PLATE HEAT EXCHANGER

Operation and Maintenance Munual

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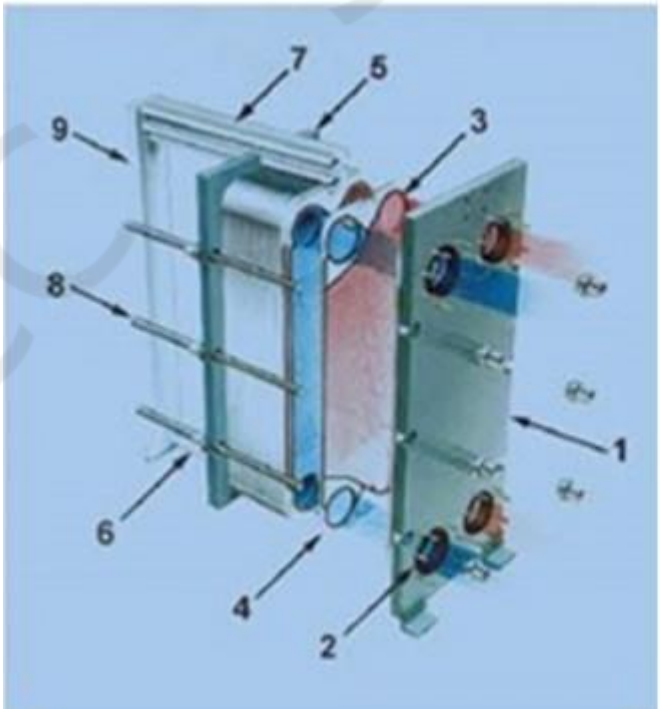
Contents

1. Equipment Overview

1.1 Equipment Purpose and Principle Purpose: The plate heat exchanger is widely used in industries such as chemical, pulp and paper, heating, ventilation and air conditioning (HVAC), petroleum, construction, pharmaceutical, and shipbuilding.

Principle: The plate heat exchanger consists of key components including heat transfer plates, sealing gaskets, frame, tightening bolts, and a roller mechanism (see the equipment installation diagram). The heat transfer plates, made from high-quality materials, are pressed into shape with corrugations on a specialized hydraulic machine and stacked to form a highly efficient heat exchanger. The working fluid flows through narrow, curved channels formed between two plates, with hot and cold fluids alternating through different channels. Heat is exchanged through the plate separating these fluids. heat transfer plates have corner holes, and the plates with sealing gaskets are clamped between the fixed and movable tightening plates within the frame, secured by tightening bolts.



1. Fixed Tightening Plate
2. Flange Connection
3. Sealing Gasket
4. Plate
5. Movable Tightening Plate
6. Lower Guide Rod
7. Upper Guide Rod
8. Tightening Bolt
9. Frame

1.2 Structural Features

The plate heat exchanger is characterized by high heat transfer efficiency, small footprint, low heat dissipation loss, long service life, safe and reliable operation, and ease of disassembly and cleaning.

1.3 Equipment Parameters:

Please refer to the "Technical Specifications Table" in the accompanying drawings.

1.4 External Diagram of the Plate Heat Exchanger:

Please refer to the accompanying drawings.

2. Equipment Description

2.1 Structural Layout Description

The plate heat exchanger is composed of key components such as heat transfer plates, sealing gaskets, tightening plates, tightening bolts, and others.

- **2.1.1 Heat Transfer Plates**
  The heat transfer plates are made from stainless steel or other materials, with four flow holes, herringbone corrugations pressed in the middle, and sealing grooves around the edges. The plates are aligned and positioned using two guide rods, and the tightening bolts compress the plates between the fixed and movable tightening plates to form the internal flow channels of the heat exchanger.
- **2.1.2 Sealing Gaskets**
  Gaskets are placed around the edges of the plates, providing sealing and creating gaps between the plates to form fluid channels.
- **2.1.3 Tightening Plates**
  The tightening plates include both fixed and movable plates. The fixed plate has four interfaces and tightening bolt holes, while the movable plate has tightening bolt holes. These plates compress the heat transfer plates, ensuring no leakage of the fluid medium.
- **2.1.4 Tightening Bolts**
  The tightening bolts, usually double-threaded, are used to secure both ends of the tightening plates.
- **2.1.5 Upper and Lower Guide Rods**
  The upper guide rod is generally made of I-beam steel, while the lower guide rod is made of square steel tubing. These are fixed between the fixed plate and the support frame and are used to suspend and support the heat transfer plates.
- **2.1.6 Support Frame**
  Typically made from I-beam or channel steel, the support frame

supports the entire structure.

2.2 Documents Provided with the Equipment:

- a. Product Certificate;
- b. Quality Certificate;
- c. Completion Drawings;
- d. Installation, Operation, and Maintenance Manual;
- e. Delivery List.

3. Installation

3.1 Pre-installation Inspection

- 3.1.1 Before installing the equipment, check all items according to the packing list. If any discrepancies are found, notify the company within 12 hours for timely resolution.
- 3.1.2 Reserve about 1-2 meters of maintenance space around the installation site. The plate heat exchanger should be kept vertical during installation and fixed on the concrete foundation with anchor bolts, flat washers, and nuts.
- 3.1.3 Before connecting pipelines, clean the connected pipelines to prevent sand, oil, welding slag, and other debris from entering the heat exchanger, which could block the flow channels or damage the plates. A filter should be installed before the heat exchanger to ensure safe and efficient operation.
- 3.1.4 Ensure that the heat exchanger is not subjected to pressure or tension from the connected pipelines.
- 3.1.5 Do not use the heat exchanger frame or plates as grounding points for welding. Ensure proper insulation when welding other connected pipelines.
- 3.1.6 If the surface temperature of the heat exchanger is too high, consider adding protective measures during installation.

3.2 Site and Foundation

- 1. Ensure enough space is reserved at both ends of the equipment for disassembly and maintenance after installation.
- 2. The foundation size should match the support dimensions, and the foundation can be made of concrete or steel structure. If using a concrete foundation, embed

foundation plates for the movable supports, ensuring the foundation surface is flat and smooth.

3.3 Hoisting the Equipment

- 1. The heat exchanger should not be deformed, and fasteners should not be loose or mechanically damaged.
- 2. During hoisting, the slings should not be attached to pipes, beams, or plates.

3.4 Installing the Equipment in Place

- 1. Before use, check all tightening bolts for looseness. If any are loose, tighten them to the specified dimensions in the installation diagram, ensuring the two tightening plates are parallel with an error of no more than 4mm.
- 2. The heat exchanger should be installed horizontally, with 1 meter of clear space around it for maintenance and repair.
- 3. The pump delivering liquid to the heat exchanger should be equipped with a throttle valve. If the pump output pressure exceeds the equipment's pressure, install a pressure-reducing valve.
- 4. If shut-off valves, throttle valves, pressure-reducing valves, and pressure control valves are assembled, they should be installed at the equipment inlet, not the outlet.

4. Commissioning and Precautions

4.1 Preparation for Commissioning the Plate Heat Exchanger

- 4.1.1 After completing the pressure test and non-destructive testing, ensure the inside of the heat exchanger is dry and free of debris.
- 4.1.2 All connections must be sealed.

4.2 Commissioning the Plate Heat Exchanger

- 4.2.1 Before installing the equipment, check all items against the packing list. If there are any discrepancies, notify the company within 12 hours for resolution.

- 4.2.2 Ensure that there is about 1-2 meters of maintenance space around the installation site. The plate heat exchanger should remain vertical during installation, secured to the concrete foundation with anchor bolts, flat washers, and nuts.
- 4.2.3 Before connecting the pipelines, clean them to prevent sand, oil, welding slag, and other debris from entering the heat exchanger, which could block the channels or damage the plates. To ensure safe and efficient operation, a filter should be installed before the heat exchanger.
- 4.2.4 Ensure that the heat exchanger is not subjected to pressure or tension from the connected pipelines.
- 4.2.5 If the surface temperature of the heat exchanger is too high, consider adding protective measures during installation.

4.3 Shutting Down the Plate Heat Exchanger

Before shutdown, first stop the pump and cut off the power. Then, slowly close the hot side inlet valve, cold side inlet valve, cold side outlet valve, and hot side outlet valve, in that order.

5. Operation and Maintenance

5.1 Equipment Operation

- 5.1.1 Before use, check all tightening bolts for looseness. If any are loose, tighten them according to the dimensions specified in the installation drawing, ensuring the parallelism of the two tightening plates does not exceed 4mm.
- 5.1.2 Before starting, close the inlet valves for both the cold and hot sides, and open the outlet valves.
- 5.1.3 When starting, sequentially start the pumps for the cold and hot sides. Slowly open the cold side inlet valve, and once the cold side is fully filled, gradually open the hot side inlet valve. Avoid sudden impacts during startup to prevent damage to the gaskets. Avoid rapid pressure changes that could cause water hammer, leading to leakage from the heat exchanger. Ensure that any residual air is completely vented from the heat exchanger during operation.
- 5.1.4 Check all sealing surfaces and welds for leaks. Monitor the parameters on the pressure and temperature gauges, record them, and investigate any issues promptly to ensure the safe and efficient operation of the equipment.
- 5.1.5 The equipment should operate within the specified

temperature and pressure range. It is strictly prohibited to run the equipment under over-temperature or over-pressure conditions.

- 5.1.6 During system-wide water pressure testing, the plate heat exchanger should be isolated.

5.2 Equipment Maintenance

Due to long-term operation, the heat transfer plates of the plate heat exchanger may accumulate dirt or deposits, increasing flow resistance and reducing heat transfer performance. This is typically indicated by an increase in pressure differential between the inlet and outlet pressure gauges and a drop in the cold side outlet temperature. Therefore, regular inspection and cleaning are necessary. The steps are as follows:

- 5.2.1 Shut down the equipment in the order described above and drain the fluid from the heat exchanger.
- 5.2.2 Evenly loosen the tightening bolts and remove them. Move the movable tightening plate toward the support frame, tilt the upper end of the heat transfer plates toward the movable tightening plate, then remove the plates from the upper guide rod and lower guide rod.
- 5.2.3 When cleaning the heat transfer plates, only use a copper wire brush or fiber brush. Do not use a steel wire brush to avoid damaging the plates, which would reduce their corrosion resistance. Be careful not to damage the sealing gaskets during cleaning. If chemical cleaning is required, contact our after-sales service center. Do not use cleaning agents that may corrode the heat transfer plates or gaskets.
- 5.2.4 After cleaning, rinse the heat transfer plates with clean water and wipe the sealing gaskets with a clean cloth or cotton yarn.
- 5.2.5 Replace any aging sealing gaskets. If the gaskets need to be glued to the plates, follow these steps: Remove the aging gasket, clean any debris from the plate groove, and apply adhesive to secure the new gasket. Keep the surface flat and allow the adhesive to cure for 24 hours before reassembling and tightening to the specified dimensions.
- 5.2.6 If any fluid leaks are detected from the signal hole, check for loose bolts and re-tighten them as required. Avoid

over-tightening, which could damage the heat transfer plates. If the gasket is aging, it should be replaced.

- 5.2.7 When hoisting the equipment, use the hoisting holes. Do not hoist the equipment by the tightening bolts or guide rods.
- 5.2.8 If the equipment is packaged externally, remove the outer metal packaging before hoisting. Hoist the equipment using the lifting ears on the base frame, and ensure the equipment is balanced during hoisting.

6. Precautions

1. Before starting, close the inlet valves for both the cold and hot mediums and open the outlet valves.
2. When starting, first start the cold pump and slowly open the cold medium inlet valve. After 20 minutes of cold medium operation, open the hot medium inlet valve to allow the medium to slowly enter the heat exchanger. When there is a large pressure differential between the two sides, first start the low-pressure side, followed by the high-pressure side.
3. It is strictly prohibited to allow unfiltered medium to enter the heat exchanger through bypass pipelines. Before shutdown, first stop the pump and cut off the power supply. Then, slowly close the hot medium inlet valve, cold medium inlet valve, and both medium outlet valves. When there is a large pressure differential between the two sides, first close the high-pressure side, followed by the low-pressure side. During transportation, the tightening bolts of the plate heat exchanger may become loose. Before commissioning the equipment, tighten the bolts to the dimensions specified in the accompanying drawings to ensure safe operation.

7. Common Issues and Solutions

7.1 Leakage

1. Shutdown Leakage:
   - Cause: Frequent startup and shutdown operations of the plate heat exchanger.
   - Solution: Return to normal operating conditions.
2. External Leakage:
   - Causes: Misalignment or displacement of sealing gaskets, gaskets coming out of the sealing grooves, damage or aging of gaskets, plate corrosion or deformation, uneven or

insufficient tightening, or loosening of tightening bolts.
    - **Solution**: Re-align or replace the gaskets, tighten bolts to the correct dimensions, and inspect for any gasket or plate damage.
3. **Internal Leakage**:
    - **Causes**: Aging or damage of the sealing gaskets, or perforation of the plates due to corrosion.
    - **Solution**: Replace aged gaskets or corroded plates.
4. **Leakage Between Blind Plate and Tightening Plate**:
    - **Cause**: The blind plate has been punctured by a hard object.
    - **Solution**: Replace the blind plate.

7.2 Abnormal Pressure Drop

1. **The pressure drop exceeds the design value.**
2. **The actual flow rate is higher than the design value.**
3. **The channels between the plates are blocked.**
4. **Blockage occurs at the inlet of the corner holes of the plates.**

7.3 Abnormal Heat Exchanger Temperature

1. **The hot side outlet temperature is too high**:
    - **Causes**: The heat exchanger is undersized, insufficient heat exchange area, hot side flow rate exceeds the design value, fouling of plates, or blockage of the plates, or insufficient cold side flow rate.
    - **Solution**: Verify heat exchanger sizing, clean fouled plates, or adjust flow rates accordingly.
2. **The cold side outlet temperature is too low**:
    - **Causes**: Hot side flow rate is too low or the temperature is lower than the design value, fouling or blockage of the plates.
    - **Solution**: Adjust hot side flow rate, check for fouling and clean the plates if necessary.

In the operation of the plate heat exchanger, when faults occur, it is necessary to analyze the cause of the fault promptly and take timely corrective actions to ensure the normal operation of the heat exchange equipment.