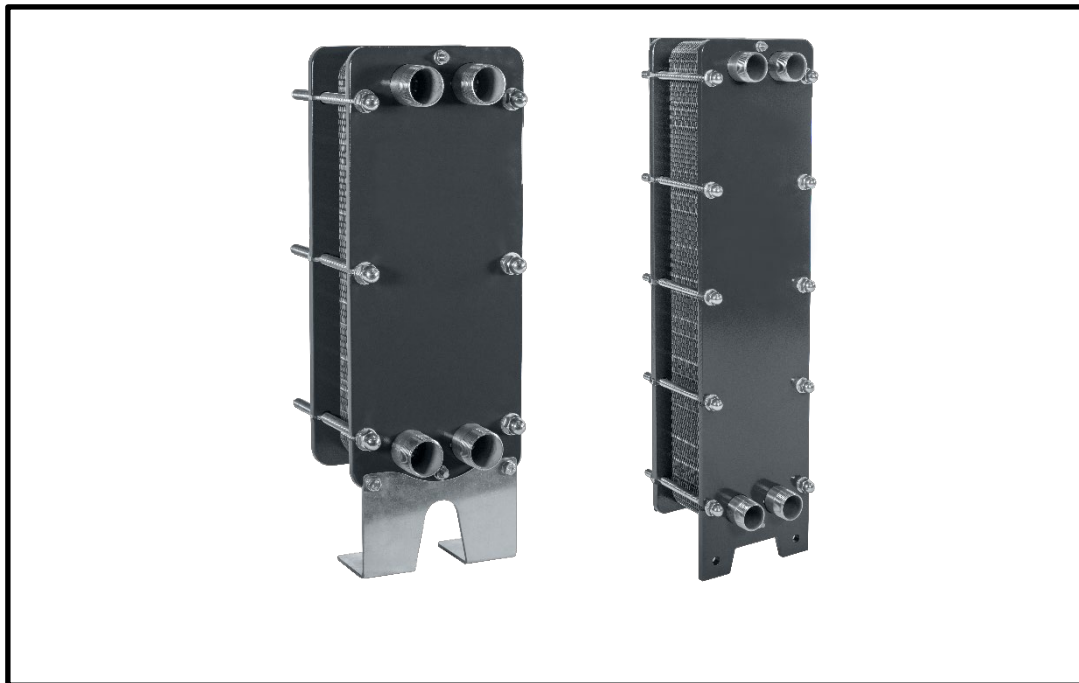


Operating Manual

Screw-on Plate Exchanger
PWT 510 and PWT 910



! IMPORTANT !

READ CAREFULLY BEFORE USE

KEEP FOR FUTURE REFERENCE

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1 General Note

1.1 Information on the Operating Manual

Thank you for choosing to purchase our product. We ask you to observe this manual for the connection and setting of the product so that you can enjoy the product for a long time.



Before commencing any work, please read the operating manual in its entirety, in particular the chapter on safety and the respective safety instructions!

The operating manual is part of the product and must be kept accessible to the user at all times in close proximity to the plate heat exchanger. This operating manual provides important information on how to handle the plate heat exchanger. Compliance with all specified safety information and instructions is essential to ensure safe working.

The manufacturer provides no warranty and/or accepts no liability in the case of incorrect or improper use.

Check the delivery for completeness and possible damage before setting up the product.

In addition, the applicable local accident prevention regulations and general safety regulations must be observed for the area in which the plate heat exchanger will be used.

1.2 Explanation of Symbols

1.2.1 Warnings

Warnings are indicated by symbols in this operating manual. The instructions are introduced using signal words that indicate the extent of the hazard.

The instructions must be strictly observed and prudent action must be taken in order to avoid accidents, personal injuries and property damage.



DANGER!

...indicates an imminently dangerous situation that can lead to death or serious injuries if not avoided.



WARNING!

...indicates a potentially dangerous situation that can lead to death or serious injuries if not avoided.

**CAUTION!**

...indicates a potentially dangerous situation that can lead to minor or light injuries if not avoided.

**NOTE!**

...indicates a potentially dangerous situation that can lead to property and environmental damage if not avoided.

1.2.2 Tips and Recommendations



...draws attention to useful tips and recommendations and information to maintain efficient and trouble-free operation.

1.3 Limitation of Liability

All information and instructions in this operating manual have been compiled taking account of the applicable standards and regulations, the latest technological standards, as well as our many years of knowledge and experience.

The manufacturer accepts no liability for damage due to:

- Non-observance of the operating manual
- Improper use
- People not trained to operate the heat exchanger
- Unauthorised modifications

The actual scope of delivery may differ from the explanations and illustrations described here in the case of special versions, the use of additional ordering options or due to the latest technical changes.

1.4 Copyright



The content of the information, texts, drawings, images and other illustrations are protected by copyright and are subject to industrial property rights. Any improper use is a punishable offence.

1.5 Warranty Conditions

The warranty provided is in accordance with the current German statutory regulations.

1.6 Product Liability

Subject to errors and technical changes.

1.7 Information about the Product Manufacturer

Manufacturer: BEHNCKE GmbH

Address: Michael-Haslbeck-Straße 13

85640 Putzbrunn, Germany

1.8 General Information about the Product

The heat exchanger PWT510/PWT910 with embossed plates consists of a structure with the following components: fixed top plate (frame plate), movable plate (loose plate), stand or support, upper guide rail, lower guide rail and a certain number of expansion bolts. The plates are connected between the fixed plate and the loose plate with the help of the expansion bolts. Each plate is equipped with a gasket so that all the plates form a closed system of parallel channels through which the hot and cold fluid flows alternately (Figure 1). The gaskets are not affixed to the plates. The gaskets that are attached around the holes and fitted with special drainage zones prevent a mixing of the fluids.

Each plate in the pack is rotated through 180° so that the fluids can flow alternately between the individual plates (Figure 2).

If the heat exchanger is to work with more than two fluids at the same time, additional intermediate plates must be inserted into the pack.

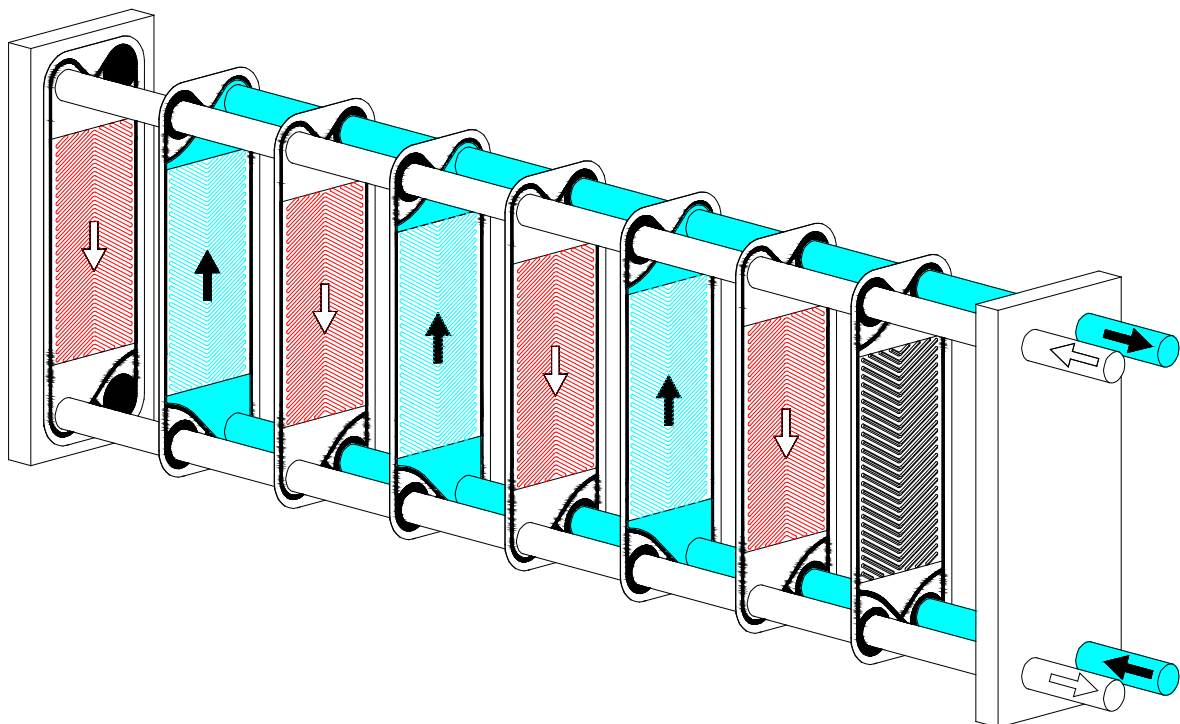


Figure 1: Flow diagram of the plate heat exchanger

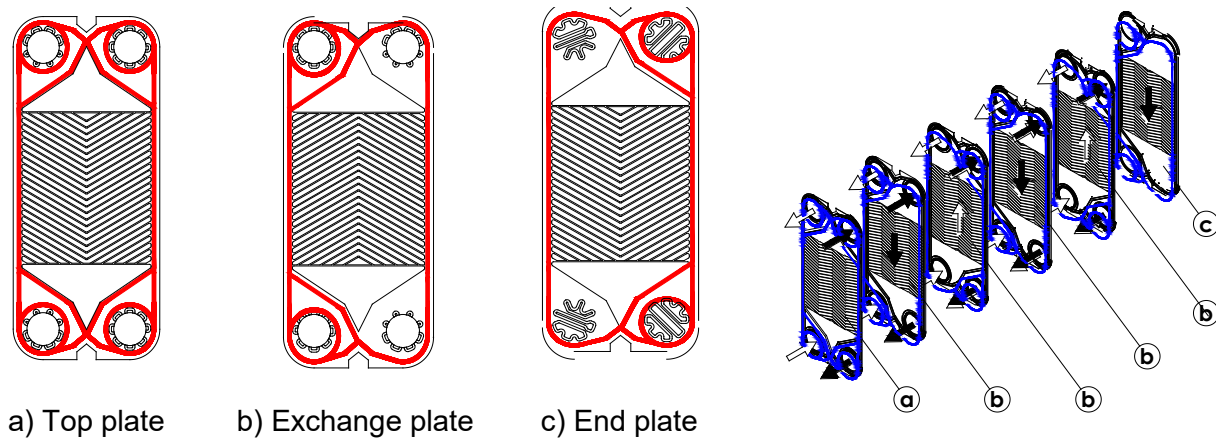


Figure 2: Plate types in the heat exchanger

The embossed plates are designed in such a way that they can be used as both “right” and “left” plates because they only need to be rotated through 180°.

The right and left plates work as follows:

- On the right plates, the fluid runs from the connection 2 to 3 or vice versa from 3 to 2 (Figure 3).
- The flow on the left plates goes from 1 to 4 or from 4 to 1 (Figure 3).

The 4 openings on the plate corners open in accordance with the desired flow configuration.

Please note: The 4 openings are marked with numbers, starting with the opening on the top of the left plate side – looking from the gasket.

This opening is number 1, then the number sequence 2, 3 and 4 runs consecutively in a clockwise direction.

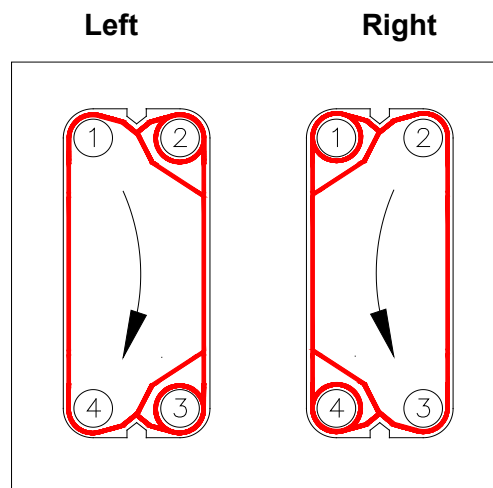


Figure 3: Left and right plate

1.9 Permissible Operating Conditions

The plate heat exchanger is solely intended for heating and cooling bathing water.

The heat exchangers must not be used for the heat exchange between two hazardous fluids (in accordance with the Pressure Equipment Directive 2014/68/EU, Article 4, fluid group 1), in accordance with the explicit reference in this manual and/or in the technical information as well as in strict observance of all regulations.

The maximum and minimum temperature and the maximum pressure indicated on the type plate must never be exceeded.

Any other use or use beyond this is deemed as improper use. The manufacturer BEHNCKE GmbH accepts no liability for any resulting damage.

Any other use is only permitted after consultation with and approval from the manufacturer.

2 Safety

This section gives an overview of all the important safety aspects for the optimum protection of people and to guarantee safe and trouble-free operation. Failure to observe the instructions and safety information in this manual may result in serious danger.

Please read this section carefully before carrying out any work on the plate heat exchanger!

Observe all safety instructions!

Please contact the manufacturer if you have any questions regarding the safety instructions!

2.1 Intended Use



Important!

Intended use also includes

- Observing all information in the operating manuals and the operating instructions of the individual components of the product
- Adhering to the inspection and maintenance work.

The plate heat exchanger must only be operated with non-hazardous fluids (fluid group 2 in accordance with the Pressure Equipment Directive 2014/68/EU)

Observe the information on the maximum temperatures and maximum operating pressure on the type plate of the plate heat exchanger.

The plate heat exchanger must only be put into operation by specialists.

The plate heat exchanger must only be operated by trained people.



WARNING!

Danger due to incorrect use!

Use only original spare parts.

Modifications and changes to the plate heat exchanger and the components are prohibited for safety reasons without consultation with the manufacturer.

Approved modifications and changes must only be made by specialists for safety reasons.

Claims of any kind resulting from incorrect use are excluded!

2.2 Dangers when Handling the Plate Heat Exchanger

The plate heat exchanger type PWT 510/910 has been manufactured in accordance with the latest technological standards and the recognised safety regulations. Nevertheless, the following **dangers** may occur when the heat exchanger is used – in particular in the case of incorrect operation or misuse:

- Death or injury to the user or third parties or
- Damage to the control unit or to
- Other material assets.

All of the people involved in the installation, commissioning, operation, maintenance and service of the plate heat exchanger must:

- Be mentally and physically capable to do this.
- Be instructed/trained in operating the unit.
- Strictly observe this operating manual.



CAUTION!

The plate heat exchanger must only be used:

- For its intended purpose.
- In a safe and perfect condition.
- The filter system must be switched off and a specialist must always be consulted in the case of faults that may impair safety.

Your safety is important!

2.3 Sources of Danger and Residual Risks

The operating instructions for the individual built-in components must also be consulted for all sources of danger and residual risks.

Work on the plate heat exchanger must only be carried out when the fluid pumps are out of operation (disconnected from the power supply) and the flow and return valves are closed.

The plate heat exchanger must only be put into operation if the closing rate corresponds to the one indicated in the table on page 22.

The plate heat exchanger heats up during operation. The plate heat exchanger must cool down for at least 30 minutes before carrying out work on it.

ATTENTION: There is a risk of burning!

**RISK OF BURNING!**

If the heat exchanger is not insulated, it may get extremely hot depending on the type of operation. Let the heat exchanger cool down for at least 30 minutes before carrying out work on it.

**RISK OF INJURY!**

If the heat exchanger is overtightened intentionally or unintentionally, the expansion bolts may break and potentially put the operator and any bystanders at risk. Therefore, never stand in front of the expansion bolts when tightening the heat exchanger.

**RISK OF INJURY!**

Special care is required when handling the heat exchanger components (turbulators, plates, connecting rods etc.). Use suitable protective clothing for this, such as protective gloves, safety shoes, protective suits etc.

**RISK OF BURNS FROM FLUIDS!**

If the heat exchanger plates are corroded, there is a risk of burns from one of the two fluids. In this case, contact the customer services team immediately and avoid contact with any leaking fluid.

**RISK OF POISONING THROUGH INHALATION OF TOXIC GAS!**

If one or both of the fluids are toxic, it is important to ensure that the vapour from these fluids is not inhaled.

**RISK OF BURNING!**

If one or both of the fluids are flammable, the appropriate precautions must be taken.

**INJURY AND/OR RISK OF BURNING!**

If the connections (mainly made of PTFE or PP) are tightened beyond the permitted point, they may break and put the operator and any bystanders at risk.

2.4 Residual Dangers in the Individual Operating States

The maintenance of the heat exchanger must be carried out by qualified personnel and only after:

- Checking the safety conditions in accordance with the accident prevention regulations;
- Checking that there is no pressure in the heat exchanger;
- Consulting with the manufacturer.

2.4.1 Installation

CAUSE	Unsuitable transport
EFFECT	Damage to the connections or frame.
DANGER	Weakening of the frame.
SOLUTION	The heat exchanger must be packed on pallets, secured with strapping and wrapped with protective film. Lift the heat exchanger with appropriate equipment. If the heat exchanger is still packed, transport and lift it on the pallet. Otherwise at the designated holes with the help of ropes. Never hold the heat exchanger by the connections.

CAUSE	Incorrect positioning of the heat exchanger
EFFECT	Little space for the maintenance of the heat exchanger, inadequate installation next to the control panels, on thermal systems or mechanical stresses, corrosive chemicals and solvents that may come into contact with the outer parts of the heat exchanger.
DANGER	Improper maintenance due to lack of space, release of hot fluid onto the electrical circuit, damage to the outer frame and structural weakening, flooding.
SOLUTION	Make sure when choosing the installation location that there will be sufficient space to carry out the maintenance properly. Place a container under the heat exchanger that can accommodate the entire volume of the heat exchanger. Install suitable earthing devices on the system. The heat exchanger must never be put under stress with external loads and it is the responsibility of the installer to protect the heat exchanger from external forces.

CAUSE	Inaccurate closing rate on the heat exchanger
EFFECT	Loss of nominal pressure, incorrect operation of the system.
DANGER	Fluid loss.
SOLUTION	The closing rate and the number of plates are shown on page 21 of this heat exchanger manual, check that these are correct. The two outer large plates must be parallel when tightening the plate pack.

CAUSE	Incorrect connection of the connections
EFFECT	Fluid leaks, flooding, poor connection.
DANGER	Release of hazardous fluids, non-functioning system, improper maintenance.
SOLUTION	Follow the instructions on the label and in the operating manual. Use Teflon tape on the connections, wherever possible. The connections must not be subjected to external pressure or vibrations. The peripherals connected to the heat exchanger must not transfer to these loads. Sharp temperature fluctuations must be avoided in plastic connections. Shut-off valves must be provided in the heat exchanger connections so that the entire system is not interrupted while maintenance is being carried out on the heat exchanger. (Bypass installation) There must be a vent valve on the system for both circuits at the highest point between the shut-off valve and the heat exchanger. This allows for the opening of the heat exchanger at atmospheric pressure.

CAUSE	Incorrect filling of the heat exchanger.
EFFECT	Leak of fluid from the heat exchanger.
DANGER	Pressure surge, gaskets unseated from their position in the plate.
SOLUTION	Fill the heat exchanger slowly. Open/close the shut-off valves carefully.

CAUSE	Storage over a prolonged period of time in unsuitable conditions.
EFFECT	Premature damage of the gaskets, deterioration of the expansion bolts, possible contamination in the system.
SOLUTION	Storage of the heat exchanger in a closed environment, away from heat, light, dust, solvents or acid. Observe the maximum storage period in relation to the type of gasket used. Treat the expansion bolts with a rust inhibitor. Cover the heat exchanger with non-transparent material.

2.4.2 Operation

CAUSE	Unseated gaskets, wear on the gaskets.
EFFECT	Fluid loss outside the heat exchanger.
DANGER	External leak of fluid from the plate pack during operation Risk if the fluids come into contact with each other. Can be toxic and have harmful effects.
SOLUTION	Replace the damaged gaskets. Place a container under the heat exchanger to collect the fluid. Use sawdust, cardboard or an oil binding agent in the case of a loss of oil. Install the plate pack correctly during the maintenance, as described on page 21 of this manual. Use the controls and automatic pressure regulators in order to avoid possible pressure surges that may cause a displacement of the gaskets. Do not use any hazardous fluids. Avoid mechanical stresses, heat and sharp temperature fluctuations. Maintain the heat exchanger properly in order to avoid wear and tear on the

	materials.
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CAUSE	Electrical eddy currents in the heat exchanger.
EFFECT	Damage to the plates caused by corrosion and electrical discharge.
DANGER	Mixing the fluids in both circuits and system failures.
SOLUTION	Earth the heat exchanger. Make sure that the operating fluid does not generate any corrosion.

CAUSE	Mechanical stresses lead to the loosening of the expansion bolts.
EFFECT	Decompression of gaskets.
DANGER	The fluid flows out of the heat exchanger.
SOLUTION	The pipes must not transfer any vibrations or pressure to the heat exchanger. (Provide pipe decoupling) The closing rate of the plate pack must be regularly checked. (See page 22)

CAUSE	Fluid leak from the connections.
EFFECT	System malfunction and loss of pressure.
DANGER	Leak (also hazardous) too much for the container that must be arranged under the heat exchanger.
SOLUTION	Avoid knocks and vibrations on the connections. Avoid pressure surges and thermal loads. Provide a safety valve on the entire system.

CAUSE	High temperatures.
EFFECT	External frame of the heat exchanger is heated to a high temperature.
DANGER	Risk of burning in case of contact with the outer frame of the heat exchanger when the fluids contained therein are operating at very high temperatures.
SOLUTION	Install thermal insulation in the heat exchanger in order to avoid burns. Let the heat exchanger cool down for at least 30 minutes before touching it.

	Regularly check the temperature during operation.
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CAUSE	Incorrect use of the heat exchanger
EFFECT	The tender data does not correspond to the data during operation of the heat exchanger.
DANGER	Safety is not guaranteed and inadequate performance.
SOLUTION	Carefully read the heat exchanger operating conditions.

2.4.3 Maintenance and Disassembly

CAUSE	Incorrect connection
EFFECT	Pressure reduction phase and incomplete emptying of the heat exchanger.
DANGER	Probable contact with hazardous fluids, harmful vapours.
SOLUTION	It is necessary to switch off the system before carrying out maintenance work. A vent valve must be provided for both circuits between the heat exchanger and the shut-off valve in order to reduce the fluid pressure. The maintenance must only be carried out by specialists who have read the operating manual. Place a container under the heat exchanger with a capacity greater than the fluid that may leak out of the heat exchanger.

CAUSE	Improper manual cleaning.
EFFECT	Flow losses and damage to the plates.
DANGER	Residues of harmful and aggressive fluids may stick to the plates. The plates may have sharp edges.
SOLUTION	The maintenance must only be carried out by specialists who have read the operating manual. Remove the dirt with brushes (soft brushes) and hot water or a suitable solution (depending on the fluids used in the heat exchanger). (See page 32)

CAUSE	Improper installation of the plate pack.
EFFECT	Mixing of the fluids in both circuits, incorrect alignment of the plates.
DANGER	Danger in the case of a chemical reaction between the fluids that may cause explosions and toxic or other harmful effects on people. Fluid leak.
SOLUTION	Check that all plates are positioned and aligned correctly. Pay attention to all the information in this manual for the use and maintenance of the heat exchanger. Do not use any unsuitable fluids.

CAUSE	Lack of lubrication of the expansion bolts.
EFFECT	Difficulties in releasing the nuts of the expansion bolts.
DANGER	The expansion bolts may break when trying to release the plate pack.
SOLUTION	Provide adequate lubrication of the expansion bolts.

2.5 Possible Problems

2.5.1 LEAK BETWEEN THE PLATE PACK AND FRAME

Cause	Solution
If a leak is detected near the connection, check whether the first gasket is damaged/has become displaced. The problem may be due to the displacement of or damage to the gasket.	Replace the original gasket. Insert the correct first gasket. Check that each screw is tight and make sure that the pipes are not mechanically stressed.
Make sure that the inner surface of the front plate is free of foreign objects; they may affect the leak-tightness of the gasket.	Position the first gasket on the front plate without any indents (residues, defects).
Check whether there are indents and/or holes on the first plate.	The plate must be replaced if it is damaged.

2.5.2 LOSS OF FLUID FROM THE FIRST PLATE PACK

Carefully follow the instructions in the manual in order to open a heat exchanger.

Problem	Solution
The temperature and pressure of the heat exchanger do not correspond to the design specifications.	Establish only the designated operating conditions. Plan for the appropriate instruments to detect the conditions in your system.
Check the correct value of the closing rate. (See page 22)	Take the heat exchanger pressure, check the closing rate and adjust these if necessary.
Check that the gaskets are positioned correctly on the plate.	Insert the gaskets correctly in their position.
Check the gaskets for wear/damage (as soon as the plate pack is opened).	Replace the damaged gaskets.
Make sure that the plates are installed correctly and that they are properly aligned.	Install the plates in the correct order and orientation.

2.5.3 INTERNAL LEAKS BETWEEN HEAT EXCHANGER CIRCUITS AND THE MIXING OF FLUIDS AS A RESULT (VERY RARE)

Contact the manufacturer immediately.

Problem	Solution
Check that the pipes are connected to the heat exchanger in accordance with the circulation plan that can be found on the heat exchanger.	Secure the connections properly.
Check each plate for holes and grooves.	Replace any plates that are damaged or have holes in them.
Make sure that the plates are installed in the correct order.	Install the plates in the correct order.

2.5.4 INCREASED PRESSURE LOSS OR TEMPERATURE CHANGE

Problem	Solution
The pressure loss is higher than the design specification.	Check the accuracy of the measuring instruments. Clean the heat exchanger.
The temperatures are correct, but the pressure loss is still too high.	If the plates are clean, the connections or the inlet channel may be blocked. We recommend checking the circulation of the fluid in the opposite direction.
The temperatures no longer correspond to the original values.	Contamination can reduce the performance of the heat exchanger. Clean the heat exchanger.
The heat exchanger is cleaned, but the pressure loss is too low.	Check the pump output.

2.5.5 LEAKS BETWEEN THE CONNECTION AND FRAME

Problem	Solution
The fluid leaks out of the connection and front plate.	If the flange connection has a rubber coating, check that it is sealed and positioned correctly.

2.6 Dangers due to Structural Modifications and Spare Parts

Structural modifications can affect the operational safety. The heat exchanger must therefore only be rebuilt and modified in consultation with the manufacturer. No components must be removed, in particular safety devices.

Only BEHNCKE spare parts and accessories must be used.

Any accessories must not endanger the safety of the system.

2.7 Safety Measures at the Installation Location

The heat exchanger must be installed securely on a firm and level surface or on a mounting plate and is not suitable for use in constant sunlight.

Operate the heat exchanger only if all the peripheral safety devices are fully functional.

The heat exchanger or the surrounding area may be damaged if the specifications are not observed.

An adequately dimensioned safety floor drain must be available in the installation area in order to avoid water damage in the case of any leaks.

The installation area must not be colder than 5°C during operation and when carrying out maintenance, commissioning, cleaning or repair work.

**CAUTION!**

Check the heat exchanger for leaks, for visible external damage and to ensure it is functioning **at least once a week**.

2.8 Personnel Requirements

2.8.1 Qualifications

**WARNING!****Risk of injury in the case of inadequate qualification!**

Improper handling can lead to serious personal injury and property damage.

- Specific activities must only be carried out by the people designated in the respective chapter of this manual.
- Keep unqualified personnel away from the danger areas.

The following qualifications for different areas of activity are designated in the operating manual.

- **Trained/instructed person**

Has received training from the operator in their assigned tasks and the possible dangers in the case of improper behaviour.

- **Specialist**

Is in a position to carry out their assigned work and identify possible dangers independently because of their technical training, skills and experience as well as their knowledge of the relevant regulations.

- **Qualified electrician**

Is a person who can assess their assigned work and identify possible dangers because of their technical (electrical engineering) training, skills and experience as well as their knowledge of the relevant standards and regulations.

- **Systems mechanic**

The vocational training of a systems mechanic incorporates the job description of a gas fitter and plumber and a heating and ventilation engineer, which now no longer exist in their original form. Instead, these have been amalgamated into the systems mechanic profession. In addition, components of solar technology and electrical engineering are included in order to be able to carry out minor electrical work, such as wiring a heating circuit or charging pump.

2.8.2 Authorised Users

The heat exchanger must only be used by people who:

- Are mentally and physically capable to do this.
- Are instructed in operating it.
- Have read and understood this operating manual – in particular the safety chapter and warnings.

2.9 Responsibility of the Operator

The operator must:

- Be instructed in operating it.
- Have read and understood this operating manual – in particular the safety chapter and warnings.
- The heat exchanger must be stored in a frost-free area over the winter.

2.10 Personal Protective Equipment

It is necessary to wear personal protective equipment when carrying out any work in order to minimise the health risks.

- Always wear the necessary protective clothing for the respective work when carrying out the work.
- Observe the signs relating to personal protective equipment displayed in the working area.

Always wear:

Always wear the following when carrying out any work:



Protective work clothing

Is tight-fitting work clothing with low tear strength, with tight sleeves and no protruding parts.

Do not wear any rings, chains and other jewellery.

Wear a hairnet!



Safety shoes

For protection against heavy falling parts and slipping on slippery surfaces.

2.11 Behaviour in the Case of Danger and Accidents

In the case of an emergency: take the right action

- Take the filter system out of operation immediately and disconnect it from the power supply.
- Rescue any people from the danger zone as long as this poses no danger to your own health.
- Initiate first aid measures.
- Alert a doctor and/or the fire service.
- Inform the responsible person on site and keep access routes clear for emergency vehicles.
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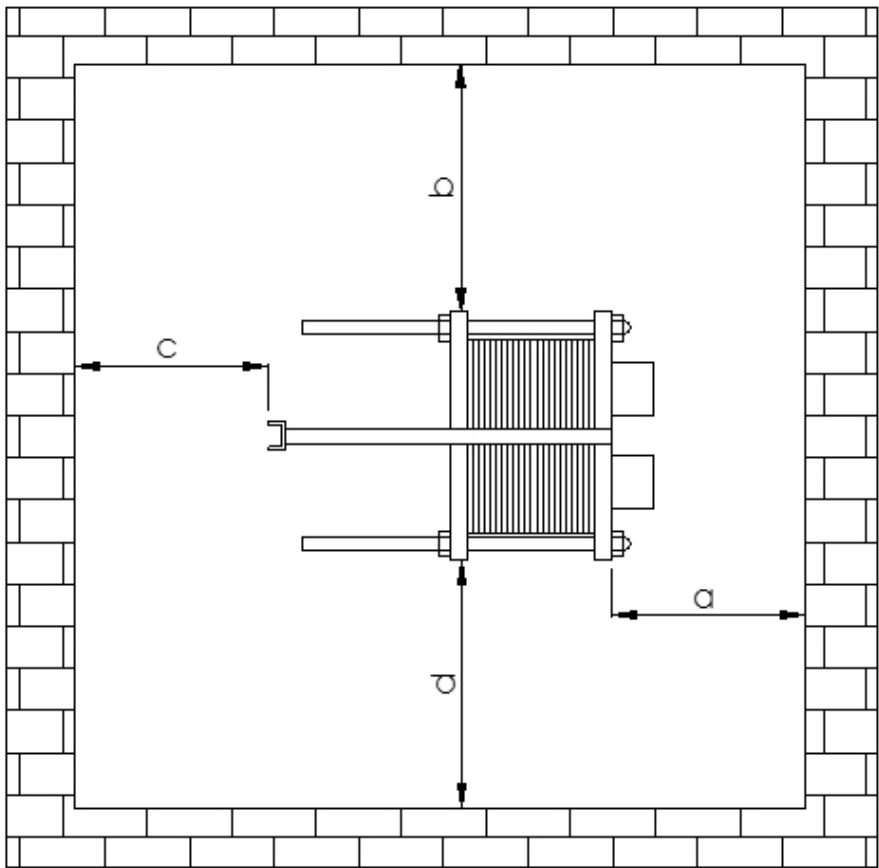
3 Technical Data

Type	Number of plates	Plate type	Output				Min/max. temp.	Max. operating pressure	Test pressure
			Primary ON/OFF						
			Secondary ON/OFF						
			50/30 °C	40/30 °C	15/35 °C	15/35 °C	° C	bar	
PWT 510 P 15 H	15	HIGH	35 kW	15 kW	35 kW	15 kW	-11/110	6	8.58
PWT 510 P 27 H	27	HIGH	70 kW	30 kW	70 kW	30 kW	-11/110	6	8.58
PWT 910 P 19 H	19	HIGH	104 kW	52 kW	104 kW	52 kW	-11/110	6	8.58
PWT 910 P 25 H	25	HIGH	140 kW	70 kW	140 kW	70 kW	-11/110	6	8.58
Material									
Type	Connections	Art. no.	Art. no. Insulation		Frame	Plates	Gaskets	Expansion bolts	Connections
PWT 510 P 15 H	4 x 1 ¼"	305 225 15-18	P-130 004		P 355 NH	AISI 304	EPDM	A 193 B7	AISI 304
PWT 510 P 27 H	4 x 1 ¼"	305 225 27-18	P-130 006		P 355 NH	AISI 304	EPDM	A 193 B7	AISI 304
PWT 910 P 19 H	4 x 1 ¼"	305 230 23-18	P-130 018		P 355 NH	AISI 304	EPDM	A 193 B7	AISI 304
PWT 910 P 23 H	4 x 1 ¼"	305 230 31-18	P-130 018		P 355 NH	AISI 304	EPDM	A 193 B7	AISI 304

3.1 Measurements and Dimensions

Sufficient clearance must be provided around the heat exchanger during the installation, for example:

Model	Clearance (mm)			
	a	b	c	d
PWT 510	300	500	300	500
PWT 910	300	500	300	500



The dimensions of the heat exchanger are indicated on the design data sheet that you have received from the manufacturer.

3.2 Calculation of the closing rate

$$F = S \times NP + Y$$

F = closing rate

S = closing unit (see table)

NP = number of plates

Y = overthickness (see table)

Model	S Maximum closing rate [mm]	S Minimum closing unit [mm]	Y Overthickness for stainless steel connections [mm]	Y Overthickness for PP connections [mm]
PWT 510	2.8	2.7	2	6
PWT 910	2.8	2.7	2	6

4 Transport, Packaging and Storage

4.1 Safety Instructions for Transport

Unauthorised transport



NOTE!

Damage caused by improper transport

Substantial property damage may occur in the case of improper transport.

- Proceed carefully when unloading packages, with deliveries and with internal transport and observe the symbols on the packaging.
- Only use the designated attachment points.
- Remove packaging only just before the installation.
- Transport the heat exchanger only with suitable tools and equipment.

4.2 Transport Inspections

Check the delivery immediately upon receipt for completeness and transport damage. Please compare the delivered product with the enclosed delivery note.

Proceed as follows in the case of outwardly visible transport damage:

- Do not accept the delivery or only under reservation.
- Note the extent of the damage on the transport documents or on the delivery note of the transport company.
- If possible, produce photographic evidence.
- Initiate a complaint.



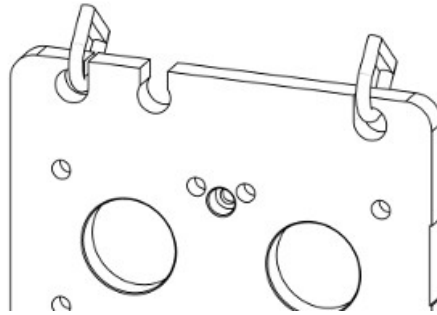
Register a complaint for any defect as soon as it is detected. Claims for damage can only be made within the applicable periods for complaints.

4.3 Transport/Storage

It is advisable to transport/handle the heat exchanger with a harness fastened to the frame (or into the holes designated for this purpose). However, this must not be done with chains and/or steel ropes.

It is prohibited to move/handle the heat exchanger by the connections as they are fragile and may be damaged.

The heat exchanger must always be installed in a vertical position and anchored to the floor by means of the designated points on the frame to ensure that there is sufficient space for the maintenance or repair.



4.4 Packaging

Remove and recycle packaging.

5 Installation and Initial Commissioning

5.1 Safety Instructions for Installation and Initial Commissioning



The installation and initial commissioning must only be carried out by a systems mechanic or specialist!

- Work on the electrical equipment must only be carried out by qualified electricians.
- Loose connections and damaged components must be secured immediately or replaced.



WARNING!

Risk of fatal injury from an incorrect installation and initial commissioning!

Errors during the installation can lead to life-threatening situations or cause substantial property damage.

- Never climb onto the heat exchanger.
- Maintenance and cleaning work must only be carried out by specialists when the peripherals are switched off, disconnected and have cooled down.

5.2 Installation

5.2.1 Requirements at the Installation Location

- The foundations must be designed for the anticipated static and dynamic loads.
- The foundations must be level and secure.
- The area must be frost-proof.
- The area must be covered and dry.
- The area must not have an aggressive atmosphere.
- Condensation can damage the system components; make sure that the area is well ventilated.
- The area must be equipped with sufficient lighting (at least 200lx).
- Ensure easy access for customer service work.
- Observe the minimum installation dimensions in accordance with the installation plan. (See page 22)
- The system components must be easily accessible for cleaning.
- The capacity of the intended floor drain and channel must be adequately dimensioned.
- The floor drain must be resistant to the fluids used.
- No vibrations must be transferred from the product to the peripherals.

5.3 Basic Information on the Installation

1. Install the heat exchanger in a vertical position with adequate clearance around it (see page 22), in particular in front of the loose plate so that the device is accessible for any maintenance work. It is not advisable to install the heat exchanger as shown in Figure 4 b), c) and d) (this applies in particular to heat exchangers with embossed plates that have no crossover connections) because air bubbles (or other heavily ventilated media) can form in this case that reduce the exchange coefficients and increase the pressure losses.
2. Please observe the flow diagram for connection of the primary and secondary circuit (figure 1, 2, 3, page 3 et seq.).
3. Only use suitable materials for the connection. The manufacturer accepts no liability for corrosion due to the incorrect choice of materials. (Only stainless steel screw fittings must be used for the connection on the swimming pool side (no brass screw fittings)).
4. Suitable shut-off valves must be provided for all connecting lines on the heat exchanger.
5. Circulation pumps with the appropriate properties must be installed in the primary and secondary circuit.

In order to generate process water (without purification), it is necessary to ensure that the heat exchanger cannot heat up when it is not working. For example to do this, a thermostat can be fitted that stops the pump and a back pressure valve that switches off the circulation of residual media. In the case of the return flow, a modulating valve must be installed in the primary circuit that is controlled by a sensor in the secondary circuit so that a temperature of 50°C is not exceeded here.

6. In the case of very dirty fluids, filters should be installed before they enter into the heat exchanger.
7. Filters can only be dispensed with if the circuits are adequately flushed.
8. Adequate drainage (safety floor drain) must be provided in close proximity to the heat exchanger so that the leaking fluids do not flood the area. (Should a lifting pump be necessary, this must have a separate fuse to the pump)
9. No force must be transferred to the heat exchanger connections (anchor the pipes to the walls in an appropriate manner).

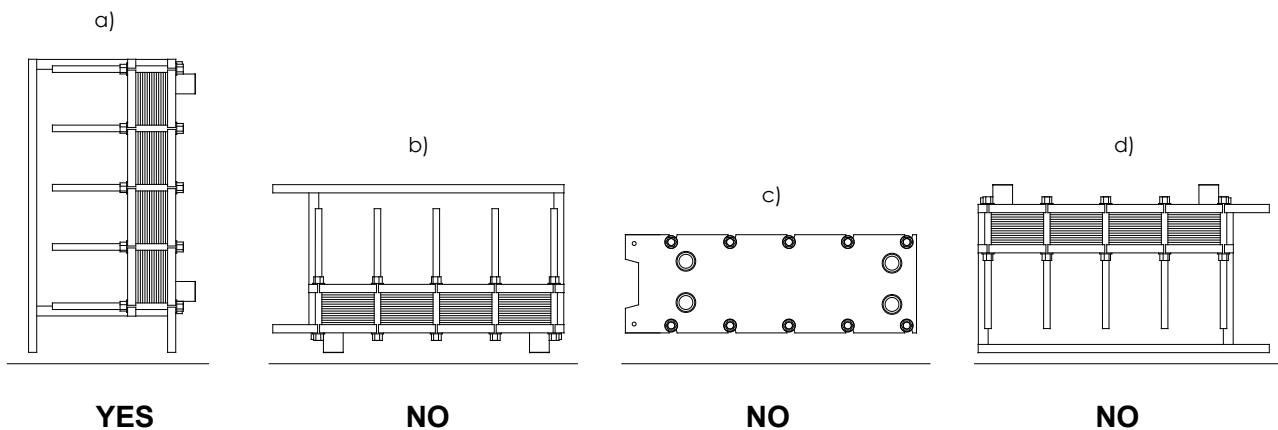


Figure 4: Installation options

6 Operation

6.1 Safety Instructions for Operating the Heat Exchanger

Basic Information



WARNING!

Risk of injury due to improper operation!

Improper operation can lead to serious injuries or property damage.

- Operate the heat exchanger in accordance with the information in this operating manual.
- The manual must be read and understood.

6.2 Commissioning

The following points must be observed during the commissioning and operation of the heat exchanger.

Operating pressure and maximum and minimum temperatures

The maximum and minimum temperatures as well as the maximum nominal pressure can be found on the type plate. **It is not permitted to exceed/drop below these values!**

Control

It is necessary to ensure that any control valves are set correctly.

Pump start-up

The (centrifugal) pump must always be started up when the valves are closed.

Then the valves are opened slowly in order to avoid abnormal dynamic loads.

Pressure fluctuations and vibrations

The heat exchanger must not be exposed to pressure surges or vibrations that can be caused by piston pumps or other devices.

These symptoms can lead to fatigue fractures on the plates.

Leak of flow media during the commissioning

Fluid may leak during the start-up phase.

This stops when the plates and the gaskets have reached the operating temperature and the pressure has balanced out in the entire unit.

Non-condensable media

Air (or other non-condensable media) in the heat exchanger reduce the exchange coefficients and increase the pressure losses. The device must therefore be vented.

Pressure increase and temperature fluctuations

It must be possible to measure the pressure and temperature continuously during operation. Increasing pressure losses and a reduced heat exchange point to the formation of deposits on the plates. These deposits must be removed (see the MAINTENANCE chapter on page 29 et seq.).

Leak of fluids during operation

See the "Possible Problems" chapter. (See page 14 et seq.)

Long-term decommissioning (winter storage)

The heat exchanger must be emptied and cleaned if it is taken out of operation for an extended period of time. After emptying and cleaning the heat exchanger, it must be gently opened and covered with a black plastic film/material in order to prevent the gaskets being damaged by sunlight (this applies only to embossed plates). The correct closing rates must be checked again before commissioning the heat exchanger again (see chapter on page 22).

**IMPORTANT NOTE!**

The heat exchanger must be installed in a well-ventilated area if one or both of the fluids are hazardous, toxic or highly flammable.

The use of such fluids conflict with the intended use of the heat exchanger.

7 Maintenance

7.1 Safety Instructions for Transport

Basic Information



WARNING!

Risk of injury due to improperly carried out maintenance work!

Improper maintenance can lead to serious injuries or property damage.

- Before starting, ensure that there is sufficient room to carry out the installation work.
- Make sure that the installation location is tidy and clean! Loose components and tools lying around or on top of each other are sources of accidents.
- If components have been removed, make sure that they are installed properly. Reinstall all fixing elements and observe the screw tightening torques.

7.2 Use of the Heat Exchanger

The heat exchanger gaskets should be replaced at regular intervals (approx. 3 years).

Regularly check that the operating values do not exceed the values designed for the device and make sure that no fluids leak out, especially in a cold state when the device is at a standstill. If there is a significant loss of water, close the shut-off valves and contact the technical services team immediately. In addition, make sure that no corrosion damage occurs on the surfaces of the pressurised parts (expansion bolts and plates) that may be caused by moisture and/or the ambient conditions.

7.3 Maintenance

The following points must be observed when opening and installing the plate heat exchanger:

7.3.1 No Pressure and Low Temperature

Before opening the heat exchanger, make sure that there is no pressure in the device and that the temperature has dropped to at least 35°C in order to avoid accidents and/or burns.

7.3.2 Opening and Disassembly

The expansion bolts must be loosened evenly when opening and disassembling the heat exchanger (i.e. the movable plate must be able to slide while it remains parallel to the fixed plate. The end distance of the opening can be adjusted with the help of 2 bolts; this means that the moving plate can be pushed back to the frame support. If the heat exchanger is installed on a vessel, the loose plate must be fastened to a pillar.



IMPORTANT NOTE!

Suitable protective gloves must be worn before handling the individual parts of the heat exchanger (plates, expansion bolts etc.).

7.4 Cleaning of the Plates

Remove the plates from the frame and, if they are contaminated or encrusted, immerse them in a solution as shown in Figure 5 (see page 32) until the dirt comes loose, then rinse under plenty of running water.



IMPORTANT NOTE!

Always use suitable protective equipment (goggles, gloves, breathing mask) when cleaning with acids or other solutions.

7.4.1 Manual Cleaning

Open the heat exchanger and separate the plates from each other. Use a soft brush and quality product to clean the plates. The heat exchanger must be depressurised and have cooled down before this process.

In the case of heavy contamination with organic material, it is best to soak the plates in a tray with the addition of a suitable cleaning agent (see page 33). Do not use metal brushes, sandpaper, scrapers etc. Neither the plates nor the gaskets will tolerate being treated with hard cleaning tools.

If necessary, a high-pressure cleaner can be used, but with the utmost caution and without adding any abrasives. Wear suitable protective equipment!

7.4.2 Cleaning in Situ

The deposits on the plates must be soluble if in-situ cleaning is to take place. In addition, it is important to make sure that all materials used in the circuit affected by the circulation are resistant to the product used for the cleaning.

The cleaning can also be carried out without any circulation. In this case, the heat exchanger must be filled with a quality cleaning agent. After a while, the cleaning agent is then flushed out with clean water.

7.4.3 Examples of an In-situ Cleaning Cycle:

Residues of the cleaning agent and heating/cooling media fluids are drained as follows:

- Rinsing with hot or lukewarm water
- Hot circulation of the cleaning fluid
- Rinsing with cold or lukewarm water
- Cleaning with water and the addition of chemicals
- Rinsing with cold or lukewarm water

7.4.4 Cleaning Agent

A quality cleaning product is a medium that can remove the deposits on the plates without damaging the plates and gaskets.

The stainless steel is coated with a protective film. This film must not be destroyed because it ensures that the corrosion resistance of the stainless steel is preserved.

7.4.5 Special Cleaning Agent

Oil and grease are removed with an emulsifying water/oil solvent.

Organic substances and greases are removed with sodium hydroxide (NaOH) at a concentration of up to 3 % and a temperature of 85°C. The concentration corresponds to 10 litres of 30% NaOH in 100 litres of water.

Limescale deposits are removed with nitric acid (HNO₃) at a concentration of up to 6% and a temperature of up to 65°C. The concentration corresponds to 9.6 litres of 62% nitric acid in 100 litres of water. The nitric acid supports the formation of the protective film on the stainless steel.

7.4.6 Cleaning Control

The cleaning is an important factor for the efficiency and performance of the plate heat exchanger. The plates must therefore each be carefully checked individually, especially when problems have occurred during the commissioning.

The reasons for ineffective cleaning can often be traced back to the following factors:

- Insufficient flow rate
- Inadequate cleaning time
- Insufficient quantity of chemical products compared to the extent of deposits on the plates
- Insufficient cleaning between two consecutive work cycles

7.5 Replacement of the Plates

When replacing and installing new plates, make sure that the power is switched off and the expansion bolts have been removed. Before the replacement plates are used, it is necessary to check that they are identical to the plates being replaced. It is possible to reduce the number of plates, provided that the plates are removed in pairs so that the plate pack is reinstalled with the same right/left configuration following the reduction. All 4 openings must be open on the plates that are removed. The closing rate (see page 22) must be checked again following such a reduction.

A reduction in the number of plates means that the heat exchange range of the device is reduced proportionally to the plates that are removed. In addition, there are higher pressure losses in the device.

7.6 Cleaning and Replacement of the Gaskets

7.6.1 Cleaning

“ACETONE” is used to clean and degrease new gaskets and their seating positions. It is important to make sure that the cleaning agent has fully evaporated before the new gaskets are inserted.



ATTENTION!

Solvents are harmful. Do not inhale. Wear suitable protective equipment!

7.6.2 Replacement

Proceed as follows to replace the gaskets properly:

- Remove the gaskets from their seating positions.
- Clean the plate edges.
- Insert the new gaskets. Should this process prove to be difficult, the folded edge of the plate can be raised slightly with a small spatula.

It is extremely easy to replace the gaskets on embossed plates.

7.7 Installation and Assembly

This process can be carried out without special equipment (torque wrench or similar) and without strictly adhering to “closing rates”. The special design of the plate permits a variation in the closing rate (F) depending on the age of the gaskets and the thermal loads to which the heat exchanger is exposed. The permissible tolerance range of this measurement is derived from the technical data in the table (see page 22).

The plates and gaskets must be carefully checked before they are installed. The plates must be clean and the gaskets must not be contaminated with grease or other substances. Any sand or granules on the gaskets can cause leaks and damage to the gaskets. The gaskets must always be aligned with the head end of the heat exchanger on embossed plates. If the gaskets have been replaced or the heat exchanger has just been delivered, it is necessary to check whether the device has been installed in accordance with the minimum distance specified in the table. (Installation dimensions, see page 21/22)

Make sure that the fixed plate and loose plate are parallel during the assembly. We therefore recommend measuring the distance at the top and bottom between the two plates on both sides.

The following points must be observed when tightening the nuts (see Figure 5 on page 33):

- | | |
|--|--|
| <p>PWT 510</p> <ol style="list-style-type: none"> 1. Tighten the nuts 1 – 6 – 3 – 4 2. Tighten the nuts 2 – 5 | <p>PWT 910</p> <ol style="list-style-type: none"> 1. Tighten the nuts 1 – 10 – 5 – 6 2. Tighten the nuts 2 – 9 – 4 – 7 3. Tighten the nuts 3 – 8 |
|--|--|

Repeat the processes until the desired closing rate is achieved.



ATTENTION!

Tightening the nuts too firmly damages the gaskets and could lead to the expansion bolt being damaged and the service engineer being injured as a result.



ATTENTION!

Do not stand in front of the connecting rods when tightening the nuts.

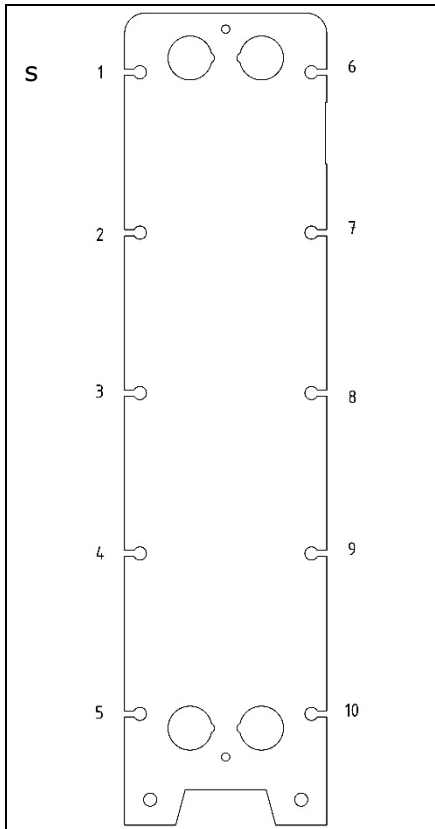
	CLEANING AGENT	ENCRUSTATION	DIRT
	WATER		SOFT
	3% SODIUM HYDROXIDE (NaOH)	ORGANIC SUBSTANCE	HARD SUBSTANCE ORG.
	6% NITRIC ACID (HNO ₃)	INORG. SUBSTANCE	HARD SUBSTANCE INORG.
	6% SULPHAMIC ACID (H ₃ NO ₃ S)	INORG. SUBSTANCE	HARD SUBSTANCE INORG.

Figure 5: Cleaning table

7.8 Check for Leaks

Any possible leaks in the device can be detected in the following way:

- Remove one of the lower connecting pipes and then pressurise the opposite side. No fluid must leak out of the open connection once the pressure has balanced out. If fluid continues to leak out, there is a leak in one or more plates. In this case, the plate pack must be removed and each plate must be carefully checked individually.
- Disassemble the heat exchanger and dry all the plates, then assemble the heat exchanger again and allow the fluid to circulate at maximum flow rate. The other circuit is left with no fluid and no pressure. Stop the circulation after a few minutes and carefully open the heat exchanger so that no fluid runs onto the previously dried side. A careful check of the plates can determine any wet points on the dry plates. Once the zones of the defective plates have been identified, these must be checked with a penetrating fluid.
- Disassemble the heat exchanger and check all the plates with the help of a coloured test fluid.

7.9 Modifications

The plate heat exchanger is a modular and therefore flexible device that can be expanded and reduced in any way. The capacity of the device can be changed by increasing or reducing the number of plates.

Notification of the article number specified on the type plate and the desired modifications suffice for this purpose.

7.10 Spare Parts

The device type and the article number of the heat exchanger (information on the type plate) must be indicated on the order form for spare parts. The following points must be observed in order to avoid incorrect deliveries:

- It is essential to specify the correct type number of the heat exchanger when placing orders related to embossed plates.
- It is sufficient to specify the article number when ordering a complete set of gaskets.
- The exact article number is required when ordering an individual gasket.

7.11 Dismantling and Disassembly of the Heat Exchanger

In the event of the dismantling or disassembly of the heat exchanger, it is important to observe the applicable regulations for the removal of the materials from which it is made (stainless steel, synthetic plastics and non alloy steel).



IMPORTANT NOTE!

The following points must be observed if the heat exchanger is out of operation for an extended period of time.

- If there is water in the circuits, shut off the valves and leave the heat exchanger full so that the gaskets do not age prematurely.



IMPORTANT NOTE!

If the heat exchanger is exposed to sudden temperature fluctuations during normal operation, especially from warm to cold, for instance if it is shut down suddenly, it may be that the device drips temporarily, but this will stop as soon as the normal operating temperatures are restored.

8 Troubleshooting

<u>ERROR</u>	<u>CAUSE</u>	<u>REMEDY</u>
No heat exchange	Shut-off valves are closed	Open the valves
	Pumps are not connected	Connect the pumps
	Heating control is faulty or incorrectly calibrated	Repair the heating control or set it correctly
Insufficient heat exchange	Air bubbles in both circuits	Vent the circuits
	Dirt deposits and encrustations in both circuits	Disassemble the heat exchanger and clean the plates
	Temperatures in the primary circuit lower than the program values	Increase the temperature in the primary circuit or the number of plates
	Flow rate in the primary circuit lower than the program value	Install a suitable pump
	No countercurrent	Check the connections
Increased pressure losses	Encrustation and/or blockage	Disassemble the heat exchanger and clean the plates
Low temperature at the secondary circuit outlet	Secondary circuit flow rate higher than the program value	Throttle the inlet valve of the secondary circuit

Troubleshooting

Leak (general)	Deposit of limescale or dirt on or under the gasket Broken or worn gasket Maximum pressure higher than the permissible pressure (see data plate) Closing rate may be higher than the specified rate (see table on page 22)	Carefully remove any trace of dirt and limescale Replace the gasket Reduce the pressure to the specified values Close the plate pack in accordance with the specified minimum value ATTENTION: The heat exchanger must no longer be under pressure before the closing process
Leak (especially in a cold state)	Closing rate may be higher than the specified rate (see table on page 22)	Close the plate pack in accordance with the specified closing rates (see table on page 22) ATTENTION: The heat exchanger must no longer be under pressure before the closing process
Frequently occurring encrustation (when generating process water)	Heat exchanger is constantly in the temperature state, for example, continuously connected to the heating system or to a permanently running pump. It may also be a case of spontaneous circulation	Install the heat exchanger correctly, make sure that it stays cold, but does not exceed a temperature of 48°C if this is not required; provide appropriate back pressure valves

Troubleshooting

Temperature fluctuations in the secondary circuit (for the generation of process water)	Boiler thermostat is not sensitive enough. Primary temperature is not constant	Make sure that there is continuous circulation in the boiler
Increased pressure in one of the two circuits as a result of the connection	Gaskets are worn or plates are corroded and/or perforated	Replace the gaskets and/or plates

9 Declaration of Conformity

Product:	Plate heat exchanger
Manufacturer:	BEHNCKE GmbH
Type:	PWT 510 / PWT 910
Type plate no:	
Year of manufacture:	
Operating medium:	Fluid (water/water)
Max. operating pressure:	6
	[bar]
Test pressure: [bar]	8.58

This declaration of conformity has been developed, designed and produced in accordance with the listed EC directives.

By: BEHNCKE GmbH
 Michael-Haslbeck Str. 13
 85640 Putzbrunn/Munich, Germany

- Pressure Equipment Directive 97/23/EC
- DIN EN ISO 13732-1 – Temperatures that can be tolerated on contact with hot surfaces
- Original operating manual is available in German

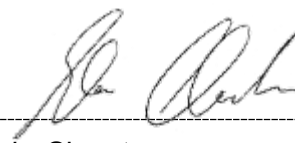
Putzbrunn 01/01/2018 Christian Ebert, Plant Manager

Place

Date

 Name/signatory
 information about the signatory

and Signature



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