SECESPOL

INSTRUCTION MANUAL

Brazed Plate Heat Exchangers

Fig. 1

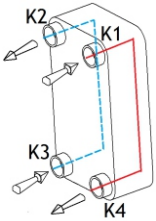

Fig. 2a

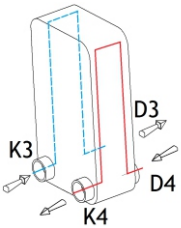

Fig. 2b

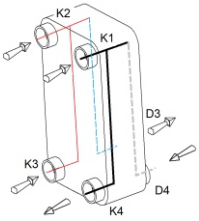

Fig. 2c

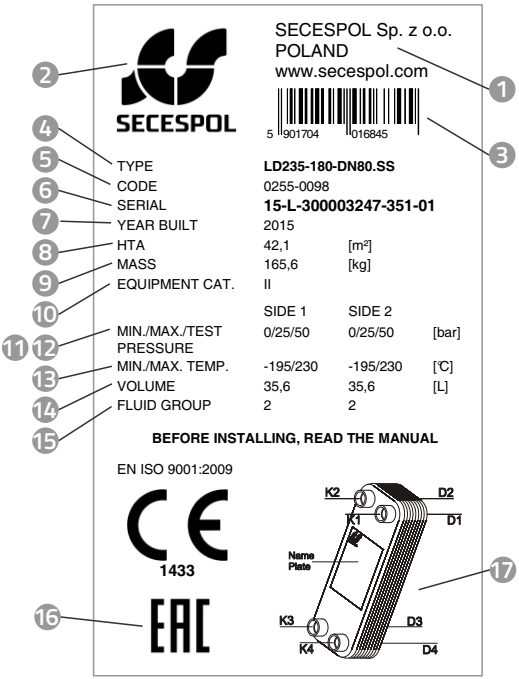
SECESPOL Sp. z o.o.
POLAND
www.secespol.com
5 901704 016845
SECESPOL
TYPE LD235-180-DN80.SS
CODE 0255-0098
SERIAL 15-L-300003247-351-01
YEAR BUILT 2015
HTA 42,1 [m²]
MASS 165,6 [kg]
EQUIPMENT CAT. II
SIDE 1 SIDE 2
MIN./MAX./TEST PRESSURE 0/25/50 0/25/50 [bar]
MIN./MAX. TEMP. -195/230 -195/230 [℃]
VOLUME 35,6 35,6 [L]
FLUID GROUP 2 2
BEFORE INSTALLING, READ THE MANUAL
EN ISO 9001:2009
CE
1433
EAC
K2
D2
K1
D1
Name Plate
K3
D3
K4
D4
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Fig. 3

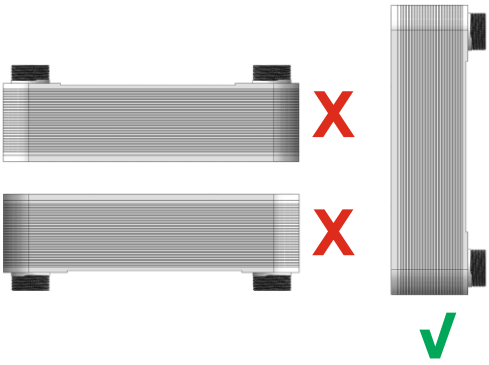
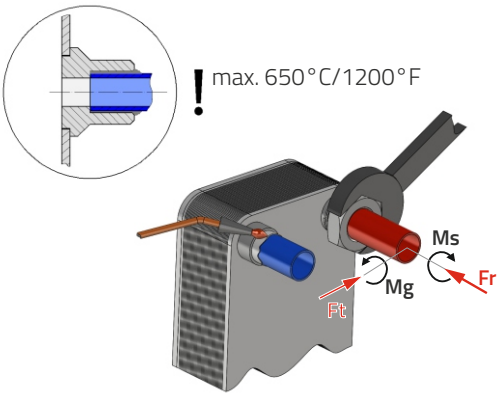


Fig. 4



	Ft		Fr		Ms		Mg	
Size	[kN]	[lb]	[kN]	[lb]	[Nm]	[lb·ft]	[Nm]	[lb·ft]
1/2"	3	675	3	675	55	40	20	15
3/4"	4	900	3	675	65	48	30	22
1"	5	1125	4	900	140	103	55	40
1 1/4"	7	1575	5	1125	160	118	65	48
1 1/2"	8	1800	7	1575	320	235	120	88
2"	10	2250	12	2700	600	441	250	184
2 1/2"	12	2700	14	3150	740	544	330	243
3"	14	3150	18	4050	900	662	500	368
4"	16	3600	20	4500	1000	735	900	662

Fig. 5

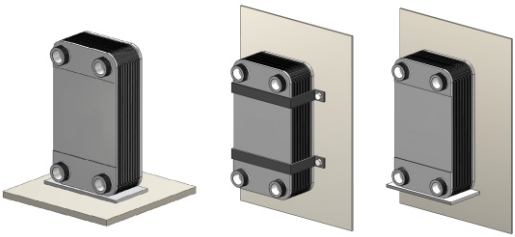


Fig. 6

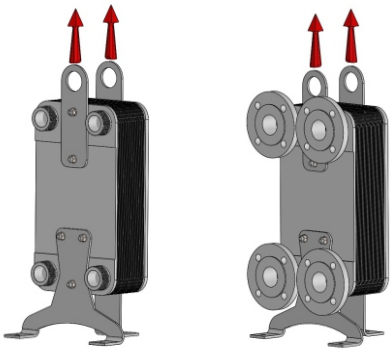
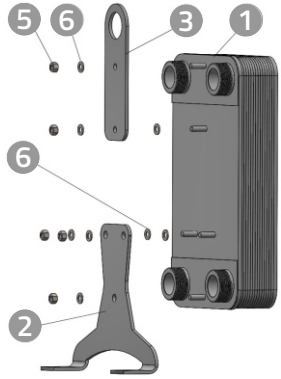
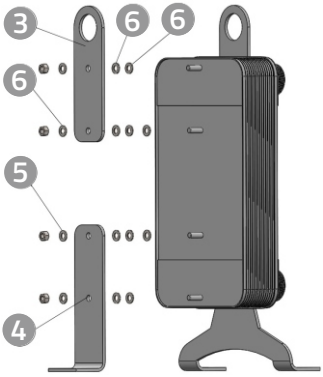


Fig. 7





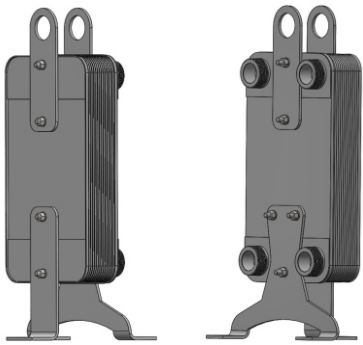


Fig. 8

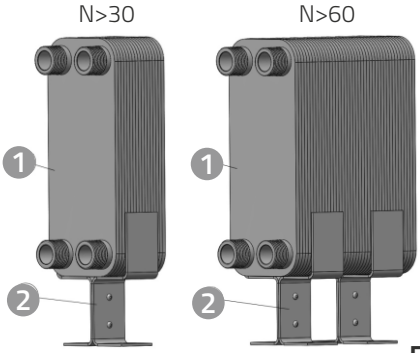


Fig. 9

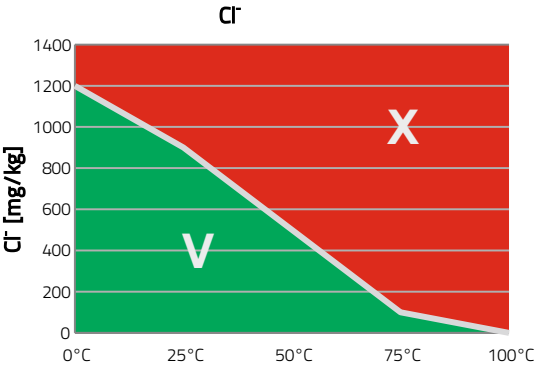


Fig. 10

Description

1.1. Definition

Brazed plate heat exchanger

A unit consisting of a specific number of corrugated heating plates brazed together under high temperature and vacuum, closed by cover plates reinforcing the entire structure.

Heating plate

A plate made of stainless steel extruded in a corrugated pattern.

Cover plate

A corrugated or straight plate made of stainless steel closing a packet of heating plates, equipped with inlet and outlet connections.

Packet of heating plates

A group of heating plates connected together in such a way that the corrugations form inner canals through which media flow.

Heat transfer area

A heating plate surface in contact with both working fluids in a heat exchanger.

Total heat transfer area

A total surface of heating plates packet in contact with both working fluids in a heat exchanger.

Water hammer

A water hammer is a pressure surge as a result of a rapid change in flow speed through the system. It can appear when flow control equipment is suddenly opened or closed. Water hammer can damage the unit.

1.2. Main structural elements, Fig.1:

1. cover plate
2. packet of heating plates
3. connection
4. support
5. mounting pin
6. transport lug

1.3. Construction

Brazed plate heat exchangers are flow units, Fig.2:

2a -one-pass heat exchanger with 4 connections
2b - two-pass heat exchanger with 4 connections
2c - two-pass heat exchanger with 6 connections

Heat transfer area is formed by brazed corrugated plates made of stainless steel. The corrugations in the heating plates, joined at the contact points, form the channels. The shape of the corrugations and their contact points direct the flow of media through the proper channels. Due to this construction the heat exchanger is resistant to pressure of the operated medium. The connections for supply and discharge of working fluids are located in the cover plates.

The plate heat exchanger is a non-dismantling construction!

1.4. Name plate, Fig.3:

1. manufacturer
2. manufacturer's logo
3. unit type barcode
4. unit type
5. unit code
6. unit serial number
7. year of production
8. heat transfer area
9. mass
10. unit category acc. to 2014/68/EU
11. min./max. pressure
12. test pressure
13. min./max. temperature of heat exchanger operation
14. volume
15. group of working fluid acc. to 2014/68/EU
    - group 1 - dangerous
    - group 2 - safe
16. place for approval designation
17. possible location of connections

1.5. Operation

Brazed plate heat exchangers consist of a packet of the interconnected corrugated plates made of high quality stainless steel. The working fluids are supplied by the connections, and then distributed in the channels between the heating plates through which heat is transferred. The heat transfer area is made up by a set of plates.

1.6. Application

Brazed plate heat exchangers are used in the pumping systems for central heating and domestic hot water, supplied with thermal energy from the high-efficiency water heat generating plants. The heat exchangers can also be used in ventilation, technological and air-conditioning systems, in which the working fluid is water, air, and other fluids or gases as well. Heat exchangers for refrigeration systems are used e.g. in refrigeration installations of heat pumps or chilled water generators. Treated water should be used in closed systems and water treatment equipment – in open systems.

Mounting

2.1. Requirements

The data of the product for the normal refrigerants, e.g. HFC, HCFC, are suitable for the refrigeration applications. The use of dangerous fluids must be compliant with the proper safety rules related to handling of specific fluids.

Heat exchangers should be mounted in a way allowing easy operation and control, preventing transfer of vibrations and stresses in

The safety valves should be mounted in accordance with the regulations related to the pressure vessels!

the installation onto the connections of the heat exchanger, **Fig.6**. The recommended mounting of heat exchangers is presented in **Fig. 4**. The maximum permitted torque cannot be exceeded while tightening the threaded connections, **Fig. 5**. Heat exchangers with the number of the plates (N) greater than 30 should be mounted with a support, the heat exchangers with the number of the plates (N) greater than 60 should be mounted with two supports, **Fig.9**.

2.2. Information on mounting

Prior to the connection of the heat exchanger to the installation check if all foreign objects are removed from the interior of the heat exchanger.

The installation must be equipped with the safety devices (among other things - diaphragm pressure expansion vessel, safety valve) protecting against the increase of pressures and temperatures over the maximum values and against the drop below the minimum values specified on the name plate.

In order to achieve the best thermal efficiency the heat exchanger should be connected in such a way that media flow in opposite directions (in the counter current).

The safety valves should be mounted in accordance with the regulations related to the pressure vessels!

2.3. Mounting of refrigerant heat exchangers

In the applications of the refrigerant heat exchangers and in the applications in which the medium phase transition takes place, the heat exchanger should be mounted vertically according to **Fig.4**.

Freezing of working media in the heat exchanger must be avoided!

During the mounting of the refrigerant heat exchangers an anti-freeze thermostat and flow control equipment should be used to ensure the constant fluid flow before and after the start-up of the compressor.

The technical condition of the pump should be controlled to avoid its breakdown.

2.4. Welding / brazing

During the mounting works take into consideration a fire risk, e.g. keep the distance from flammable substances in mind.

In case of welding / brazing the heat exchanger should be protected against overheating around the connections by heat absorbing components, e.g. a cotton string soaked with water.

The refrigeration system should be silver-brazed (min. 35% of silver); however, the temperature cannot exceed 650°C/1200°F, **Fig.5**.

In case of the heat exchanger equipped with the connections to be welded in, the TIG or MIG welding method should be used for the installation of the heat exchanger in order to minimise the amount of heat input.

2.5. Lifting

The heat exchanger with the transport lugs can be lifted using these lugs only!
Do not lift the heat exchanger by the connections or mounting pins, Fig.7.
When the heat exchanger is mounted the transport lugs should be removed!

Operation

3.1. Start-up

The following rules should be observed in order to ensure the correct start-up of the heat exchangers:

1. In case of the system equipped with several pumps determine the correct sequence of their start-up.
2. At the start-up of the system the circulation of cold fluid should be started first. The temperature rise cannot exceed 10°C/min (50°F/min) and the pressure rise 3 bar/min (43,5PSI/min) to avoid water hammer. The maximum difference in temperature of the working fluids cannot exceed 150°C/302°F.

3. Check whether the valve between the pump and the flow rate control module is closed.
4. If the valve is mounted on the outlet connection piece check whether it is fully opened.
5. Open the vent and start the pump slowly.
6. Open the valve slowly.
7. Close the vent when air is completely removed.
8. Repeat the steps 3-7 for the other medium.

3.2. Requirements of water quality

Do not use the medium that causes corrosion in steel AISI 316L/304L (1.4404/1.4307) or brazing material in the heat exchanger.

water pH (at 25°C/77°F)		7-10 (6-9 for LUNA type & nickel braze)
electrical conductivity		10-500µS/cm
free ammonia	NH_3	<2,0 mg/l
carbon dioxide	CO_2	<20 mg/l
iron	Fe^{3+}	<1,5 mg/l
manganese	Mn^{2+}	<0,1 mg/l
chlorine	Cl^-	Fig.10
nitrate	NO_3^-	<80 mg/l
sulphate	SO_4^{2-}	<80 mg/l
total hardness		6-15 °dH
free Chlorine	Cl_2	<0,4 mg/l
hydrogen sulfide	H_2S	<0,04 mg/l
hydrogen carbonate	HCO_3^-	<250 mg/l
sulphates	SO_3^{2-}	<1,0 mg/l
sulphide	S^{2-}	<1 mg/l
nitrite	NO_2^-	<0,1 mg/l
free aggressive carbonic acid	H_2CO_3	<20 mg/l

3.3. Equipment in operation

The following rules should be observed in order to ensure the correct operation of the heat exchangers:

1. Do not exceed permissible pressure and temperature.
2. Avoid abrupt changes in temperature and pressure of the working fluids. Maximum difference in temperature of the working fluids cannot exceed 150°C/302°F.
3. Avoid excessive fouling of the heat exchangers.
4. Clean heat exchangers periodically according to the below-mentioned recommendations:

– heat exchangers operating in the central heating system every 18 months at least;
– heat exchangers operating in the domestic hot water system every 12 months at least;
– cleaning frequency should be increased in case of disadvantageous operation conditions.

3.4. Protection against freezing

Risk of freezing of the working media at the low temperatures should be taken into account. In order to avoid any damage to the heat exchanger caused by freezing, the operated medium must contain the anti-freeze agent under working conditions.

Heat exchangers that are turned off at the ambient temperature lower than the freezing point of the medium should be emptied and dried.

3.5. Protection against blocking

A mechanical filter should be mounted in the system to protect the heat exchanger against mechanical contaminations. In case of doubt concerning the maximum size of the particles permissible in the medium contact the manufacturer.

3.6. Protection against thermal or pressure damage

In order to protect the heat exchanger avoid the abrupt changes in temperature and pressure of the working agents. Therefore check whether the heat exchanger operates without the variations in pressure / temperature according to the principles:

1. Mount the temperature sensor as close as possible to the outlet of the medium from the heat exchanger.
2. Select the valves and control devices to stabilise the temperature / pressure for the heat exchanger.
3. Avoid water hammer, e.g. do not use quick-closing or quick-opening valves.
4. Automated systems should be programmed in such a way that the amplitude and frequency of the variations in pressure are as low as possible.

Do not use the medium susceptible to ignition at the operating temperature of the heat exchanger!

3.7. Turn-off

In case of the system equipped with several pumps determine the correct sequence of their stopping, then:

1. Reduce the flow rate of the medium slowly in order to avoid water hammer.
2. Turn off the pump when the valve is closed.
3. Repeat the steps 1-2 for the other medium.

Maintenance

4.1. Guidelines

1. Stainless steel is susceptible to corrosion as a result of the reaction of chlorine ions. Therefore avoid the compounds containing chloride salts NaCl and $CaCl_2$. The maximum content of chloride ions in water is presented in **Fig.10**. In case of higher temperatures the maximum content of chloride ions should not exceed 50 ppm.
2. Do not use hydrochloric acid with the plates made of stainless steel.
3. Chlorine reduces resistance to corrosion in stainless steel.
4. Rinse the heat exchanger thoroughly.

4.2. Cleaning

Pass the stream of cleaning liquid at least 1,5-times greater than the stream during the operation through the heat exchanger by means of the pumping system. The cleaning liquid should be selected for the kind of deposits in the heat exchanger. When water is used the most popular deposit is lime scale $CaCO_3$ or iron trioxide Fe_2O_3.

Leaving one of the deposits, while removing the other one at the same time, may cause corrosion in the heat exchanger.

The cleaning instruction of the heat exchanger can be obtained from the manufacturer.

Defects

5.1. Pressure drop

1. Check whether the valves with the non-return valves are opened:
   - measure the pressure upstream and downstream of the valves,
   - measure / assess the flow rate, where possible.
2. If the observed pressure drop is greater than the one determined for the current flow, check point 3. If the pressure drop is less than the one determined in the specification, it can be connected with the improper selection of the pump.
3. The pressure drop can be caused by the deposits stored on the heat transfer surface. It is noticeable through the reading of the temperature diverging from the correct one.

5.2. Problems with heat transfer

If there are problems with heat transfer, measure the temperature / flow rate on the inlet and outlet of each medium. Then check the measured value with regard to the amount of the thermal energy transfer in accordance with the specifications. If the heat transfer efficiency drop below the specified values, clean the heat transfer surface.

Accessories

The accessories are not delivered with the heat exchanger as standard, they can be ordered additionally.

6.1. Mounting brackets

The brackets affix the heat exchanger to the floor or structural elements of the system. They are not delivered with the heat exchanger as standard but can be ordered additionally.

Fig.8 presents how to affix the brackets to the heat exchanger:

1. heat exchanger
2. front support
3. transport lug
4. rear support
5. nut M10
6. washer M10

Fig.9 presents how to affix the other type of the brackets:

1. heat exchanger
2. support

6.2. Thermal insulation

The thermal insulation of the brazed plate heat exchangers consists of two parts connected by the latch clamps. It reduces the heat loss and does not cause unnecessary heating of the room where the heat exchanger is installed.

The cold insulation of the brazed plate refrigerant type heat exchangers is made of the adhesive rubber mat tightly attached to the surface of the heat exchanger.

Packaging, storage and transport

Heat exchangers should be stored in a sheltered place, protected against climatic influences and corrosive agents. During transport and storage heat exchangers should be protected against damage and contamination.

For matters not covered by this instruction manual please contact the technical department of the manufacturer.

EC Declaration of Conformity is available for download on www.secespol.com