Operating/Maintenance and assembly instructions for heat exchangers

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1. Introduction

WätaS plate-fin heat exchangers are designed as gas/liquid heat exchangers. Areas of application include coolers, heaters, direct evaporators, condensers, heat pipes with refrigerant or other customised solutions. The design is based on the customer's individual requirements.

The following notes and information on the installation, maintenance and use of the heat exchanger are based on our extensive experience, the current state of the art and incorporate knowledge acquired over many years. This, however, does not release the user from an inspection at his own risk.

Use as intended and in compliance with the underlying conditions to ensure safe operation.

The specific conditions for the respective heat exchanger can be found in the special documents provided for the respective heat exchanger.

2. Important information

2.1 General safety requirements

Our heat exchangers comply with the basic health and safety standards set by the European Community. However, dangerous situations may still arise.

Do not use the heat exchanger for a purpose that has not been specified by the manufacturer.

Always pay attention to the following:

- the applicable local work instructions
- the applicable local safety regulations
- the applicable local laws and environmental regulations

The operator or an authorised person must be notified immediately if the personnel of the operator detects faults on the unit or hazards relating to the unit.

The safety regulations applicable to the product must be fully complied with when handling chemical substances as well as oils and greases.

Before working with similar substances, carefully read and comply with the instructions for use on the chemicals packaging. This also applies to detergents.
Check whether this/these substance/s can be used for the corresponding heat exchanger.

The hazard and safety warnings attached to the heat exchanger must always be kept in an easily legible condition.

Explosive and/or highly flammable chemicals must not come into contact with hot parts of the heat exchanger.

2.2 Safety devices

A heat exchanger becomes cold or hot during operation.

Depending on the installation position, surfaces must be protected against potential contact using appropriate safety devices.

A warning symbol may need to be attached to hot surfaces if appropriate.

The use of adequate protective equipment is required when working on a heat exchanger.

2.3 Handling the heat exchanger

The heat exchanger must be handled in compliance with the safety and hazard instructions.

Loads, such as wind loads-, that may impact on the heat exchanger must be arranged in such a way that the heat exchanger is not exposed to these loads at the place of installation, regardless of their direction.

Vibrations of any type that may impact on the heat exchanger due to media or superstructures must be eliminated at the place of installation.

Heat exchangers must be installed in a completely structure-borne sound and load insulated way.

Primary measures must reduce the vibration at its source. If secondary measures are required, vibration damping elements must be installed at the place of installation before the heat exchanger.

Pressure surges during start-up or by opening and closing valves must be excluded. For this, measures must be taken at the place of installation. Pulsations that may occur, inter alia, at pumps must not be transferred to the heat exchanger as well.

Furthermore, check that the heat exchanger does not display any visible defects. This includes dented pipes, pipe elbows, fins or seals.

Faults that have the potential to impact on safety must be rectified as quickly as possible.

2.4 Transport and storage

2.4.1 General information

The entire delivery must be checked for integrity and possible defects in the presence of a representative of the transport company immediately upon receipt.

The accompanying documents and the delivery note give you the opportunity to review the delivery.

Complaints relating to transport damages can only be accepted if they are communicated, indicated and marked on the delivery documents of the forwarding agent on the day of receipt of the goods and if they are then immediately communicated to the manufacturer.

The WätaS information on the transport packaging must be complied with.

Ensure that the fins and other parts of the heat exchanger are not damaged during transport and storage. Do not place any objects on the fins themselves. Keep media that may corrode the heat exchanger away from the heat exchanger.

Transportation and the attachment of loads as well as unpacking must only be performed by appropriately qualified and instructed specialists who are capable of transporting heat exchangers based on their skills and experience in the transport sector.

2.4.2 Transport

WätaS heat exchangers are packaged in accordance with their size and weight or in coordination with the customer.
Only lift the unit in the following manner to ensure that it is not damaged:

- Use cut-resistant work gloves to lift the heat exchanger **at the frame**. Do not carry the unit using the fins, pipes or pipe elbows and these must not be impacted by any other forces.
- Larger heat exchangers may need to be carried by several individuals. The weight is indicated on the drawing released by the customer.
- Transport lugs are provided to transport heat exchangers weighing 500 kg or more.
- Pay attention to the respective transport regulations and ensure compliance with the diagonal pull angle, etc.

During transport take particular care to ensure that the fin stack and the side pipes and pipe elbows are not damaged. Operators of materials handling equipment-, such as forklifts-, must ensure that the heat exchanger is not damaged from below or the sides when inserting the forks.

The heat exchanger must not come into contact with doors, walls and hard objects in general.

2.4.3 Unpacking

The condition on delivery must immediately be checked by the recipient. Any condensate that may have formed or that may form must be removed.

Ensure the correct and environmentally compatible removal of the heat exchanger's transport cover and insulation.

Comply with the applicable national regulations.

2.4.4 Storage

Heat exchangers must be stored dry in a permanently frost-free room. The heat exchanger must be able to expand unimpeded, especially for larger units, to ensure that no material stresses occur. Avoid temperature fluctuations which may cause the formation of condensation on or in the heat exchanger during storage.

The end caps that are located on the pipe connections protect against dirt and other liquids. They must be removed at a point prior to installation, so that the unit can still be ventilated.
The pipes and fins have thin walls, so do not place any objects on the fin stack that may cause damage to the fins and pipes.

Attention must be paid to the following, particularly for heat exchangers that are not installed immediately:

- Do not allow the heat exchanger to sweat due to the use of covers or as a result of temperature fluctuations. Any existing foils, etc., may need to be removed for this purpose.
- The ambient air must not allow corrosion processes with the core materials (generally Cu, Al and stainless steel) to occur.
- The heat exchanger must be protected against contamination.

2.5 Disposal

2.5.1 General information

Please pay attention to the following when disposing of your heat exchanger:

- The nameplate (potentially with CE marking) on the heat exchanger must be removed and completely destroyed.
- The heat exchanger must be completely dismantled-, the recyclable parts must be recycled and the rest must be disposed of appropriately.
- You can dismantle the heat exchanger yourself and/or on your own responsibility.

2.5.2 Environmental compatibility

All materials used for the heat exchanger are noted on the drawing to ensure an environmentally compatible disposal.

Please pay attention to your national regulations.

3. Use

3.1 Intended use

The heat exchanger may only be used as intended.

This point is described in detail in the "Description and function" section.

The heat exchanger may be used only in a flawless technical condition, in line with its intended use and in compliance with the Instruction Manual.

3.2 Description and function

3.2.1 General information

In most heat exchangers, air flows through the fins. The design of WätaS is always based on the assumption that the atmospheric air is free of grease, oil and dust. Adhesive components must be avoided. Certain corrosive components in the air may destroy the fins.

The same applies to corrosive media in the pipes of the heat exchanger.
The operator is responsible for informing WätaS of the used media (gaseous, liquid) already in the enquiry. In case of uncertainties regarding material compatibilities, WätaS is willing to provide documents relating to the used materials. However, the compatibility must be clarified on site.

It should be also noted on site, which materials were connected to the heat exchanger directly or remotely in the line and whether those have an effect on the heat exchanger regarding corrosion or contamination.

All heat exchangers are subject to a test pressure that is higher than the operating pressure requested by the customer in line with the indicated medium temperature. This pressure is indicated on the drawing that must be released by the customer and is subsequently shown on the nameplate.

The air-side tightness must be explicitly specified when ordering. This is done in the separate ‘WätaS – Classification Groups”:

A: Sealing with suitable sealing compound
B: Sealing with suitable sealing compound + riveted hood
C: Technically tightly welded hoods (only possible in stainless steel)

If nothing else is specified by the customer, the production of the heat exchanger takes place without these seals.

WätaS equips every individual heat exchanger with a nameplate as standard.

3.2.2 Operating principle of a plate-fin heat exchanger

In this case, the colloquial term heat exchanger stands for a heat transfer system. These are devices in which heat energy is transferred from one substance to another.
Ribs, referred to as fins, are attached to the pipes. The heat is transferred at these flanks and conducted in the fin to the pipe wall. The pipe has been press-fitted onto the fins to make this possible. The thermal conduction creates a temperature gradient in the fin. The temperature decreases along the fin in the direction of the heat flow.

3.3 Incorrect use

The heat exchanger may present a danger if it is used incorrectly or not as intended.

3.4 Prohibited modes of operation

Operational safety can only be guaranteed if the heat exchanger is used as intended in accordance with our order documents.

Never exceed or fall below the limit values that are defined in our order documents in any circumstances.

An abrupt temperature change is only permissible if the heat exchanger can perform the expansion or shrinkage in its entirety without destroying its structural design. Any dimensional changes due to media temperatures are the responsibility of the purchaser and have to be observed and taken into account on site.

3.5 Heat exchangers with cold water or brine as the cooling medium

See Point: “3.2.2. Operating principle of a plate-fin heat exchanger”.

Apart from coming into contact with the heat exchanger itself, injuries may be caused by the spraying out of fluids such as water or another energy source.

Pay attention to the temperature and pressure. Precautionary measures must be taken at the place of installation in order to prevent contact with the heat exchanger at lower temperatures, either due to unintentional contact or when operating the control elements.

If these measures cannot be performed, the areas with the lower temperatures must be identified using appropriate markings such as warning symbols and the like. The presence of these kinds of dangers must also be noted in the technical documentation prepared and attached at the place of installation.

If preventing contact with lower temperature parts of the heat exchanger is not possible, appropriate protective clothing must be worn. The requirements relating to this kind of clothing must be included in the technical documentation prepared at the place of installation.
The heat exchanger and the other parts of the system must be operated in line with the manufacturer information and protected against overpressure.

3.6 Heat exchangers with hot water or thermal oil as the heating medium

See Point: “3.2.2. Operating principle of a plate-fin heat exchanger”.

Injuries may be caused by the spraying out of fluids such as compressed air, steam and highly pressurised thermal oil or water.

Pay attention to the temperature and the pressure. Precautionary measures must be taken at the place of installation in order to prevent contact with the heat exchanger at higher temperatures, either due to unintentional contact or when operating the control elements.

If these measures cannot be performed, the areas with higher temperatures must be identified using appropriate markings such as warning symbols and the like. The presence of these kinds of dangers must also be noted in the technical documentation prepared and attached at the place of installation.

If preventing contact with higher temperature parts of the heat exchanger is not possible, appropriate protective clothing must be worn. The requirements relating to this kind of clothing must be included in the technical documentation prepared at the place of installation.

The heat exchanger and the other parts of the system must be operated in line with the manufacturer information and protected against overpressure.

3.7 Heat exchangers with steam as the heating medium

See Point: “3.2.2. Operating principle of a plate-fin heat exchanger”.

Apart from coming into contact with the heat exchanger itself, injuries may be caused by the spraying out of fluids such as compressed air and highly pressurised steam.
For steam-heated heat exchangers, the condensate that arises inside the exchanger and which can form under the different operating conditions must be able to quickly and freely drain at the lowest points. If condensation can form inside pipelines for gaseous fluids, equipment to drain or remove deposits from low-lying areas must be provided at the place of installation in order to prevent damage due to water hammers or corrosion.

If elements such as valves, branching points, pipe elbows, etc., are installed in the system and these reduce the speed, the max. permitted pressure must not be exceeded by the pulse peaks.

Appropriate measures must be taken at the place of installation. Only if this requirement has been met, can a uniform heat dissipation over the entire heat exchange surface and the full functioning and performance of the unit be ensured and steam hammers be prevented.
Preventing vibrations: see Intended use

The heat exchanger and the other parts of the system must be operated in line with the manufacturer information and protected against overpressure.

3.8 Heat exchangers with refrigerants

See Point: “3.2.2. Operating principle of a plate-fin heat exchanger”.

Injuries may occur from coming into contact with the heat exchanger itself as described above. When working on refrigeration systems, pay attention to accident prevention regulation BGV D4 (formerly VBG 20) and other applicable regulations.

Corresponding safety data sheets or substance data sheets from the manufacturer as well as general information provided by the professional association of the chemical industry (Berufsgenossenschaft der chemischen Industrie) are available for every refrigerant.

Extensive work may only be performed by appropriately qualified and instructed specialists.

The heat exchanger and the other parts of the system must be operated in line with the manufacturer information and protected against overpressure.

4. Set-up

Every individual connection is noted in the drawing.

Only use the connections specified with the relevant nominal diameters.

The installation location of the heat exchanger is defined in the drawing. Any changes to the installation situation must be coordinated with the manufacturer.

Connections to the WätaS heat exchangers must be implemented in such a way that they can expand unimpeded.
If a volume flow controller (VSR) is installed in the system (ventilation, air-conditioning, etc.), the heat exchanger must generally be installed after the volume flow controller.
A full-surface inflow and outflow to/from the heat exchanger and operation in accordance with the requested and confirmed media temperatures and flows is essential to achieve the performance indicated in the data sheet.
Our heat exchangers are not designed to absorb external forces such as duct or nozzle forces. The absorption of such forces must be prevented. If the impact of external forces cannot be ruled out during assembly activities, the necessary offsetting measures must be taken to ensure that the heat exchanger is not damaged.
When installing the heat exchangers, make sure that there are no material combinations that may initiate or accelerate electrochemical processes.

Ventilation and drainage must be ensured.

Stationary condensate leads to corrosion and may result in an overflow, e.g. from the condensate drip tray.
In principle, a syphon must be attached to the condensate discharges. The condensate drain should also be supported by a slight incline (1 to 3° towards the drain).

If there are influences such as pulsating flows or mechanical forces that are not considered in the design, an inspection must be performed by us prior to start-up.

4.1 Transfer points

Connections to heat exchangers:

Pipelines that lead to the heat exchanger must be permanently installed. There must not be any leverage forces, which may impact the collector or the entire heat exchanger, during its installation into the pipeline or duct system under any circumstances. Where the use of flexible tubes cannot be avoided (vibration damping, etc.), equipment that is designed for the heat exchanger's most difficult mode of operation and the expected operating conditions must be used. In particular, make sure that protection against bending or twisting movements as well as against thermal damage is provided at the place of installation.

5. Technical parameters

Refer to the design specifications (released drawing and/or data sheet)

6. Installation/Start-up

6.1 General information

Installation and start-up may only be performed by appropriately qualified and instructed experts from a specialist company. All inspection, installation and start-up measures according to current technological knowledge must be taken (e.g., repeat pressure test in the event of an extended storage period; removal of residual water from pipes using compressed air; check the existing overpressure on delivery in the same condition).

6.2 Operation

6.2.1 General information

Every heat exchanger must be checked for visible defects before start-up.

Heat exchangers must not be operated with dirty water or other polluted fluids. Filters may need to be installed at the place of installation. In particular, clean, oxygen-free water must be used in the circuit for heat exchangers with copper pipes. We also recommend using water within a pH range of 7 - 10 to operate our heat exchangers.

Important! If our heat exchangers are used in open systems in which, for example, well water, river water or similar media are used, the use of copper pipes may lead to corrosion damage. Counter-measures-, such as the use of other materials-, must already be coordinated with the specialist companies involved as well as WätaS at the time of request.

Freeze protection must be considered, particularly for heat exchangers that are not operated using brine. All necessary measures must be taken by the system operator. Brine heat exchangers are also susceptible to frost below a certain ambient temperature!

6.2.2 Starting heat exchangers with water, brine or thermal oil as the heating medium

Please pay attention to the following steps when starting these heat exchangers:

1. Please ensure flawless ventilation when filling to prevent air cushions within the heat exchanger.

2. After switching on the pumps, open the three-way motor valve a short distance and wait until you can identify the complete and uniform heating of the heat exchanger.

3. Now, carefully open the three-way motor valve while also fully engaging the fan.

7. Cleaning the heat exchanger

General information

Please note that regular cleaning is required. Otherwise, the heat exchanger's performance may be minimised.

WätaS plate-fin heat exchangers predominantly consist of aluminum, copper, steel or stainless steel. Combinations of these materials are sometimes also installed on the heat exchanger. The fins are 0.12 to 0.2 mm thick while the pipe walls are 0.3 to 0.5 mm thick.
Soiling of the fins leads to reduced output, increases the air pressure loss and may lead to or accelerate corrosion on the fin stack. It also leads to a higher airflow need and significantly higher energy consumption by the fan.

Deposits in the drip tray, on the condensate drain and/or in the connected syphon may impair or prevent the condensate from draining. Unimpeded drainage must be checked and restored where necessary.

The area surrounding the heat exchanger must be clean-, dust and dirt must not impair the heat transfer. In most heat exchangers, air flows through the fins. Check that the atmospheric air, which is grease, oil and dust-free and required by the design, is present. Adhesive components must be prevented and eliminated if they occur. The operator may need to be informed if appropriate. Filters must be installed upstream to ensure that certain corrosive components in the air do not destroy the fins and pipes.

As this cannot always be guaranteed, make sure that the heat exchangers are cleaned and maintained on a regular basis.

Stainless steel heat exchangers and their components are exposed to different loads depending on the location and on the environment, for example due to:

- Contact of the surface with building chemicals which adhere to the surface (such as lime or cement dust, acid fumes, etc.).

- Assembly with tools made of steel, which previously came into contact with normal iron.

- Flying sparks, which get onto the surface e.g., during grinding.
- High humidity containing salt near the sea.
- Contact of the surface with splash water containing de-icing salt near streets.
- Contact with chlorides or other harmful substances.

Incorrect detergents or cleaning at too large intervals; we highly recommend the use of deep cleansers (“BF Inosoft”, “Inox Finish Pflegespray”, or comparable products).

It must be checked if the galvanised, tin-plated or other coated heat exchangers are compatible with the industrial atmosphere.

Accumulated water (without aggressive contents) must be able to run off or to evaporate in order to prevent white rust or corrosion.

The frequency and the extent of cleaning depend on the type of use and the resulting demands placed on the heat exchanger as well as the degree of contamination.

Cleaning can take place using compressed air or by flushing. Do not damage the fins and pipes. Flushing is performed using special industrial cleaning systems and various chemical additives that are selected based on the type of contamination, area of application of the heat exchanger and the materials used. Confirmation of the safe use of the detergent with the materials used in the heat exchanger must be provided by the detergent manufacturer. Subsequent flushing with clear water and drying with compressed air is recommended in order to prevent detergent residues on the fins. When cleaning with compressed air, make sure that the jet of compressed air is an adequate distance away and parallel to the direction of the fins in order to prevent the fins from being destroyed.

The use of incorrect equipment or chemicals for cleaning increases the risk of destroying the fins and/or pipes and the risk of premature corrosion of the heat exchanger. It also voids the warranty. For these reasons, the cleaning must be performed by appropriately qualified and instructed specialists at intervals to be specified based on the degree of contamination, but at least once every year.
Cleaning/Maintenance may only be performed under frost-free conditions.

8. Liability and warranty

We are only liable for legal claims resulting from the contractual relationship within the scope of the warranty obligation agreed in the main contract.

Any manufacturer responsibility expires in the event of:

- improper or incorrect use of the heat exchanger
- changes to a heat exchanger that are not approved by the manufacturer
- incorrect assembly, operation, maintenance or cleaning

Appropriately qualified and instructed specialists must be assigned to transport, set up, assemble, start up, operate, maintain, clean and dismantle the heat exchanger.

Legal responsibility expires if it can be demonstrated that errors occurred during assembly, use and/or operation.

Wätas disclaims any warranty in case of a breach of due diligence and of the installation instructions.
Adaptations and/or changes may be made to a heat exchanger in certain cases if prior approval is obtained from the manufacturer.

We always look forward to receiving suggestions for improvement and are happy to take them into consideration.