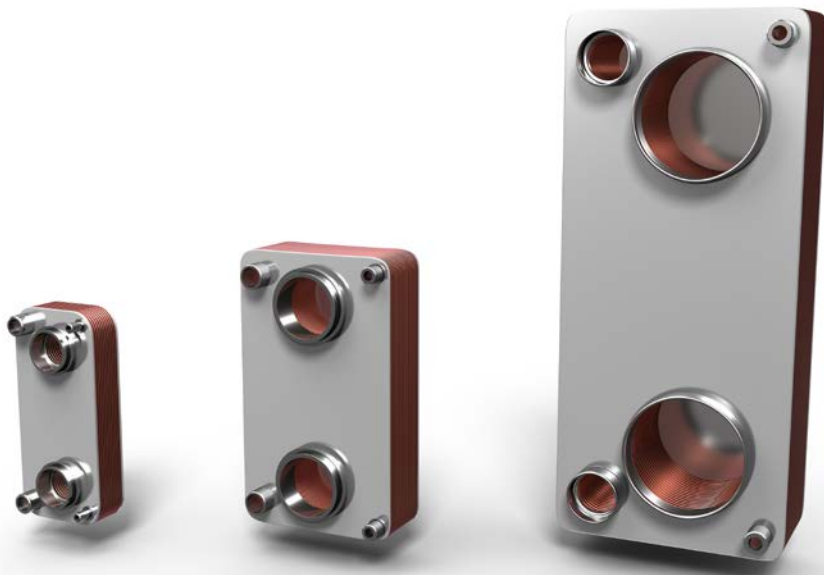




Installation and maintenance manual

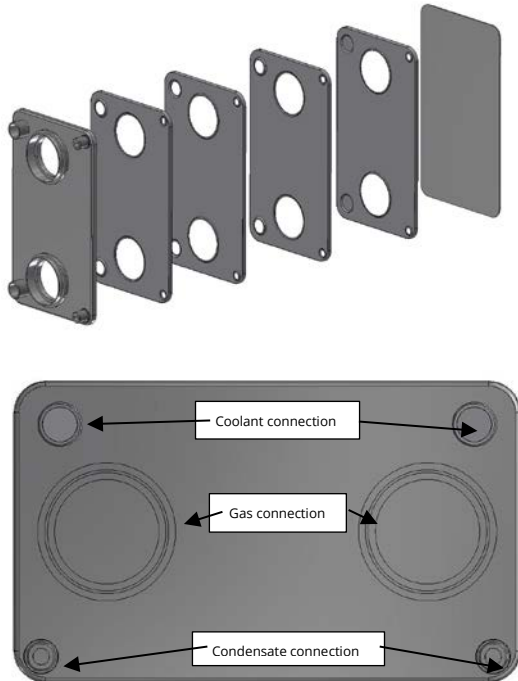
Compact product family



Version: 001
Date: 06-10-2016

General information

The Airec Compact exchanger is an asymmetric brazed plate heat exchanger consisting of stainless steel plates brazed together with copper or nickel. The Compact family consist of six different models, Compact 25, 36, 37, 70, 71 and 72 which refer to the plate size, for further measurements please see respective Product Data Sheet on www.airec.com. The Compact family consist of several types depending on material combinations, pressure ratings and functions.



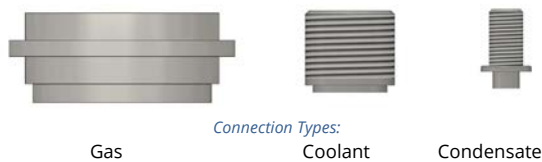
Principle sketch of Compact with Gas, Coolant and Condensate connections marked

Connections

All connections on the Compact are brazed in the general vacuum-brazing cycle, which gives a very strong seal between the connection and the cover plates. However do not use excessive force which can damage the connection.

The Compact are available with connections adapted to the model/size, for exact measurements please see respective Product Data Sheet on www.airec.com.

The Compact are available with threaded ISO-G connections for liquid and condensate connection. The gas connections are of type welding/brazing connection.

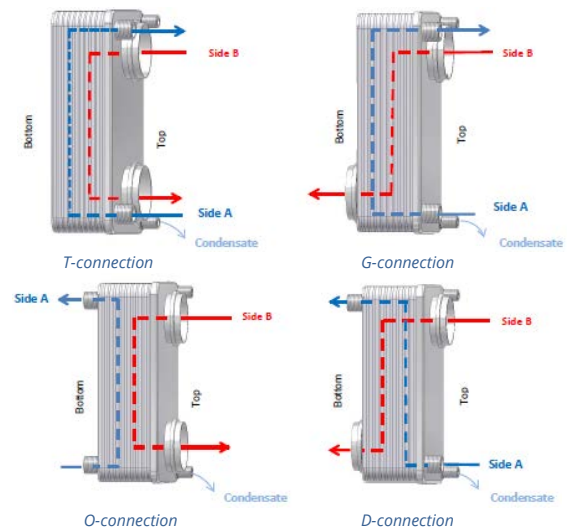


Compact model	Gas Connection	Coolant Connection	Condensate Connection
25	W 60	G 0.75	G 0.25
36	W 85	G 1	G 0.5
37	W 85	G 1	G 0.5
70	W 160	G 2.5/W 70	G 1
71	W 160	G 2.5/W 70	G 1
72	-	-	-

Connection configuration

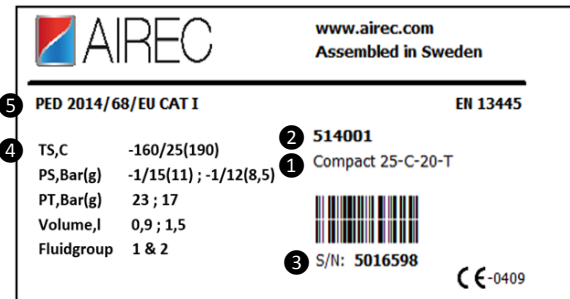
The Compact heat exchangers are available in different connection configurations. There are four standard configurations: T, G, O, and D.

Please note that other configurations than the ones pictured below may exist.



Denomination / Product identification

All Airec heat exchangers are equipped with an adhesive label which includes vital information about the unit, e.g. type of heat exchanger, execution, material combination and item number. The label also includes the serial number and Operating Conditions; state the maximum operating material temperature and pressure as per the respective approving organization.



- 1 Compact 25-C-20-T
Product type: Compact
Size: 25
Brazing material: N (nickel) / C (copper)
Number of plates: 20
Connection configuration: T (all conn. on top-plate)
Gas-connection size/type: W85 (welding conn. Ø 85mm)
Water-connection size/type: G1 (threaded ISO-G, dim: 1)
- 2 Item number
- 3 Serial number
- 4 Operating conditions;
TS: Operating plate temperature min/room temperature (max)
PS: Operating pressure min/room temperature (max)
PT: Test pressure
Volume: liquid side / gas side
Fluid group: according to approving organization
- 5 Approving organization

Pressure vessels

The product type Compact is manufactured according to the European Directive for Pressure Equipment (PED 2014/68/EU). The pressure rating for the Compact is depending on the model and type, please see respective Product Data Sheet on www.airec.com and/or contact Airec.

For copper brazed Compact the maximum operating wall temperature is 220°C (428°F) and for nickel brazed the maximum operating wall temperature is 350°C (662°F).

Note: *The gas temperature may be considerably higher than the material temperature provided there is sufficient coolant temperature and flow.*

For divergent operating conditions please contact Airec.

For approved units the data on the label must not be exceeded at any circumstances. The heat exchangers are designed for use with fluids according to groupe1 and 2 in PED 2014/68/EU.

For operating conditions concerning the European approval PED, please see Product sheets on www.airec.com. For more details on the respective approvals, please contact Airec.

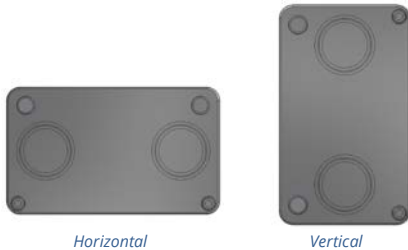
Installation

Personal protection

Suitable protective clothing i.e. goggles, gloves and shoes shall be worn whilst installing and/or maintenance of heat exchangers. Please be aware of: - filled heat exchangers might be heavy, - heat exchangers can be hot from high temperature operation, - condensate might be corrosive/caustic.

Connecting the Compact to the system

Compact can be installed in both vertical and horizontal direction.



Horizontal

Vertical

Note! For condensing application the installation is recommended to be Vertical with Gas-flow from top – down through the heat exchanger and condensation connection must be at lowest point to avoid build-up of condensate inside the heat exchanger.

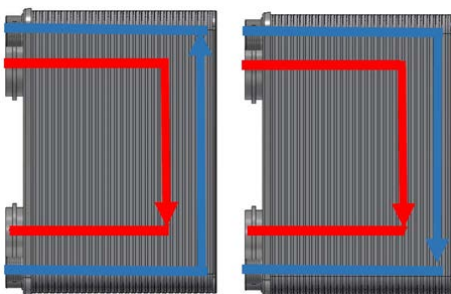
Flow direction of the fluids into the Compact heat exchanger can be either:

Concurrent = fluids flow in the same direction through the heat exchanger

or

Counter-current = that the fluids will move in the opposite direction through the heat exchanger.

Please consult the system drawings for the flow directions for the Compact heat exchanger.



Counter-current

Concurrent

Mounting Compact

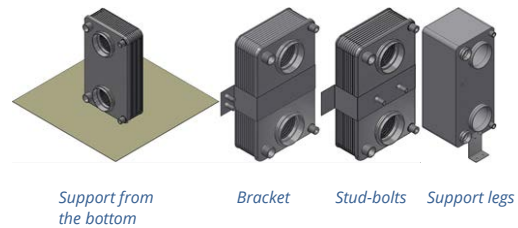
When mounting the Compact treat the heat exchanger with care and do not use excessive force, bending or welding on the heat exchanger.

Never expose the Compact heat exchanger to excessive pulsations (i.e. cyclic pressure or temperature changes). It is also important that no vibrations are transferred to the unit. If there is a risk of this, install vibration absorbers / muffler. For large connection diameters, we advise you to use an expanding device in the pipeline. If installation allow it is also suggested that a buffer is installed between the Compact and the support.

Regardless if the heat exchanger is mounted horizontal or vertical must the heat exchanger have full support.

Do not install the Compact only to the connections as it will give too high stress on the connections.

Airec suggest mounting according to below example. Support legs (Compact70) and stud-bolts in different versions and locations are available as options, please contact Airec.

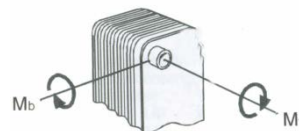


Mounting stud bolts for BPHEs are available as an option. These stud-bolts are welded to the BPHE. The maximum allowable loads on the stud bolts during assembly are stated in below table.

	Tension force F_T [N]	Torque moment M_T [Nm]
M6	1200	3,8
M8	2400	9,5
M10	3600	19

The maximum allowable connection loads given below are valid for low cycle fatigue. If high cycle fatigue is involved special analysis should be made. The following limits for moment should not be exceeded.

Connection	Max. Traction [N]	Max. Bending Moment [Nm]	Torque Moment [Nm]
Coolant	6000	50	150
Condensate	3000	20	70
Gas	6000	50	150



Welding/Soldering Connection and Pipe

When soldering; degrease and polish the surface. Apply flux, note that flux properties make it potentially very aggressive and it is therefore important to use the correct amount of flux, as too much might lead to severe corrosion. No flux must be allowed to enter the heat exchanger. Insert the copper tube into the connection, hold it in place and braze with min. 45 % silver solder at max. 450°C (840°F) when soft soldering and 450-800°C (840-1470 °F) when hard soldering. Do not direct the flame at the Compact. Use a wet rag to avoid overheating the Compact. Protect the heat exchanger interior from oxidation with N₂ gas. Excessive heating may cause serious damage to the heat exchanger.

When welding; protect the heat exchanger from excessive heating by using a wet cloth around the connection making a chamfer on the joining tube and the connection edges. Use TIG or MIG/MAG welding. If using electrical welding circuits, connect the ground terminal to the joining tube, not to the back of the Compact. A small flow of N₂ through the heat exchanger will reduce internal oxidation.



Airec does not assume any responsibility for incorrect soldering or welding nor for any accidents that may occur during the process.

Operational conditions

The Compact is used with a liquid on the circuit with threaded connections and a gas on the circuit with welding/soldering connections. The heat exchanger must operate in line with approved design parameters; temperatures, pressures and flow rates.

Liquid side

Typical media are, Ethylene/Propylene glycol, Thermal oil, Water or other for stainless steel non corrosive coolant. It is important that the coolant is of good quality without contamination or corrosive substance. If any of the media contains particles larger than 1 mm (0.04 inch), we recommend that a strainer with a size of 16-20 mesh (number of openings per inch) is installed before the Compact. The particles could otherwise block the channels, causing bad performance, increased pressure drop and risk of boiling.

System with water or another evaporating coolant must be equipped with necessary bleeding valve mounted in a position higher than the heat exchanger. Air/gas inside the liquid channels will reduce heat transfer and water circulation which also could cause boiling.

The liquid flow must be constant and with sufficient pressure to keep its evaporating/boiling temperature above the plate temperature. Local evaporation/boiling will adversely affect heat transfer and water circulation, and may lead to a risk of serious damage to the heat exchanger. Note: The pressure at the coolant outlet must be high enough to avoid boiling.

The Compact heat exchanger must always have the cooling fluid circulating fully before the hot gas enters the heat exchanger.

The Coolant must NEVER be allowed to freeze.

Never expose the Compact heat exchanger to excessive liquid pulsations (i.e. cyclic pressure or temperature changes).

Gas side

The gas media should not be corrosive to the heat exchanger.

Note: Copper brazed Compact products can under no circumstances be used for gases containing NH₃ (Ammonia). The concentration of sulphur and/or sulphur containing compound should be kept at a minimum.

The gas flow must be started after, or simultaneously to, the start of the liquid flow. If the liquid flow is interrupted, the gas must be stopped or caused to by-pass the Compact heat exchanger to avoid boiling on the liquid side.

The Compact heat exchanger must not be operated in such a manner that stagnant condensate is allowed to accumulate. Never expose the Compact heat exchanger to excessive gas pulsations (i.e. cyclic pressure or temperature changes). The heat exchanger can NEVER be operated without a coolant flow.

Operation start-up

Make sure that:

- If there is a risk of high temperatures, the unit is insulated as a precaution to avoid injuries.
- Installation has been carried out according to the flow schedule / drawing and recommendations.
- Connections are tight.
- No vibrations or pulsations are transferred to the Compact heat exchanger.
- The liquid side is filled and deaerated.
- The flow rate and pressure on the liquid side are correct before gas flow is started.
- The temperature and flow rates are according to specification.
- There is appropriate drainage to deal with any condensation.

Maintenance

The Compact has no moving parts or electrical components.

The following should be inspected regularly:

- Operational design conditions for the system being maintained, and meeting the calculated / design values (leaving temp., pressure drop).
- Increased pressure drop and decreased thermal efficiency over time are signs of possible fouling.
- Connections for tightness.
- Signs of corrosion.
- Seal and gaskets.
- External components such as valves, dampers and controls.

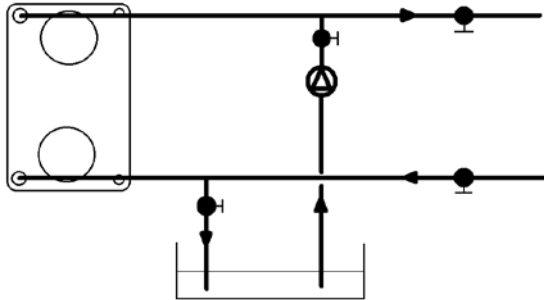
Cleaning

The normally high degree of turbulence in the Compact gives a self-cleaning effect in the liquid channels, which reduces fouling and the build-up of contamination, which can seriously reduce heat transfer capacity and increase pressure drop.

Cleaning of coolant side

In some applications the fouling tendency can be very high, e.g. when using extremely hard water at high temperatures. In such cases it is always possible to clean the Compact by:

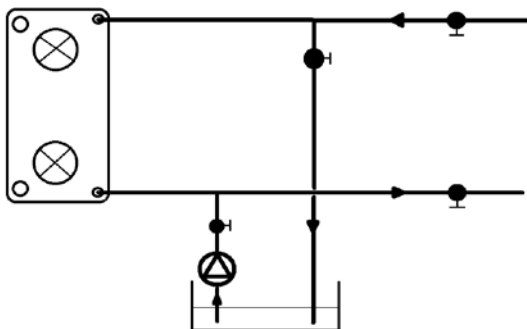
- Circulating a cleaning liquid (CIP - Cleaning In Place).
- A solution of 5 % phosphoric acid or 5 % oxalic acid in water is recommended to chemically clean the channels.
- The flow rate of the cleaning liquid should be greater than the design coolant flow, and it should flow in the reverse direction through the heat exchanger compared to the normal operation flow direction.
- ATTENTION! *After the cleaning process it is very important that the heat exchanger is flushed thoroughly with clean water before start-up.*



Cleaning of gas side

Heavy condensation can have a self-cleaning effect, washing the Compact and reducing fouling on the gas side. In applications where the gas contains elements of soot, grease or oil residues the risk of clogging the gas channel can be high. In such cases it is always possible to clean the Compact by:

- Blocking the gas connections.
- Circulating a cleaning liquid (CIP - Cleaning In Place) either through the condensate connections or (if the fouling issue have been addressed in the design phase) through specially designed connections on the connecting pipes. A suitable CIP-solution for the residues from the gas should be used.
- ATTENTION! *Chemicals known to corrode copper (i.e. ammonia, sulphur, etc.) are strictly forbidden to use as cleaning agent.*
- The flow rate of the cleaning liquid should be greater than the design liquid flow, and it should flow in the reverse direction through the heat exchanger compared to the normal operation flow direction.
- ATTENTION! *After the cleaning process it is very important that the heat exchanger is flushed thoroughly with clean water before start-up.*



Storage

The Compact shall always be stored in a dry and protective environment. The temperature should not be below 1°C and not over 50°C for long term storage (more than 4 weeks).

At long operational stand-by periods the system should be inspected for contamination on Liquid and Gas side, if necessary clean the Compact according to the cleaning instructions. Liquid side with water should be drained.

Disclaimer

The Compact performance is based on installation, maintenance and operating conditions done in conformance with this manual. Airec cannot assume any liability for Compact heat exchangers that do not meet these criteria.

Declaration of Conformity

It is hereby confirmed that the products Compact family has been designed, manufactured, tested and documented to fulfil the category requirements in the Pressure Equipment EC Directive 97/23/EC and the new Pressure Equipment Directive 2014/68/EU, module B (production) + D (no. 15-1002306-100). The products have been designed according to standard 13445.

Notified body: Inspecta 0409, PO Box 30100, SE-104 25 Stockholm, Sweden.

Further information on the product identification label on respective product.

AIREC AB

Signature:

Sven Persson

For further information, please consult Airec's technical information or your local Airec representative.



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