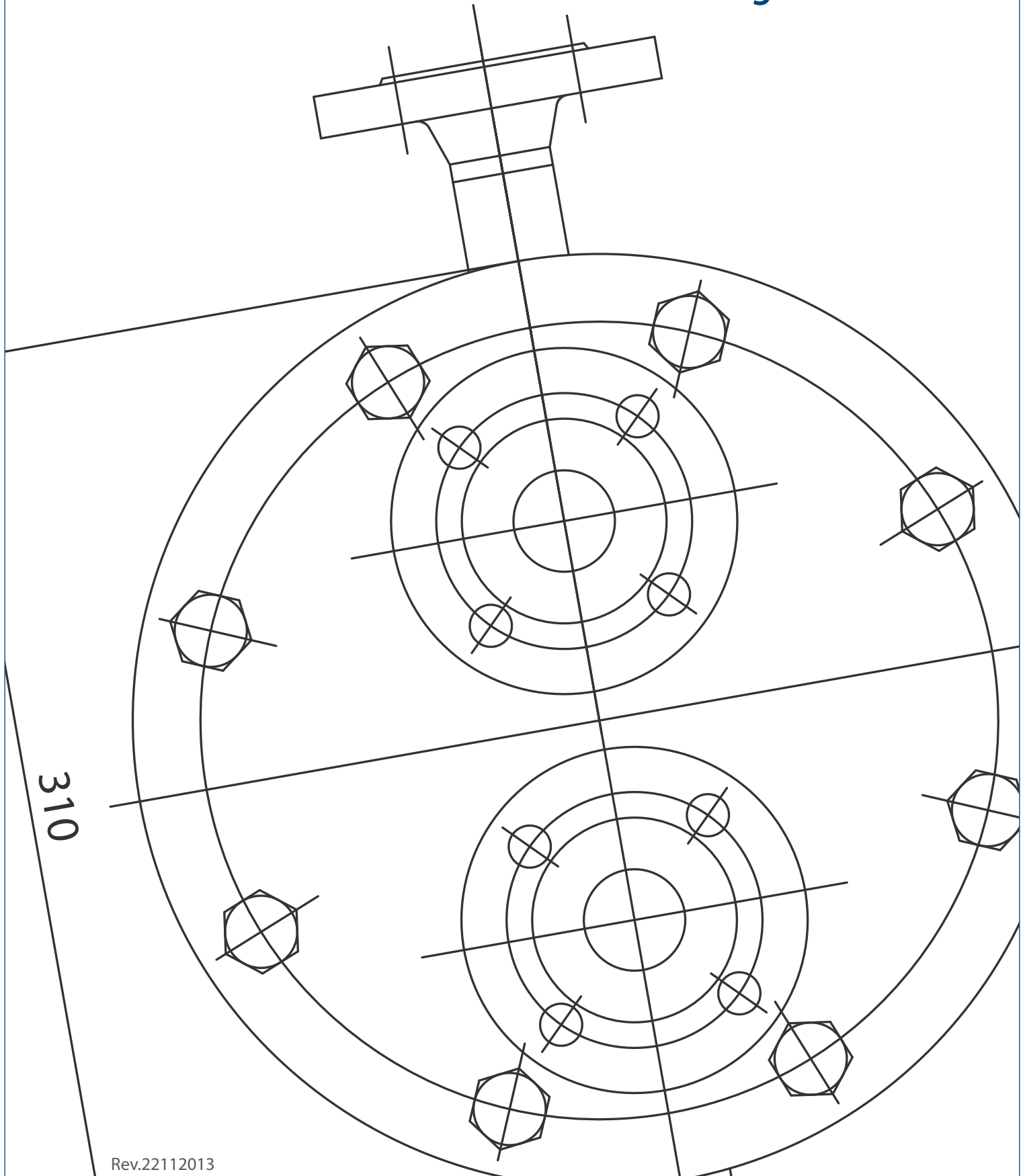


SONDEX

▶ **Operating and Instruction Manual**

Plate & Shell Heat Exchanger



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1. Identification of the Heat Exchanger

Identification of the Spiral heat exchanger

All types of Sondex Plate and Shell heat Exchangers are supplied with a name plate with following specifications:

- Type of Plate and Shell Heat Exchanger
- Year of production
- Manufacturing number
- Nominal capacity in kW
- Effective heating surface in m²
- Max. working pressure in bar
- Test pressure in bar
- Max. working temperature in °C
- Max. differential pressure
- Volume
- Flow

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| | | | |
|----------------------------|----------------------|---------------------------|----------------------|
| PLATE HEAT EXCHANGER TYPE: | <input type="text"/> | YEAR | <input type="text"/> |
| MANUFACTUR. NO.: | <input type="text"/> | MARKING | CE |
| NOMINAL CAPACITY kW | <input type="text"/> | l/h | <input type="text"/> |
| TRANSMISSION SURFACE | <input type="text"/> | m ² | <input type="text"/> |
| MAX. WORKING PRESSURE | <input type="text"/> | TEST-PRESSURE (bar) | <input type="text"/> |
| FLUID | <input type="text"/> | V, VOLUME IN LTR. | <input type="text"/> |
| TS, WORKING TEMP. MIN. °C | <input type="text"/> | TS, WORKING TEMP. MAX. °C | <input type="text"/> |

IMPORTANT:
The starting up must be done without shocks and against closed valves.

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2. Installation – General Points

Lifting : The lifting device must be carefully attached before any relocation.
Lift from underneath if placed on a foundation (pallet).
Lift by means of lifting eyes (if fitted).
Lift by means of the support brackets on the shell.

Avoid : Lift at the connections.

Space : The following steps are recommended for correct installation of the SPS heat exchanger :

Piping must be made to facilitate the opening of the cover plates and to pull out the plate pack.
Provide free space along the sides of the SPS, for mechanical cleaning and maintenance work.
For fully welded heat exchangers this is not required.



Safety : If the unit is to operate above 60°C, or if it contains corrosive media, protective screens/shields around/above the heat exchanger should be considered for the safety of the personnel nearby.

Pressure: In case of errors in the operating system it is important to protect the heat exchanger against the effects from overpressure. As a pressure block precaution, consider a pressure relief device to be mounted centrally upon the heat exchanger without the regulating or insulating valve between the device and the heat exchanger.

Pipe work : We recommend the following:

- 1) When connecting the pipe system to the heat exchanger make sure that no stress or strain is imposed, by the pipe system, on to the heat exchanger!
- 2) The pipe work must be thoroughly rinsed before connected to the heat exchanger.
- 3) Mounting of suitable vents and drains.
- 4) Mounting of insulating valves/by-pass valves in order to facilitate service, when necessary.
- 5) Consider construction of pipe work for the plate pack, as the pipe work must be removed before service,
Additional information, see "Space", page 2

Fittings : The use of thermometers and manometers to record temperatures and pressures through the inlet and outlet of the heat exchanger is recommended. Periodic checking of these devices will allow the performance of the heat exchanger to be monitored , plus, give a visual warning that the internal passages are becoming fouled up through service.

Welding : Do not use earth connection when welding near the heat exchanger. A separate earth connection must be established. The unit must not be used for that purpose. Carbon arcs may occur between the plates; therefore the heat exchanger must be isolated, before welding works take place.

- Filtration :** Depending on the type of heat exchanger a filter mesh should be used to remove all particles. Please ask your local Sondex supplier. If necessary "inline" filters should be fitted.
- How to connect the SPS unit:** Connect the SPS unit according to the information given by Sondex.
The normal orientation of the heat exchanger is to have the shell horizontal, with the shell connections in the vertical plain. This allows both circuits to be fully drained through the lower most connections.
- The heat exchanger can be mounted in various orientations; however, drainage from either side must always be possible.
- If any doubt please contact your Sondex dealer.

3. Starting and Maintenance

It is of big importance that the heat exchanger is not subject to thermal or mechanical shocks as this may lead to failure of the heat exchanger. Normal yielding of the flange gasket may have occurred between the time of the factory test, and the installation at the job site. Therefore, all external bolted joints may require re-tightening after installation.

- Start up :**
- 1) Fully vent system
 - 2) Close insulating valves between pump and heat exchanger
 - 3) Fully open the valve in the return line of the heat exchanger
 - 4) Pressure on the liquid side must not be so low that steam arises because of the temperature on the other side.
 - 5) Always establish the cold side flow first, then the hot side flow. If the heat exchanger is installed as a cooler and if there is a risk that the cold media might crystallize, it is **very important** that the circulation of the hot media is started up before turning on the cooling media to avoid such incident.
 - 6) Gradually open the closed valve in the inlet side of the heat exchanger
 - 7) Vent circuit again, if necessary - Special consideration must be given to discharge of hazardous or toxic fluids
 - 8) Repeat for the other circuit

- Control :**
- Check for pressure pulses in system caused by the pumps or control valves. If found, stop operation and rectify. Continuous pressure pulses will result in metal fatigue in the plates.
 - Visually check unit for leaks - tighten heat exchanger shell bolts, if the heat exchanger is not fully welded.

Steam : Only use slow-acting control valves and mechanisms.

Before start-up:

- A) Ensure that the steam control valve is fully closed.
- B) Ensure that the heat exchanger is totally drained.

Start the cold circuit first, then the steam side.

Open the steam control valve slowly. This prevents water hammer in the steam line and reduces pressure/thermal shock to the heat exchanger. Ensure that the steam trap is correctly dimensioned to allow full condensate discharge. This prevents water clogging inside the heat exchanger.

4. Shutting down the Heat Exchanger

Warning: Water hammer and thermal shock may damage the heat exchanger resulting in a loss of liquids from one or several liquid circuits.

Water hammer occurs when a flowing liquid is suddenly stopped. Pressure shocks move along the pipes creating a water hammer effect.

Thermal shock occurs when the temperature of the heat exchanger suddenly increases or decreases. In consequence of this the expansion or contraction of the unit may result in damage to the plate pack. Avoid water hammer as well as thermal shock by means of slow-acting control valves. Therefore an automatic control system protecting the heat exchanger must be considered.

Shutdown : Follow steps 1-4 for the hot side first, then repeat the procedure for the cold side. Always decrease the flow to the hot side until closed. Then shut down the cold side.

- 1) Slowly close the control valve on the hot side whilst maintaining full flow on the cold side.
(Shutdown cold side first if hot side is liable to freeze).
- 2) Switch of the pump
- 3) Slowly close the outlet valves
- 4) Drain and vent the heat exchanger
- 5) Repeat steps 1-4 for the cold side

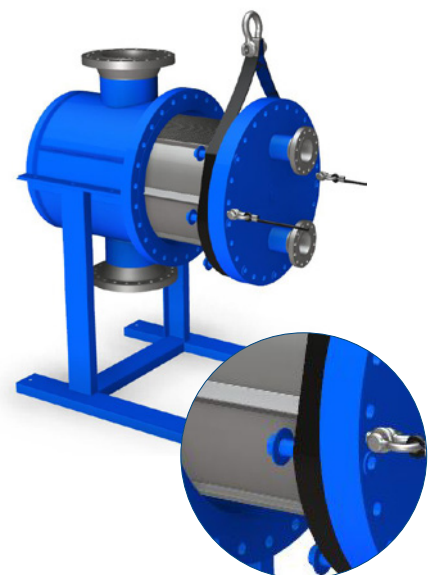
Storage : If the unit is taken out of operation for a long time, following procedure must be observed:

- Allow the unit to cool, and then release all pressure from inside the exchanger.
- Lubricate tie bolt (if mounted)
- Fill the heat exchanger with inert gases and close all connections. Alternatively, the heat exchanger must be treated with rust protection (only the steel shell side), e.g. Shell Ensis Liquid G (remember that rust protection must be totally removed and rinsed by means of a mineral solvent, before the heat exchanger is taken into operation again).

5. Opening of the Heat Exchanger (not applicable to fully welded units)

Tools : Spanner and a light machine oil.

- Procedure :**
- Allow the unit to cool and release pressure from the heat exchanger.
 - Remove pipe work connected to the plate pack nozzles.
 - Lightly lubricate tie bolt threads.
 - Undo the clamping bolts uniformly - in a diametrically staggered pattern.
 - Pull out the plate pack from the shell. The plate packs of big units are very heavy; lifting straps must be attached around the plate pack (fasten bolts onto the back of the shell and then attach lifting straps around the bolts to support the plate pack, when it is removed, see drawing to the right). A base must be prepared, before the plate pack is removed from the shell.



WARNING

Be **very** careful; the plate pack is easily damaged by impact or if it is dropped. After removal the plate pack must be supported by supporting blocks. If the plate pack is not very heavy, the nozzles can be used as support (plate pack must turn upwards).

6. Cleaning of the Heat Exchanger

A reduction of the heat exchanger performance - especially combined with an increase of the pressure drop across either circuit - indicates that the heat transfer surfaces have become fouled.

The heat exchanger can be cleaned either chemically or manually (only inside the shell and if the unit is not fully welded). For the plate pack chemical cleaning is the only possible method.

Generally chemical detergents are best - industrial detergents remove fouling and limestone. Before use, always check if the construction material of the heat exchanger tolerates the detergent in question.

The plant operator decides the detergents to be used. This will depend on the type of deposit. We recommend contacting a cleaning specialist who is able to state the deposit to be removed, provide for the correct detergent and equipment and comply with all Health and Safety Regulations.

Safety: Wear gloves and eye goggles when using detergents.

Rinsing: After use of detergents, always thoroughly rinse with fresh water.

7. Gaskets

Replacement: Gasket surfaces must be thoroughly cleaned and with no scratches or other defects. A gasket is mounted to seal the plate pack in the shell (not applicable if the unit is fully welded). In order to reduce the possibility of future leaks it is recommended to replace the gasket every time the plate pack is removed - even if the original gasket seems to be in a good condition. Compound gaskets may "dry up" and become weak. Therefore they will not seal up effectively, when they are reused.

8. Assembling and Test of Plate Packs

Pressure test: Fill the plate pack with the test medium. Vent if the hydraulic method is used - gradually increase the pressure until normal working pressure of the heat exchanger is obtained. Close all valves. After that check for leaks in the heat exchanger and keep an eye on the pressure gauge reading.

The procedure of plate pack insertion is the opposite of the removal procedure. Tighten the bolts evenly by using a diametrically displaced pattern. The bolts must be tightened so that the gasket is compressed evenly. Excessive tightening should be avoided after start up; the bolts can always be re-tightened if gasket setting occurs after that the heat exchanger has obtained the maximum working temperature.

Max. Torque

M16 bolt size: 160 Nm

M20 bolt size: 260 Nm

M24 bolt size: 450 Nm

M30 bolt size: 560 Nm

9. Trouble shooting

| Symptom | Possible Causes | Corrective Action | Remarks |
|--|---|--|--|
| External leakage at cover plate. | Improperly tightend bolts. Flange gasket failure. | Retighten bolts If leaking persists, replace gasket. | If retightening the the bolting does not stop the leak, remove cover plates and change all gaskets. |
| Contermination of one channel by the other. | Plate cassette cracked from water hammer, thermal shock or a hole in a plate due to corrosion | Send to Sondex dealer for further testing and determination of corrective action | If you suspect corrosion to be subject to the failure, check the chloride content of the fluids. If high, consider purchasing a unit with a higher alloy which is compatible with the process fluids. Contact Sondex for advice. |
| Extremely low thermal performance and a very high pressure drop. | Shell or plate side channels clogged with accumulation of debris or scale from the process. | Measure pressure drop across each side of the heat exchanger to make sure that the problem does not arise from another place in the system | It is important to establish the appropriate cleaning frequency to avoid unscheduled shut-downs |
| Gradual decline of heat transfer performance. | Progressive fouling of the plate and/or the shell side. | Clean one or both channels as required. | It is important to establish the appropriate cleaning frequency to avoid unscheduled shut-downs |

10. Spare Parts

When ordering parts it is important that the correct details are given.

At least the following should be quoted, to your local Sondex dealer:

- Project and order number
- Exchanger type and manufacturing number (see name plate)
- Required parts



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