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HEATING NETWORK HEATER

Operation and Maintenance Instruction Manual

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Contents

1.Equipment Overview

1.1 Equipment Purpose and Principle

The steam-water heat exchanger is used to heat circulating water, with steam as the heat medium, to raise the circulating water to the required supply water temperature.

1.2 Structural Features

The steam-water heater features no heat exchange dead zones, strong adaptability, resistance to scaling, small footprint, and easy installation.

1.3 Equipment Parameters

See the "Technical Characteristics Table" in the accompanying drawings.

1.4 Equipment Outline Diagram

See the accompanying drawings.

2.Equipment Description

2.1 Structural Arrangement Description

The main components of the steam-water heat exchanger include: front and rear header boxes, shell (including tube bundle), and supports.

1). Front and Rear Header Boxes

The front and rear header boxes are constructed with standard elliptical heads welded to cylindrical sections and container flanges, with internal structures having partition plates for the tube side. External interfaces include circulating water inlet, circulating water outlet, exhaust port, and drain port.

2). Shell (Including Tube Bundle)

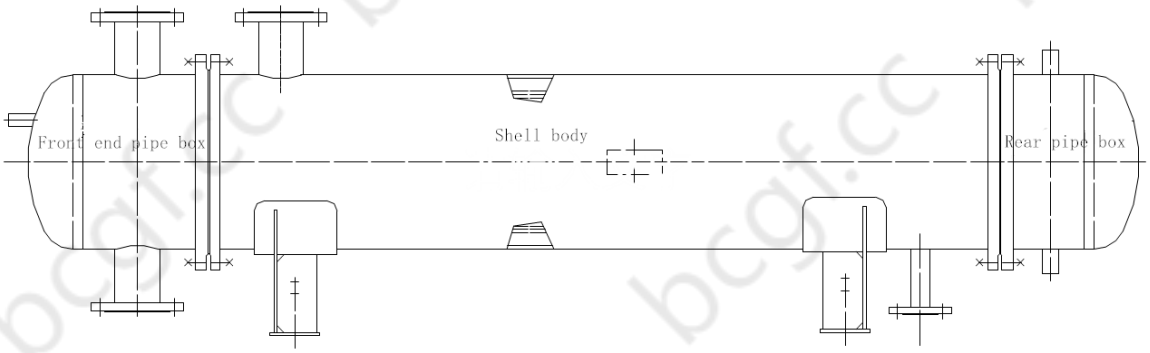
The shell (including tube bundle) is constructed with tube plates welded to cylindrical sections, with internal structures including heat exchange tubes and baffles. External interfaces include steam inlet, condensate outlet, exhaust port, drain port, and liquid level control device interface (some heat exchangers may not have this).

3). Supports

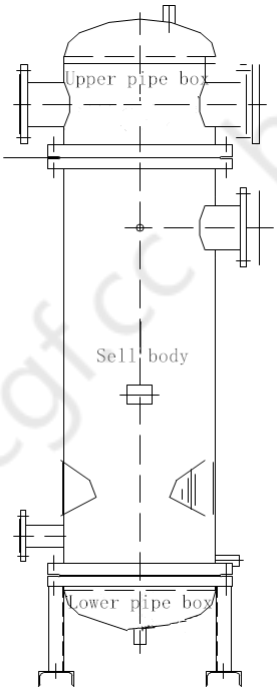
The horizontal steam-water heater is equipped with two supports (one fixed and one sliding) to accommodate thermal displacement of the equipment, while the vertical steam-water heater is supported by two channel steels.

The steam-water heat exchanger is categorized as vertical or horizontal based on the installation method, as shown in the structural schematic below.

Horizontal steam-water heat exchanger



Vertical steam-water heat exchanger



4). Accessories

(1) Instruments: Local pressure gauges and temperature gauge interfaces are installed on the front and rear header boxes and the shell.

(2) Liquid Level Control: If controlling the condensate temperature of the steam-water heat exchanger is required, each unit should be equipped with a liquid level device interface. The details of the condensate liquid level interlock control can be found in the accompanying drawings. Relevant construction details for the control system are available in the thermal control construction documentation.

2.2 Factory Documentation

a. Product quality certificate;

b. Quality assurance certificate;

c. As-built drawings;

d. Installation, operation, maintenance, and user manual;

e. Delivery list.

3.Installation

3.1 Pre-installation Inspection

(1) Check whether the equipment appearance meets the drawing requirements and whether there are any damages from transportation.

(2) Check for rust at each interface that may affect sealing.

(3) Check whether any fasteners are loose, rusted, or show other defects.

3.2 Site and Foundation

(1) Sufficient space should be reserved at both ends of the installation for disassembly and maintenance needs based on the equipment's structural form.

(2) Foundation dimensions should correspond to the support dimensions. The foundation can be poured with concrete or use a steel structure. When using a concrete foundation, foundation pads should be embedded on the foundation surface for the movable supports, and these pads must remain level and smooth.

3.3 Equipment Hoisting

(1) Equipment hoisting must strictly adhere to on-site operating specifications.

(2) Pay attention to the center of gravity of the equipment when lifting.

(3) If the equipment has lifting lugs, use them for hoisting. If there are no lifting

lugs, the equipment body or other safe methods must be used. At no time should components, lifting lugs, or piping connections be used to lift the equipment.

3.4 Equipment Positioning and Installation

(1) The horizontal equipment should be placed on the foundation and leveled; the vertical equipment should be positioned upright on the foundation, with a centerline deviation of less than 5 mm, and then tighten the nuts.

(2) Movable supports with anchor bolts should have two locking nuts installed, with a 1-3 mm gap between the nuts and the base plate.

(3) After installation, the movable or rolling support ends should not obstruct the thermal expansion of the equipment.

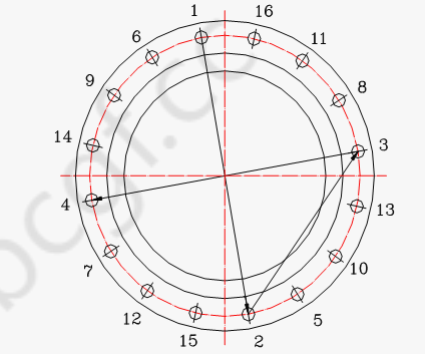
(4) Equipment should connect pipelines and fittings without stress to avoid forceful assembly.

(5) Before trial operation, valves and instruments should be installed and positioned according to the drawings and system control requirements.

4.Operation and Precautions

4.1 Preparation for Heater Commissioning

4.1.1 A pressure test should be conducted before trial operation. Bolts should be re-tightened before the test, following the sequence shown in the drawings to avoid leakage at the sealing surfaces. After all inspection work is completed, ensure the equipment is intact; the safety valves on the steam and water sides (if any) should be calibrated and ready for operation.



4.1.2 All instruments on the steam-water heat exchanger should be complete and in good condition, with all pressure gauges and water level gauges opened (if applicable).

4.1.3 Contact the thermal engineering team to activate the remote water level gauge for the steam-water heat exchanger (if applicable), ensuring the water level indication is correct and consistent with the local water level, and that water level protection is activated.

4.1.4 The circulating water pipeline system of the heater should be flushed and qualified, with the drain valve on the water side of the steam-water heat exchanger closed.

4.1.5 The inlet and outlet valves on the water side of the steam-water heat exchanger should be opened, while the bypass valve should be closed. Water should flow through the heat exchanger, and the vent valve should be closed after water appears (during the trial operation phase, the venting valve should be opened periodically to check if the water side is full and to prevent air blockage).

4.1.6 Open the steam side drain electric valve, regulating valve, and

manual valve for the steam-water heat exchanger (do not open too wide for easy slow adjustment).

4.1.7 Ensure that the manual and electric valves on the steam supply side are functioning normally and that the unit is ready for operation.

4.2 Commissioning of the Heat Network Heater

4.2.1 Open the steam side exhaust valve of the steam-water heat exchanger (if applicable) and slightly open the normal drainage valve (about 3%-5%), and slightly open the steam supply electric valve to warm the pipes of the steam-water heat exchanger.

4.2.2 Based on the temperature changes of the steam-water heat exchanger, gradually open the steam supply electric valve. Control the opening of the normal drainage valve to maintain the water level in the steam-water heat exchanger at normal levels, paying attention to changes in the drainage temperature and ensuring the rise in circulating water temperature does not exceed 0.5°C/min, with the circulating water outlet temperature not exceeding the heater's set temperature.

4.2.3 To ensure the extraction steam pressure does not fluctuate significantly and to prevent high pressure in the extraction chamber or alarm from large differential pressure, the adjustment of the extraction steam control valve should be done slowly during temperature adjustments.

4.2.4 Check that steam emerges from the exhaust valve on the steam side of the

steam-water heat exchanger after the steam supply valve is opened. Once the non-condensable gases inside the steam-water heat exchanger are cleared, close the air vent on the exhaust side.

4.2.5 According to the water level in the steam-water heat exchanger, start one heat network drainage pump (without a drainage shell, it should be above the normal level by 100 mm; with a drainage shell, the heater generally needs the water level to rise to about 200 mm above the normal level to start the drainage pump to ensure sufficient pressure for siphoning).

4.2.6 During start-up or shutdown, temperatures should be gradually increased or decreased to avoid excessive pressure differentials and thermal shock.

4.2.7 When multiple devices are operated in parallel, it is best to start them simultaneously. If they cannot be started together, the later started heater should stabilize its water level through the emergency drainage valve before being connected to the normal drainage line of the already operating heater. Care should also be taken to control the valve openings, slowly reducing the emergency drainage valve and slowly increasing the normal drainage valve; fluctuations in water levels during parallel operation of multiple devices are normal.

4.3 Stopping the Heater

4.3.1 Confirm the need to take the steam-water heat exchanger out of operation.

4.3.2 Close the steam-water heat exchanger's gas balance valve.

4.3.3 Gradually close the steam supply adjustment valve, ensuring that the outlet water temperature of the heater does not change by more than 0.5°C/min.

4.3.4 Depending on the thermal load, one heat network circulation pump and drainage pump may be stopped.

4.3.5 After the steam supply adjustment valve is fully closed, close the electric steam supply valve and open the drainage valve on the steam supply pipeline.

4.3.6 When the water level of the heater drops to the low alarm level, interlock all heat network drainage pumps to stop the automatic operation of the steam-water heat exchanger's drainage.

4.3.7 Confirm that the steam supply electric valve of the steam-water heat exchanger is tightly closed, then open the bypass valve on the water side of the heater, and slowly close the inlet and outlet valves on the water side of the steam-water heat exchanger. After opening the inlet valve, open the water drainage valve before the outlet valve, and open the air vent on the water side to drain the accumulated water from the steam-water heat exchanger.

4.3.8 Open the water drainage valves of all drainage pipelines and the air vent on the steam side, and after draining the steam-water heat exchanger's drainage, close the drainage valve. During this process, monitor the vacuum changes in the main unit.

4.3.9 As needed, all circulating pumps of the unit may be stopped, close the main circulating water supply and return valves, and open the drainage and air vent

valves along the circulating water pipeline.

4.3.10 For long-term shutdown of the steam-water heater, protective measures should be taken for both the steam and water sides of the heater.

5.Operation and Maintenance

5.1 The equipment must not operate under conditions exceeding those specified on the nameplate.

5.2 During operation, regularly check whether all valves and measuring instruments are functioning normally and if there are any leaks. If abnormalities are found, they should be repaired or replaced in a timely manner.

5.3 During operation, continuously monitor the temperature, pressure drop, drainage volume of the media in the pipes and shell, and the vibration condition of the tube bundle. If any abnormalities are detected, analyze the reasons promptly, and carry out repairs and maintenance as necessary. Maintenance must be conducted during shutdown.

5.4 For cleaning tube bundle deposits, chemical or mechanical cleaning methods may be used depending on specific conditions.

5.5 The circulating water should undergo anti-corrosion softening treatment, with water quality indicators required as follows: dissolved oxygen less than 100 μg/L, total hardness less than 700 μmol/L, and suspended solids less than 5 mg/L.

5.6 When the equipment is stopped, drain and dry the internal water promptly and close all valves to prevent air from entering the steam and water systems,

maintaining the internal humidity below 20%.

5.7 If pipe blocking is needed for tube bundle maintenance, open the header boxes or access ports at both ends of the equipment and use special pipe plugs to block the ends of the heat exchange tubes.

5.8 If tube replacement is needed for tube bundle maintenance, open the header boxes at both ends of the equipment to clean the connections between the heat exchange tubes and the tube sheets, and use special tube extraction equipment to replace the heat exchange tubes, leaving enough space at one end for tube extraction.

5.9 Long-term idle equipment should be protected against corrosion.

5.9.1 Nitrogen Filling Method: Drain all water and dry, then seal all valves and fill with nitrogen, maintaining a purity of not less than 99% at a pressure of 0.05 MPa.

5.9.2 Desiccant Method: Drain all water and dry, place desiccant inside, close all valves, and check the condition of the desiccant after 7-10 days. If it has expired, replace it with a new one, and check and replace expired desiccants monthly thereafter.

5.10 Regular Inspection

5.10.1 Periodic inspection of the equipment should follow the provisions of the "Safety Technical Supervision Regulations for Fixed Pressure Vessels."

5.10.2 External inspections and internal examinations of the equipment, along

with regulations on content and safety condition levels, should comply with the "Pressure Vessel Inspection Regulations."

6.Precautions:

6.1 When cleaning the tubes, do not blow steam directly into a single tube to avoid deformation or loosening at the tube and tube sheet connection.

6.2 Select cleaning agents that are compatible with the materials of the equipment.

6.3 When disassembling equipment, if the gasket has been loosened, it must be replaced with a new one upon reinstallation.

6.4 After the water system has been shut down, steam must not enter the steam system.

6.5 When the equipment is made of ordinary austenitic stainless steel, the chlorine ion content in the heat network circulating water should be strictly controlled to not exceed 25 mg/L.

7.Common Accidents and Solutions

7.1 Rising Water Level in the Steam-Water Heat Exchanger

7.1.1 Causes

7.1.1.1 Rupture or leakage of the heat exchange tubes in the steam-water heat exchanger.

7.1.1.2 Misclosure of the outlet valve of the drainage pump or failure to activate the backup pump after the drainage pump trips.

7.1.1.3 Vaporization of the drainage pump.

7.1.1.4 Automatic failure of the drainage adjustment valve of the steam-water heater.