241	441	159	13 + 2.4 x NP	0.112	200	70	3 + 0.424 x NP
SPV50	524	241	441	159	13 + 2.4 x NP	0.112	200	70	13 + 0.431 x NP
SPB65	864	362	731	231	17 + 2.4 x NP	0.270	220	200	82.5 + 1.08 x NP

NP = Number of plates

**Materials:** Plates: AISI 316 Solder: Copper 99.9%

**Process Conditions:** Max. Pressure: 30 Bar Max. Temperature: 185°C Min. Temperature: -195°C

