

# SANHUA

## Instructions for Braze Plate Heat Exchanger



## General instructions

The design pressure and temperature are showed on the name plate of SANHUA Brazen Plate Heat Exchanger (BPHE), which are not allowed to be exceeded during the operation.  
For more details on approvals, please contact SANHUA.

The identification of connections: F1/F2/F3/F4 are on the front cover and P1/P2/P3/P4 are on the back cover of BPHE. F1 on the front corresponds to P1 on the back, and so on (Fig.1).

### SINGLE CIRCUIT

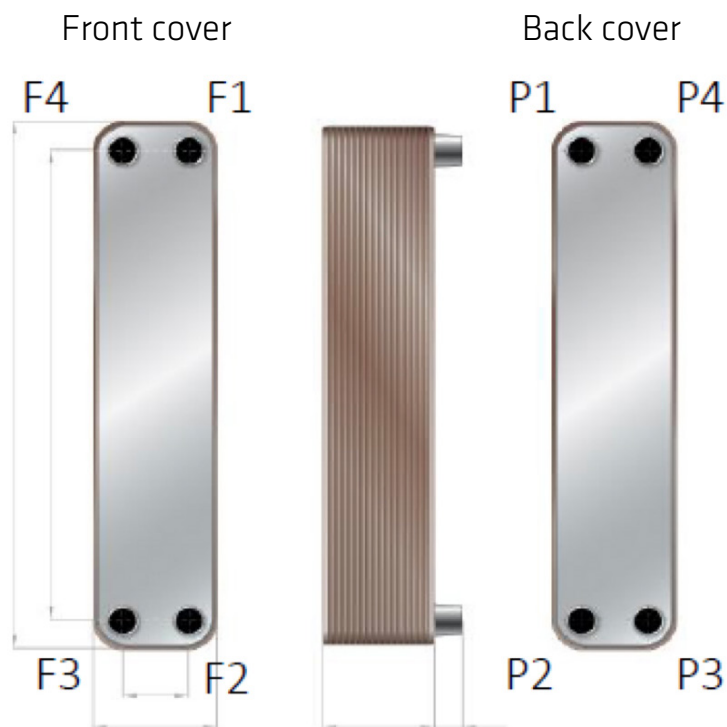


Fig.1: Identification of Connections

Fluids can pass through the BPHE in different ways. For parallel-flow BPHEs, there are two different flow configurations: counter-current and co-current. In most cases, counter-current flow provides the best heat transfer performance.

For cold-dryer application, three-in-one BPHE: JX-D-015/ JX-D-050 should be installed according to the instructions on the product drawings.

## 1. Lifting Suitable for larger PHE

- 1.1 Never lift the heat exchanger only by the connections or any of the studs.
- 1.2 The lifting angle shall be as close to the vertical direction as possible.
- 1.3 Keep the angle of the straps as close as possible to vertical.
- 1.4 Keep the safe distance of 3 meters during lifting.
- 1.5 Don't touch the heat exchanger during lifting to avoid personal injury.

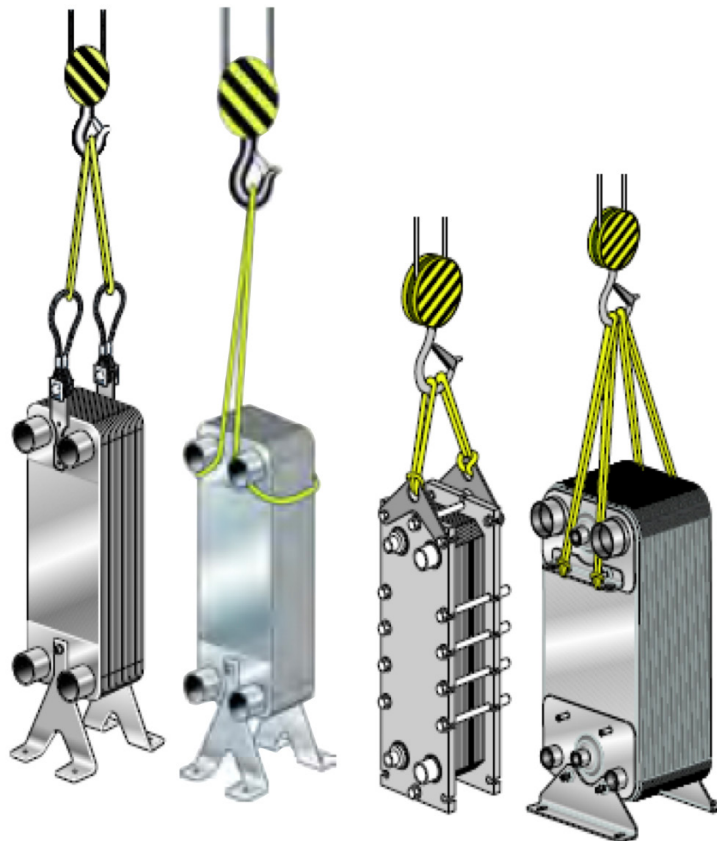


Fig.2: Indication of Lifting for larger BPHEs

## 2. Installation

- 2.1 Never expose the heat exchanger to pulsations or excessive cycle pressure or temperature changes.
- 2.2 It is important that no vibrations be transferred to the heat exchanger.
- 2.3 If there is a risk of this, install vibration absorbers. For large connection diameters, it's advisable to use an expanding device in the pipeline. A buffer between the BPHE and the mounting clamp (e.g., a rubber mounting strip) is also recommended.
- 2.4 For single-phase applications, such as water-water or water-oil, the direction of installation has little effect on the performance of the BPHE. However, for two-phase applications, Sanhua BPHE should be installed vertically.

### 3. Installation suggestions

- 3.1 When fixing the bolts, it is recommended to use lubricating oil between the threads to avoid thread damage.
- 3.2 Bottom or side mounting is bolted with a holder. Larger PHE should be secured with support mountings.
- 3.3 For the chiller and heat pump application, take protective actions, such as insulation, to reduce heat loss.

### 4. Connection

The connections of SANHUA BPHE include standard inch/metric threaded tube, welded pipe ( $\Phi 1'' \sim 5''$ ) and flange etc. All connections are soldered to the PHE. The connections are fitted with plastic cap not only to protect the threads and sealing surfaces of the connections, but also to prevent dirt and dust from entering the BPHE. The plastic cap should that carefully removed so as not to damage all sides of the connection.

### 5. Connection soldering procedure

Degrease and polish the connection surface. Use nitrogen gas inside the BPHE to avoid oxidation during soldering. Apply flux with a brush. Insert the copper piper into the connection and braze with min. 45% silver solder. The max. temperature is not higher than 450°C for soft soldering and 450°C~800°C for hard soldering.

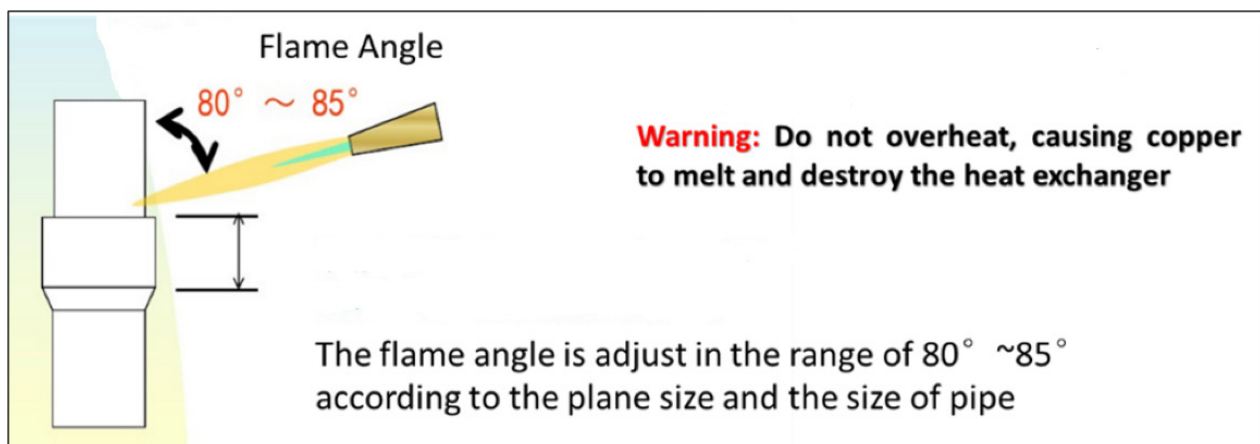


Fig.3: Soldering Precautions

6. Connection loads at installation

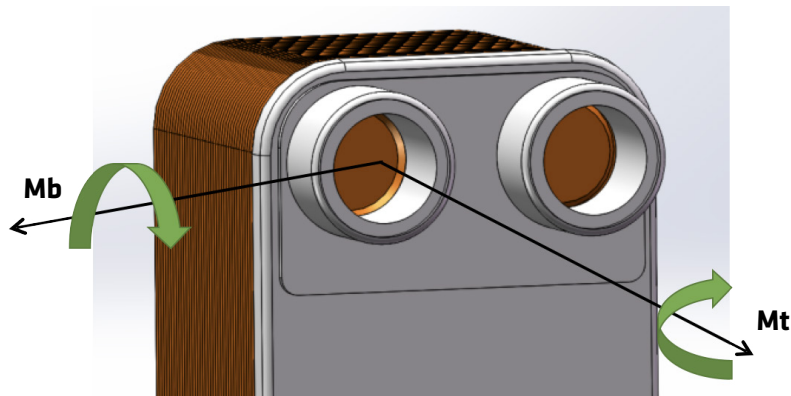


Fig.5: Indication of Bending Moment Mb and Torque Mt

Tab.1 has defined the allowable installation load for connection under low fatigue. Exceeding this load will increase the failure risk of heat exchanger.

Outer diameter Mm (inch)	Tension force Ft KN (lbf)	Bending moment Mb Nm (lbf*ft)	Shear force Fs KN (lbf)	Torque Mt Nm (lbf*ft)
15-28 (0.6-1.1")	2.4 (539)	14 (10.3)	0.7 (157)	38 (28)
29-35 (1.1-1.4")	4.0 (899)	45 (33.2)	1.2 (269)	120 (88.5)
36-45 (1.4-1.8")	6.5 (1461)	110 (81.1)	2.5 (562)	240 (177)
46-55 (1.8-2.2")	7 (1573)	120 (88.5)	4.8 (1079)	440 (324.5)
56-76 (2.2-3.0")	12 (2697)	250 (184.4)	5.2 (1169)	600 (442.5)
77-99 (3.0-3.9")	13 (2922)	310 (228.6)	5.8 (1303)	1200 (885)
100- (3.9-)	28 (6294)	800 (590)	5.8 (1303)	2500 (1843)

Tab.1: Maximum Recommended Connection Loads

**Note:** Shear force (Fs) is calculated assuming that the force is applied at the longest side of connection.

## 7. Mounting

Maximum tightening torques for the mounting bolts according to table below.

Bolt dimension	Torque (Nm)	Torque (lbf*ft)
M5	2.3	1.7
M6	3.8	2.8
M8	9.5	7
M10	19	14
M12	33	24.3

Tab.2: Maximum Tightening Torques for Mounting

## 8. Installation in general

### 8.1 Single phase application

Typically, the connection with the highest temperature or pressure is on the F3/F4 side. For example, in a water-water application, two fluids are connected in opposite directions (in counter-current flow), which hot water flows in from F4 and out from F3, and cold water flows in from F2 and out from F1, to reduce the heat loss (Fig.1).

### 8.2 Two-phase application

In refrigerant applications, water must be enclosed on both sides of each refrigerant channel. Typically, F3/F4 is connected to the refrigerant pipe and the F1/F2 is connected to the water pipe. If the water pipe is connected to the F3/F4, it will result in a drop in evaporation temperature, a risk of freezing, and very poor performance.

### 8.3 Condenser

- F4: Refrigerant/Steam inlet
- F3: Condensate outlet
- F2: Water inlet
- F1: Water outlet

### 8.4 Single circle evaporator

- F4: Refrigerant/Steam outlet
- F3: Condensate inlet
- F2: Water outlet
- F1: Water inlet

### 8.5 Dual circle evaporator

- F3/F4: Condensate inlet
- F5/F6: Refrigerant/Steam outlet
- F2: Water outlet
- F1: Water inlet

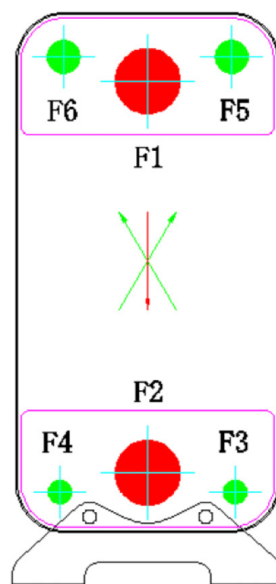


Fig.6: Connectors Indication for Dual Circle Evaporator

**9. Protection against freezing**

- 9.1 When the evaporation temperature approaches the freezing temperature of the liquid side, antifreeze is used.
- 9.2 Use an anti-freeze thermostat and flow monitor to ensure a constant water flow before, during, and after the compressor has been running
- 3. Avoid “pump down”
- 4. Starting the system, start the condenser later (or lower the flow rate)
- 5. If any of the media contain particles of 1mm or larger, a strainer be installed before the heat exchanger.

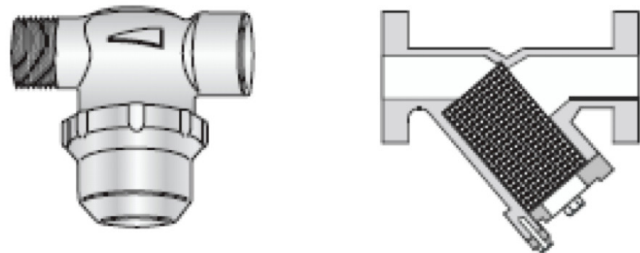
**10. Protection against thermal or/and pressure fatigue**

Sudden temperature and pressure changes could cause fatigue damage to the PHE. Therefore, the following must be taken into consideration to ensure that the PHE operates without fluctuating pressure/temperatures.

- 1. Locate the temperature sensor as close as possible to the outlet from the PHE.
- 1. Choose valves and regulation equipment which give stable temperatures/pressure for the PHE.
- 2. To avoid water hammer, quick-closing valves must not be used, e.g. on/off valves.
- 2. In automated installations, stopping and starting of the pumps and actuation of valves must be programmed so that the amplitude and frequency of the pressure variation are as low as possible.

**11. The expansion valve**

For an evaporator, the pipe should be straight between the expansion valve and refrigerant inlet. Avoid using pipe elbows between the expansion valve and refrigerant inlet. The recommended distance of the pipe is 150-250mm, or the ratio of the length to inner diameter should be between 10 and 30. It is also important to keep the pipe horizontal. Tapered connections also can be used if the pipe diameter is less than the connection diameter. The inlet connection diameter must not be larger than the F3 connection diameter, as this will increase the risk of gas-liquid separation. If using an expansion ball, it should be installed approximately 200 mm from the vaporized refrigerant outlet. For the evaporator, the total pressure drop is the pressure drop of the internal distribution system plus the pressure drop of the expansion valve. In general, choose a larger size valve can get better performance.





## 12. Protection against corrosion

Do not use the PHE for de-ionized water as this media can chemically affect the copper brazing material. Do not use the PHE for installations with galvanized pipes that chemically or electrochemically could affect or be affected by the stainless steel plates and the copper brazing material. Avoid ammonia or other media that could be corrosive to stainless steel and copper.

Temperature	304/304L	316L
25°C	100PPM	1000PPM
65°C	50PPM	200PPM
80°C	20PPM	100PPM

Tab.3: Recommended limits for chloride ions, Cl<sup>-</sup> at PH 7.5

## 13. Cleaning

Use a strainer or filter. Use a 5% solution of a weak acid such as phosphoric or oxalic acid. Reverse the normal flow direction, and increase the flow rate to 1.5 times normal. Reverse flow every 30 minutes to achieve the best cleaning effect. Before the last cleaning, use 1~2% sodium hydroxide or sodium bicarbonate solution to ensure all acids are neutralized. Do not forget to rinse the PHE several times after cleaning.

## 14. Storage

The BPHE shall be placed in a dry area, and at a temperature not less than 2°C and not more than 40°C when stored for more than 2 weeks.

## 15. Appearance

After soldering, there may be too many copper spots on the surface of the BPHE. This discoloration is not corrosion and does not affect the performance and use of the BPHE.