

Plate Heat Exchanger
Operation
&
Maintenance Manual



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General:

The PRE-heat, Inc. plate type heat exchanger is designed to transfer energy from a hot stream to a colder stream without allowing the two streams to mix. This is accomplished when the heat transfer plates are assembled as a fully welded fabrication.

Heat transfer is enhanced when the air streams flow through the heat transfer plate bundle in a counter-flow arrangement. Additional enhancement is provided through the use of different dimple stamping patterns on each individual plate. These stamping patterns actually perform two functions; first, the dimple pattern provides a means of maintaining plate spacing at even intervals across the length and width of the plates. Secondly, the dimple pattern creates turbulence as the air stream flows through the heat transfer plates. The turbulence disrupts laminar air flow producing a mixing action that breaks down the boundary layer of "air insulation" typically formed at each plate's surface.

Pre-heat Inc. also uses variable plate width, length, and thickness to build the heat exchanger for your particular application. These variables allow us to meet your requirements for heat transfer effectiveness and pressure drop.

PRE-heat, Inc. has developed heat transfer programs for all of our products. These programs have been field checked showing that the calculated performance matches that of a typical installation.

Operating Information and Temperatures:

The 409 stainless steel plate heat exchanger is used when recovering energy from exhaust streams with a limited hot inlet temperature of up to 700 F. Differential pressure across the plates is also limited to 20 inches water gauge.

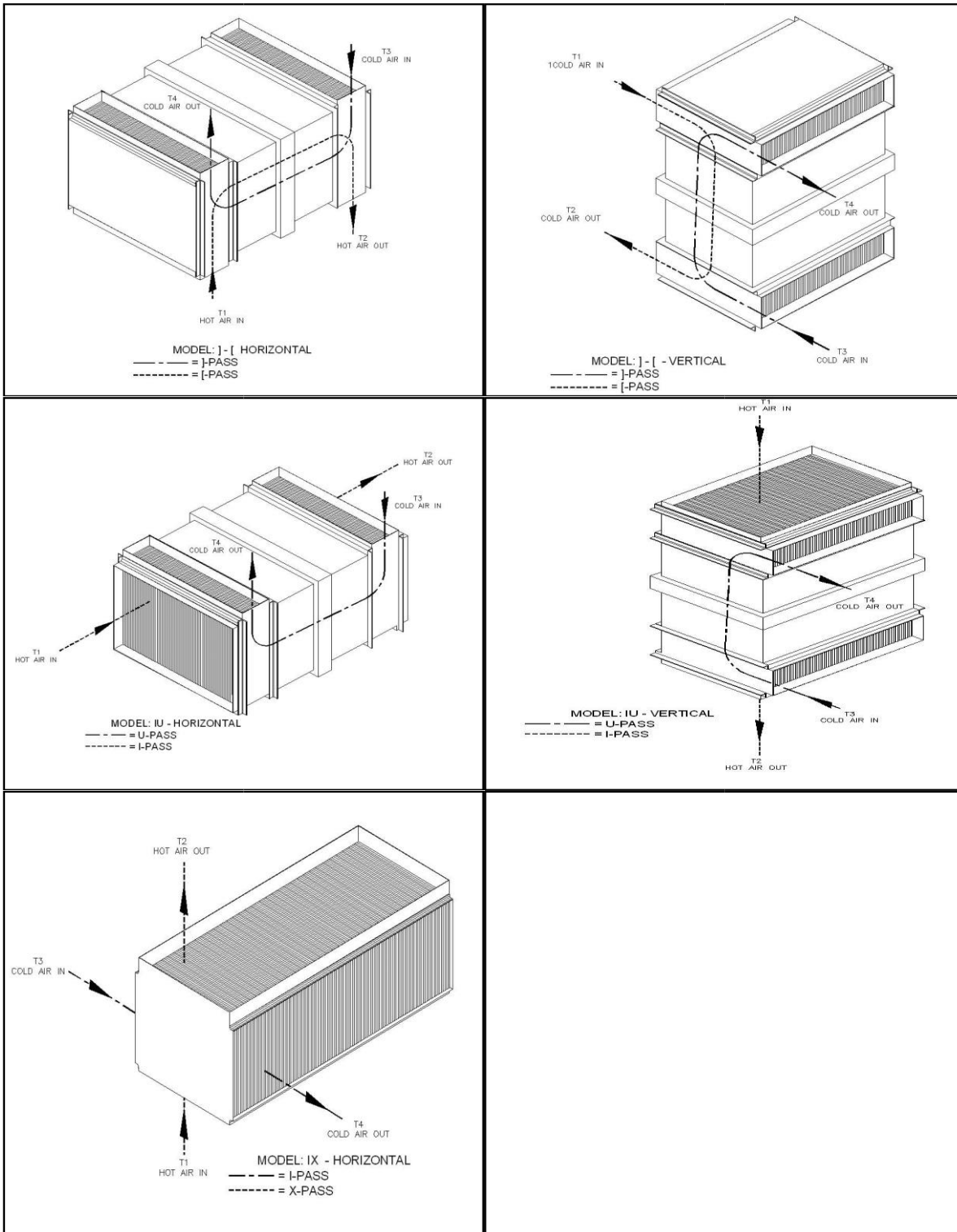
The 304L stainless steel plate heat exchanger is used when recovering energy from exhaust streams with hot inlet temperatures up to 1,200 F. Differential pressure across the plates can reach as high as 27.7 inches water gauge.

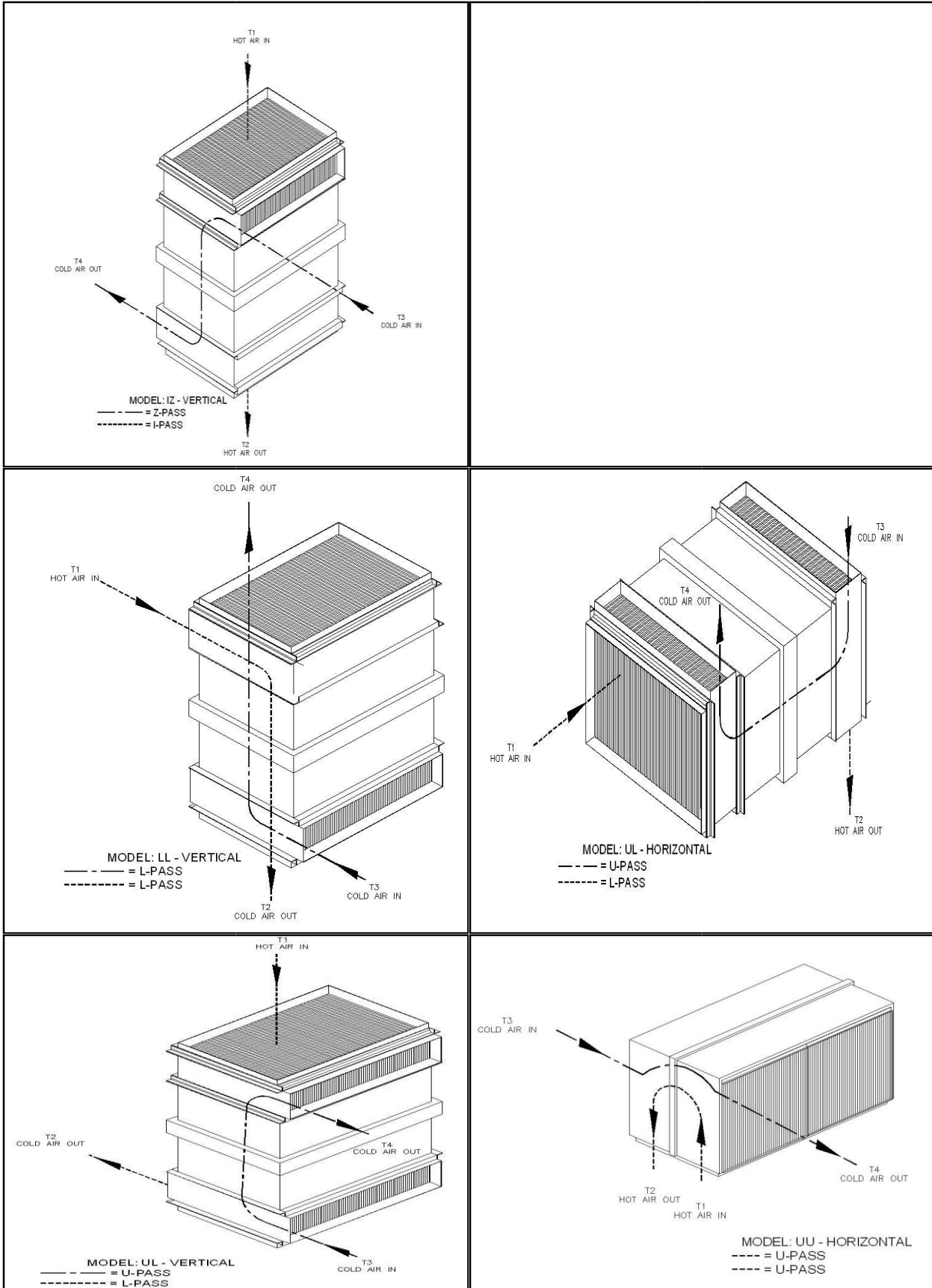
The 316L stainless steel plate heat exchanger is used when air stream chemistry requires an upgrade over 304L SS. Hot inlet temperature is limited to 1,300 F., and differential pressure at 27.7 inches water gauge.

The 309S and 310S stainless steel units are for operation when hot inlet temperatures are 1,400 F. to 1,500 F. and differential pressure up to 27.7 inches water gauge.

Important Note: Units to be heated and cooled at maximum temperature change of 50 degrees Fahrenheit per minute.

PRE-heat Plate Unit Configurations:
Heat exchanger positioning:





Receiving the heat exchanger:

Equipment received should be checked for compliance with the original order. Immediately upon receiving shipment, the unit should be inspected for evidence of damage from handling or transportation. If damage is evident, a claim should immediately be filed with the transportation-shipping company.

Storage and Handling of the heat exchanger:

If the unit is to be stored indoors prior to its installation, we recommend that the shipping covers remain in place and the unit left on its shipping pallet. When stored outdoors, we recommend the above and covering the unit with a weatherproof tarp. The heat exchanger can be moved or lifted with a forklift truck or crane of proper size for the weight and dimensions of the heat exchanger. Avoid damaging the heat transfer plates, casing and insulation with cladding. The lift load should be evenly distributed over a minimum of two lifting points on the heat exchanger exterior. This may require the use of spreader bars during crane lifts to lift at 90°, and fork extensions on forklift trucks.

Installation Considerations:

The plate type heat exchanger can be installed indoors or outdoors. We recommend that you allow sufficient room on all sides of the heat exchanger for any maintenance considerations or equipment inspections.

The plate type heat exchanger can be installed in the vertical or horizontal position. When installed in the vertical position, we suggest that the hot stream enter at the top of the I-Pass and exit at the bottom. This will allow drainage of any materials that are condensed as they pass through the heat exchanger plates. When the unit is installed in the horizontal position with the U-Pass “up” or “down” we recommend that the unit be pitched down in the direction of airflow of the condensing air stream. Typical pitch is 0.5” per 12” of unit length. All liquid drainage is handled in the attached ductwork unless the heat exchanger is specifically designed for internal drainage. Drainpipe size is determined by the expected volume of water to be removed from the system. Old rule of thumb for sizing gravity drain piping is as follows:

G P M:	MINIMUM PIPE SIZE (at heat exchanger):
0 to 11	1” Pipe
12 to 15	1.5” Pipe
16 to 25	2” Pipe
26 to 60	2.5” Pipe
61 to 90	3” Pipe
91 to 120	4” Pipe

(Above, limited to a maximum of 100 equivalent feet of pipe).

The gravity drain system with an atmospheric vent, trap depth is determined by the system’s static pressure measured at the location of drainpipe connection. The water column of the trap is 7 inches + the static pressure in inches water gage. Design the pipe trap with fittings that will allow cleaning of the trap. Remember to fill the trap with water prior to starting the system fans. Cold weather operation requires all liquid pipe systems to be heat taped & insulated to avoid freezing.

Flanges:

The gasket material for assembling flange connections should be compatible with the air stream chemistry and temperature. Flanges are bolted together using both flat and lock washers. We recommend checking the bolted connections during regular maintenance.

Ductwork and Transitions:

The effectiveness of the plate type heat exchanger can be adversely affected by poor airflow distribution. Inlet and outlet transition design should produce an even distribution of the air stream across the entire inlet and outlet face of the heat exchanger. When space limits transition design or when elbows are attached to the heat exchanger inlet, turning vanes should be used to evenly distribute the air stream.

Large heat exchanger or multiple heat exchanger installations:

Design plenums for even distribution of air across the inlet and outlet connection.

System expansion considerations:

Optional, metallic bellows expansion joints are available from PRE-heat, Inc. These expansion joints are available with or without flanges. PRE-heat, Inc. expansion joints are designed to protect the heat exchanger by allowing the unit to grow as the metal temperature increases. System expansion joints should be installed in the ductwork and piping to compensate for its expansion when operation is at or above 350 F. PRE-heat, Inc. recommends that at least one end of the heat exchanger be allowed to move in a controlled method to relieve expansion.

Heat exchanger vertical loading limits:

Consult the factory at 920-564-6876 for heat exchanger vertical load limitations if that information is not present on engineering drawings. Typical heat exchanger design limits vertical loading to a maximum of 500 LB on the heat exchanger flange. Optional structural supports can be added to the heat exchanger at the factory for vertical loads above 500 LB.

Insulation:

PRE-heat, Inc. recommends external insulation on all plate-type heat exchangers to keep heat losses to a minimum and provide safety to personnel in the vicinity of the installation.

Temperature control:

Damper systems can be added to the hot gas stream or the cold air stream to control temperature. The design and materials used would be compatible with the air stream chemistry and temperature.

Removable access doors:

Optional access doors are used on heat exchangers that are installed on exhaust streams that will result in frequent cleaning maintenance or units that require frequent internal inspection. The access doors are fastened to a flange as part of the heat exchanger. Gaskets are used to seal the connection. Check the gasket and replace, when necessary, before reattaching the removable access door.

Wash systems:

Optional wash systems are available that include wash headers, solenoid valves and controls. Utility requirements for these wash systems are listed on separate engineering drawings. Cleaning solutions are selected at the discretion of the user and should be compatible with the equipment's material of construction.

NOTE: Wash systems require the drain piping to be sized to handle the gallons per minute of wash fluid flowing through the heat exchanger.

NOTE: Cold weather operation requires all liquid pipe systems to be heat taped & insulated to avoid freezing.

Startup:

Initial system startup should have all dampers open, fans and blowers set for their lowest volume of operation and hot gas temperature at its minimum temperature setting. The startup engineer should check all parts of the system to ensure that air flowing through the heat exchanger matches the unit's design. Crossflow units have one air stream crossing at 90 degrees to the other air stream. IU and IZ airflow designs are calculated for counter-flow air stream direction where one air stream is flowing through the heat exchanger in the opposite direction of the other.

When the initial checks are completed, start ramp up of the system air volumes and temperature. When the system has reached its normal operating load and soaked out, measure the temperature at the hot (exhaust) inlet and outlet. Measure the cold (air) stream temperature at the inlet and outlet. Measure the pressure drop on the hot and cold sides of the unit. Finally measure the hot exhaust volume and the cold air volume. Compare the measurements to those listed on the equipment design worksheet / calculation page. Report any discrepancies to PRE-heat, Inc. for resolution.

Important Note: Units are to be heated up and cooled down at a maximum temperature change of 50 degrees Fahrenheit per minute.

Record the following measurements:

Hot stream inlet temperature and static pressure: _____

Hot stream outlet temperature and static pressure: _____

Hot stream volume (ACFM or SCFM): _____

Cold stream inlet temperature and static pressure: _____

Cold stream outlet temperature and static pressure: _____

Cold stream volume (ACFM or SCFM): _____

Using the above information, updated measurements and equipment inspection is used for determining when maintenance is required.

Warranty Statement:

Material and Workmanship:

PRE-heat, Inc. warrants that the equipment proposed herein of their manufacture shall be free of defects in workmanship or materials for a period of one year from the date of shipment. Should any failure or defect appear within one year of shipment, PRE-heat, Inc. shall upon receipt of written notification of said failure and substantiation that the equipment has been stored, installed, erected, maintained, and operated in accordance with good industry practice and in accordance with manufacturer's instructions correct such non-conformity by repair or replacement, F.O.B. factory, Oostburg, WI. This warranty does not cover labor or transportation charges for the removal, exchange, or reinstallation of the equipment.

PRE-heat, Inc. shall not be responsible, nor shall allowance be made, for work done, equipment furnished or for repairs or replacement made by the purchaser or others, either with or without purchaser's approval, unless prior written approval is made to the purchaser by the manufacturer. Any unauthorized repairs or parts will void the warranty.

Products or goods manufactured by others, supplied by PRE-heat, Inc. as a part of a system are not covered by this warranty. However, PRE-heat, Inc. will give their customer the benefit of any such adjustment as it finally obtains from that respective manufacturer of that component or product.

Freight damage is specifically excluded from this warranty and is the responsibility of the purchaser and the carrier.

Damage as a result of effect of corrosion, erosion, excessive heat, freezing, dirt, dust or foreign materials and normal wear for that application are specifically excluded from this warranty.

Performance Warranty:

Performance figures or requirements, if any, must be addressed in the quotation. Performance warranty, if any, must be specifically covered in the quotation. Where no performance figures are specified or warranted the manufacturer assumes no responsibility for compliance or non-compliance.

The foregoing, warranties are exclusive and in lieu of all other warranties, except that of Title, and PRE-heat, Inc. hereby disclaims all other warranties, whether written, oral or implied, in fact or in law (including any warranty of merchantability or fitness for a particular purpose).

Limitation of Liability; in no event shall the manufacturer be held responsible or liable on any claim whether in contract tort, negligence, strict liability, warranty or otherwise, for any special, indirect, incidental or consequential damages resulting from the purchase of said equipment, including but not limited to incidental or consequential damages for labor, loss of profits, lost production, lost sales, injury to person or property or any other incidental loss or damage.

Work Safety Hints

The following work safety tips are especially to be heeded:

- The heat exchangers described in this manual and their components are designed and built according to the latest technological developments. Yet this plant can be dangerous if used improperly by untrained personnel or used for other purposes than those designated.
- Each person in the operating company who is involved with the assembly, disassembly and reassembly, start-up, operation, and maintenance (inspection, maintenance, repairs) of the plant or parts of the plant must have read and understood the entire operating manual, particularly the chapters on safety. It is recommended that the operator of the plant have this confirmed in writing. All O & M documentation for applicable equipment components has been included in this manual.
- Before working on parts of the heat exchanger system the operator is responsible for the plant has to be informed. The personnel intending to work on the heat exchanger system have to be informed about the current status of the heat exchanger system (temperatures, pressures, other ongoing work etc.) and of the risks that might be involved in the work. The heat exchanger operator has to be informed when and how the work is completed.
- The heat exchangers are to be used solely for the application defined in this operating manual. Any application beyond this is considered to be not in accordance with regulations. The manufacturer is not liable for damages resulting from usage not in accordance with regulations; the user alone carries this risk.
- Observance of the conditions for assembly, disassembly and re-assembly, start-up, operation, and maintenance stipulated by the manufacturer is also a part of usage according to regulations.
- The heat exchanger system may be operated, maintained, and repaired only by authorized, trained and instructed personnel. This personnel must have received special instructions with regard to possible dangers.
- Refrain from all working methods which reduce the safety of the heat exchanger system.
- It is also the responsibility of the operator to make sure that no unauthorized people work on the heat exchanger system.
- The operator is obligated to immediately report any changes in the heat exchanger which have an influence on safety.
- The operator is obligated to always operate the heat exchanger system only when it is in design working condition and corresponds to safety regulations.
- By means of the corresponding instructions and checks, the user must ensure that the heat exchanger system is kept clean and orderly.
- Should surface temperatures exceed 158 °F (~70 °C), then the operator is obligated to put a clearly visible sign on or near the hot parts of the installed and operational heat exchanger system warning of the danger of burning.
- Self-determined modifications and changes which influence the safety of the heat exchanger system are not allowed.
- All work inside the hot parts of the heat exchanger system may only be done when the plant is cold and at a standstill. All other work must only be done in accordance with the safety regulations for the components.