

CNF, CN, CF, and SV Series Heat Exchangers

SUMMARY

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INTRODUCTION

Scope of Manual

This manual provides instructions for installation, startup, maintenance and spare parts ordering for the CNF, CN, CF, and SV Series heat exchangers.

Product Description

In the gas pressure reduction process by the "Joule-Thomson" effect, temperature drops considerably (about 0.5°C per reduction bar are estimated). This fall in gas temperature can damage equipment due to formation of dangerous ice crystals produced by water vapor in the gas.

In first stage stations in particular, gas must be heated before pressure is reduced, since high pressure changes are usually involved. We recommend that, after reduction, gas temperature should not be below 5°C. One of the best established methods of heating gas in reduction stations is to use heat exchangers employing hot water or steam as their thermal carrier fluid.

The heat exchangers we produce are sized and designed to meet a very wide range of system requirements.



Figure 1. Tube Bundle Heat Exchangers

This product has been designed to be used with fuel gases of 1st and 2nd family according to EN 437, and with other non aggressive and non fuel gases. For any other gases, other than natural gas, please contact your local sales agent.

CNF, CN, CF, and SV Series

PED CATEGORIES AND CHARACTERISTICS

PED Categories and Fluid Group

Table 1. PED Categories and Fluid Group

| TYPE | | CATEGORY | FLUID GROUP |
|---|------------------------------|----------|-------------|
| CNF-05-AP | Thermal carrier fluid: Water | III | 1 |
| | | | |
| CNF-1-AP CN2-AP CNF2-AP CF3-AP CF1-AP/5000 CF1-AP/8000 CF1-AP/12500 CF1-AP/17500 | Thermal carrier fluid: Water | IV | 1 |
| | | | |
| SV (all type) | Thermal carrier fluid: Steam | | |
| | | | |

Characteristics

Table 2. CNF, CN, and CF Series Maximum Nozzles Diameter
Gas Side Flanged ANSI (150 on request) 300/600
Water Side Flanged PN 6 - 16

| TYPE | MAX DN GAS SIDE | MAX DN WATER SIDE |
|--------------|-----------------|-------------------|
| CNF-05-AP | 50 | 50 |
| CNF-1-AP | 100 | 65 |
| CN2-AP | 125 | 80 |
| CF2-AP | 125 | 80 |
| CF3-AP | 150 | 80 |
| CF1-AP/5000 | 200 | 80 |
| CF1-AP/8000 | 250 | 80 |
| CF1-AP/12500 | 300 | 150 |
| CF1-AP/17500 | 350 | 200 |

Table 3. SV Series Maximum Nozzles Diameter
Gas Side Flanged ANSI 300/600
Steam Side Flanged PN 6 - 16

| TYPE | MAX DN GAS SIDE | MAX DN WATER SIDE |
|-------------|-----------------|-------------------|
| SV3-AP | 125 | 80 |
| SV-AP/5000 | 150 | 80 |
| SV-AP/8000 | 200 | 80 |
| SV-AP/12500 | 250 | 125 |



WARNING

Table 4. Specifications

| TYPE | RATING GAS SIDE | MAXIMUM WORKING PRESSURE, bar | MAXIMUM ALLOWABLE PRESSURE (PS), bar | |
|---------------|-----------------|-------------------------------|--------------------------------------|----------------------|
| | | | Tube Side | Shell Side |
| CNF - CN - CF | ANSI 300 | 17 | 30 | 5 |
| | ANSI 600 | 75 | 85/90 | |
| SV | ANSI 300 | 17 | 30 | 5 (12 on request) |
| | ANSI 600 | 75 | 85/90 | |

Minimum/Maximum Allowable Temperature (TS)

CNF, CN, and CF Series

Standard Version: -10/100°C

Low Temperature Version: -20/100°C

SV Series

Standard Version: -10/160°C

Low Temperature Version: -20/160°C

The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.

LABELLING

| | | | |
|--|--|--------------------------|--------------------------|
| | | | |
| | | | |
| | | N° FABBR. SERIAL N° | |
| | | DATA: Note 2 DATE: | |
| FLUIDO GRUPPO/GROUP FLUID | | | |
| (PRESSIONE DI PROGETTO/DESIGN PRESSURE) | | PS Bar | Note 3 |
| | | PS MPa | Note 3 |
| (TEMPI DI PROGETTO/DESIGN TEMPERATURE) | | TS °C | Note 4 |
| | | LATO MANTELLO SHELL SIDE | LATO TUBI TUBE SIDE |
| RADIOGRAFIA SALDATURE/RADIOGRAFY OF THE WELD | | | |
| EFFICIENZA SALDATURE/EFFICIENCY OF THE WELD | | | |
| CAPACITÀ/CAPACITY | | | |
| PESO/WEIGHT | | | |
| ATTACCHI A FLANGIA IN ENTRATA INLET | | DN | ANSI Note 5 PN Note 5 |
| FLANGE CONNECTION IN USCITA OUTLET | | DN | ANSI Note 5 PN Note 5 |
| | | LATO MANTELLO SHELL SIDE | LATO TUBI TUBE SIDE |
| (SUPERFICIE DI SCAMBIO TERMICO/HEATING SURFACE) m ² | | | |
| (PROVA IDRICA/HAULIC/HYDRAULIC TEST) | | PT Bar | Note 6 |
| | | PT MPa | Note 6 |
| (PROVA PNEUMATICA/PNEUMATIC TEST) | | PN Bar | |
| | | PN MPa | |

Figure 2. Label for Heat Exchangers

Note 1: See “Characteristics”

Note 2: Year of manufacture

Note 3: Tube Side

Maximum PS = 90 bar

Shell Side

Maximum PS = 5 bar (SV Series 12 bar on request)

Note 4: CNF, CN, and CF Series

Standard Temperature Range: -10/100°C

Low Temperature Range: -20/100°C

SV Series

Standard Temperature Range: -10/160°C

Low Temperature Range: -20/160°C

Note 5: Available with different flange ratings, see “Characteristics”

Note 6: PT = 1.5 x PS bar

TRANSPORT AND HANDLING

The equipment is self stiffened and standard lifting devices may be used for handling and erection. Since these units will be supplied with all surfaces painted, it is recommended the use of proper protection to avoid paint damage.

Stand-alone equipment is delivered either in horizontal or vertical position standing on saddles or on cage. Handling and erection has to be done using the proper lifting devices attached on lifting points. During this lifting operation avoid to use inlet/outlet nozzles of water and gas sides shall not be hooked.

Transport saddles, if any, are connected to the equipment by straps or steel ropes; during handling those are to be checked to avoid accidental saddle disconnection.

Eyebolt can be used only for water/steam side shell's lifting and not for whole equipment lifting.

PRESERVATION AND STORAGE

Stand-alone equipment is delivered with all nozzles blanked and all surfaces completely protected by primer or paint (carbon steel material versions). hence the equipment doesn't need specific precautions for storage, providing to follow the recommendations listed in "Inspection" section on page 4 of this Instruction Manual.

ATEX REQUIREMENTS

Application of ATEX Product Directive:

| TYPE | CLASSIFICATION | ATEX ASSEMBLIES | ATEX LABELLING |
|-----------------------------------|--|---|----------------|
| Regulator/SSD | Non-electrical equipment | Not falling under the 2014/34/EU Directive | No |
| Regulator/SSD + electrical device | Non-electric equipment equipped with an electrical device falling under the scope of the ATEX Directive 2014/34/EU | Constitutes an assembly according to the 2014/34/EU Directive | CE Ex II 2 GT |



WARNING

Carefully follow below instructions for the usage of "ATEX Assembly" in an explosive atmosphere.

A non-electrical equipment incorporating an electrical device (proximity, microswitch...) is an "ATEX Assembly", and in the scope of the ATEX Directive 2014/34/EU.

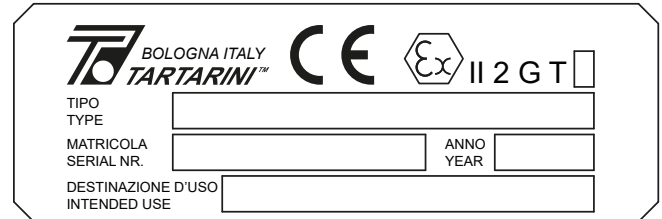
When such equipment(s) is used in a natural gas pressure control and/or measuring station in compliance with the following European standards: EN12186, EN12279 and EN 1776, can be installed in any type of classified zones according to the Directive 1999/92/EC dated 16 December 1999, in the following conditions:

- the equipment(s) / electrical circuit is connected to a suitable and certified intrinsically safe apparatus (suitable zener barrier)

- the equipment(s) / electrical circuit is used according to this instruction manual issued by the manufacturer and / or available on our website

ATEX Labelling

The nameplate will be installed on the ATEX assembly.



Where:

- Manufacturer:** Name and address and/or logo of the manufacturer
- CE:** Conformity marking to European Directive
- Type:** Description of the ATEX Assembly
- Serial Number and Year of Construction
- Ex:** Specific marking of explosion protection
- II:** Equipment group
- 2:** Equipment Category/level of protection 2 = suitable for zone 1
- G:** For gases, vapor or mists
- T:** Temperature Class (i.e.: T6 > 85 ... ≤ 100 °C)

Intended Use: Natural Gas infrastructures

OPERATION

Equipment operating at high pressure should be warmed up slowly and uniformly before applying full pressure.

Pressure should be increase in stages of approximately 10% of operating pressure up to the operating value.

In case of leakage or other inconvenience, the procedure should be immediately stopped and the problem investigated and removed before a new startup.

INSTALLATION



WARNING

Only qualified personnel shall install an Heater exchanger. Heater exchangers should be installed, operated and maintained in accordance with international and applicable codes and regulations. Following notes and instructions point out, in particular, the "pressure" risk. Installation, operation and maintenance procedures performed by unqualified personnel may result in unsafe operation.

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This condition may result in equipment damage or personal injury. If a leak develops in the system, the escaping gas may accumulate and become a fire or explosion hazard. Immediately call qualified service personnel in case of trouble.

Hazards arising from misuse and misoperating are: Personal injury, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if the equipment is installed where its capabilities (PS and TS) can be exceeded or where conditions exceed any ratings of the adjacent piping or piping connections. To avoid this, install the equipment where:

- Service conditions are within unit capabilities.
- Service conditions are within applicable codes, regulations, or standard.
- The unit is protected from exposure to physical damage and/or corrosive substances.
- Suitable pressure-limiting or pressure-relieving devices have been installed in those instances where supply pressure is capable of exceeding the maximum allowable downstream equipment pressure.

National safety standards and established rules shall be applied in heater exchanger installation and operation, concerning, in particular, electrical works, fire, and thunderbolt protection.

All means for venting have to be provided in the assemblies where the pressure equipment are installed.

Before installation, check shall be done if service conditions are consistent with use limitations.

Where this product is used:

- provide the cathodic protection and electrical isolation to avoid any corrosion
- the gas shall be cleaned by proper filters/separators/scrubbers to avoid any technical & reasonable hazard of erosion or abrasion for pressure-containing parts.

Heat exchangers shall be installed in non-seismic area and hasn't to undergo fire and thunderbolt action.

Inspection

Upon arrival at site the equipment must be inspected for eventual damages occurred during transportation. At least, the following points have to be inspected:

- Integrity of nozzles closure and equipment sealing.
- Status of painted surfaces. If paint is damage any touch-up shall be carried out in accordance with the project coating specification.
- Visual check of critical areas such as nozzles, saddles, clips.

Any damage shall be reported to quality control office and eventually to the vendor in order to agree and coordinate any repair work.

The heat exchanger have been subject to hydrostatic test at our factory according to Code and Specifications requirements and thoroughly inspected for leakage during the above test.

However, handling during transportation or moving into place may have loose gasketed seals: based upon the above, it is recommended to recheck all bolted connections, if any, prior to startup.

Cleaning

Thoroughly clean and blow all pipe lines to remove scales and other possible foreign material.

Piping Up

The piping established practice shall be follow when installing the heater exchanger. The heater exchanger must be installed with the flow as indicated by the in and out marking on the heater exchanger itself.

Foundations

Foundation or metallic supports should be suitable to support the equipment and its maximum contents, which may result in stresses caused also by piping connections.

Levelling

The heat exchanger should be installed to the correct level within the limits agreed by Data Sheet or specifications.

Access

The heat exchanger should be installed with sufficient clearance from associated structures and equipment to provide safe, efficient working by operators and to provide ready access for cleaning, inspection and maintenance.

The heat exchanger is designed with removable tube bundle after disassembly of the channel in order to permit an internal inspection (when required): so, the heat exchanger shall be installed with sufficient space in front of it (at least the length of the tube bundle).

Support should be so arranged to provide adequate movement around the equipment.

Flanged and Bolted Joints

Accurate vertical and horizontal alignment, with flange faces parallel, is an important precaution to be taken when making up a flanged joint.

A suggested bolt tightening sequence is to process "three o'clock, nine o'clock, twelve o'clock, six o'clock, etc."

After have complete the above sequence and additional check have to be performed on all bolts. The same procedure has to be followed in case of maintenance.

Piping and Connections

To avoid excessive stresses or strains due to piping connections, the following precautions should be taken:

- To avoid stresses arising from nozzle connection, piping should not be forced into alignment when connecting up.

- If the magnitude and direction of external piping forces and moments are known and the nozzles have been designed specifically to these reactions, the above forces and moments are not to be exceeded.

Ventilation

Equipment should have adequate ventilation around them, particularly where heat exchangers are located indoors.

The ventilation requirements should take into account the type of medium which may escape from the equipment.

Special requirements for lethal material should be agreed with the Authority involved.

Lighting

Where necessary, the illumination level of lighting at the equipment should be sufficient to allow free movement of operating personnel in safety while in operation under normal conditions.

Shipping Covers and Plugs

The shipping covers and plugs (if any) should remain in place until equipment is set in position and ready for piping up.

All openings should be inspected for debris or foreign material that could damage the equipment.

STARTUP AND SHUTDOWN

Heat exchanger is particularly sensitive to pressure increase very rapidly since the tube bundle may be damaged.

Pressure should be increased in stages of approximately 10% of operating pressure up to the operating value.

In case of leakage or other inconvenience, the procedure should be immediately stopped and the problem investigated and removed before a new start-up.



WARNING

During start-up phase of heat exchangers with Low Temperature shell versions (-20°C), to avoid any possible risk of brittle fracture of tube bundle, hot water (or steam) flow must be activated BEFORE increasing of gas side pressure (ref. : PED Directive Annex I – clause 4.1 and 7.5 ; PED Guideline 7/17).

Gasketed Connections

Before start-up and after initial start-up, at normal operating pressure and temperature, it is recommended to inspect all gasketed joints for tightness.

Shutting Down

When possible, reduce slowly the pressure in order to avoid damage.

In no case open the equipment before the pressure is completely released.

MAINTENANCE

Heater exchanger parts are subject to normal wear and must be inspected periodically and replaced as necessary.

The frequency of inspection and replacement depends upon the severity of service condition and upon applicable codes and government regulation.

During the inspection of the heater exchanger, the equipment with drain valves, these shall be checked that the valves are free of any debris that may restrict the drain flow.

In order to avoid personal injury or equipment damage caused by sudden release of pressure or explosion of accumulated gas, do not attempt any maintenance or disassembly without first isolating the heater exchanger from system pressure and relieving all internal pressure from the heater exchanger.

Before starting disassembly, carefully release all pressures from the heater exchanger.

- Never loosen the heater exchanger body while the unit is under pressure.
- Do not remove any pipe plugs from the unit while it is under pressure.
- Use a gauge to monitor pressure while releasing it.
- The drain valve is for releasing fluid. Direct the flow stream in a safe direction.

WASTE DISPOSAL REQUIREMENTS

The disposal of waste and e-waste from packaging, spare parts, lubricants, whole equipment/systems and produced in occasion of on-site surveillance activities (during service life and/or at the end of their service life), shall be carried out in accordance with the requirements of applicable local regulation (laws and rules).

SPARE PARTS

Spare parts storage shall be done by proper procedures according to national standard/rules to avoid over aging or any damage.

PARTS LIST

| Key | Description |
|-----|-------------------------|
| 1 | Head gas side |
| 2 | Shell gas side |
| 3 | Nozzle gas side |
| 4 | Flange gas side |
| 5 | Drain |
| 6 | Baffle separator |
| 7 | Shell flange gas side |
| 8 | Tube plate |
| 9 | Shell flange water side |
| 10 | Nut |
| 11 | Bolting |
| 12 | Fitting |
| 13 | Shell water side |
| 14 | Baffle |
| 15 | Tube bundle |
| 16 | Flange water side |
| 17 | Nozzle water side |
| 18 | Eyebolt |
| 19 | Fitting |
| 20 | Head water side |
| 21 | Thredolet |
| 22* | O-ring |
| 23 | Spacing |
| 24 | Nut |
| 25 | Washer |
| 26 | Bolting |

SCHEMATIC ASSEMBLIES

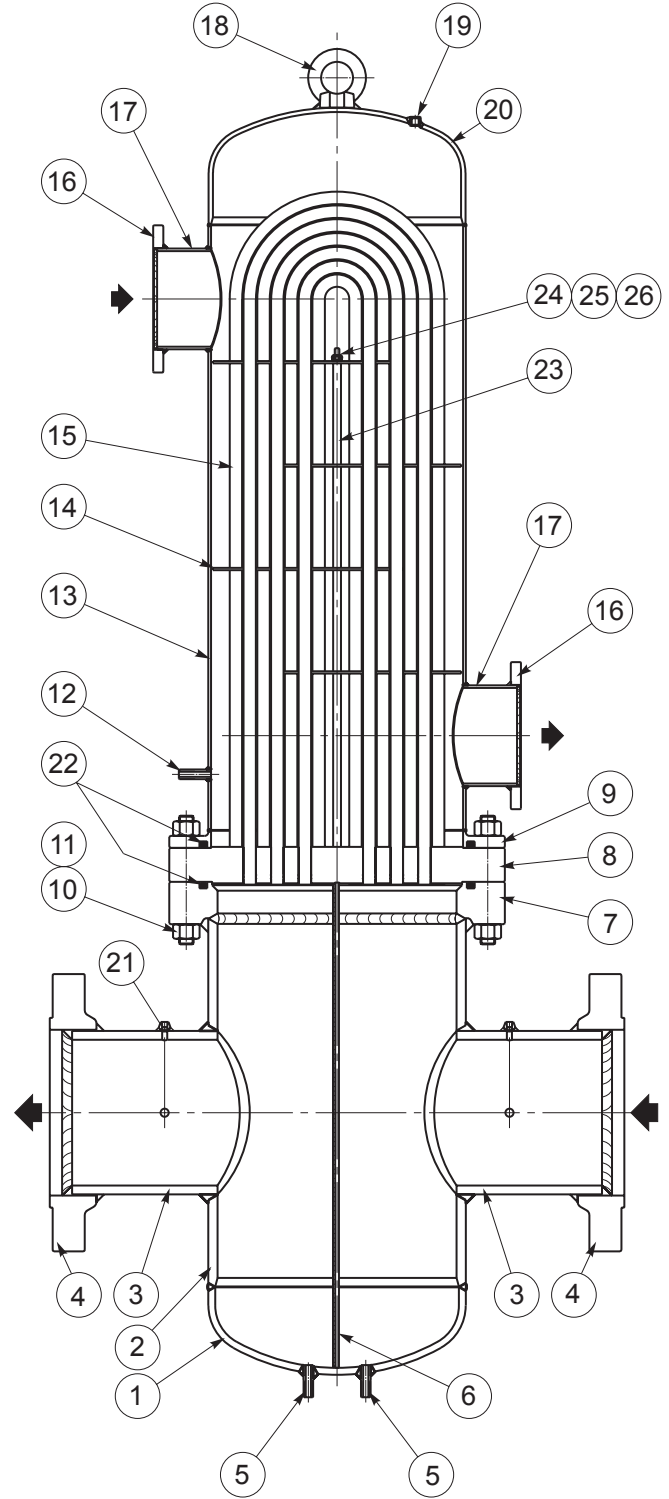


Figure 3. Tube Bundle Assembly

(*) Spare parts.

To order the spare parts it is necessary to communicate to us the type of the heat exchanger and its serial number.

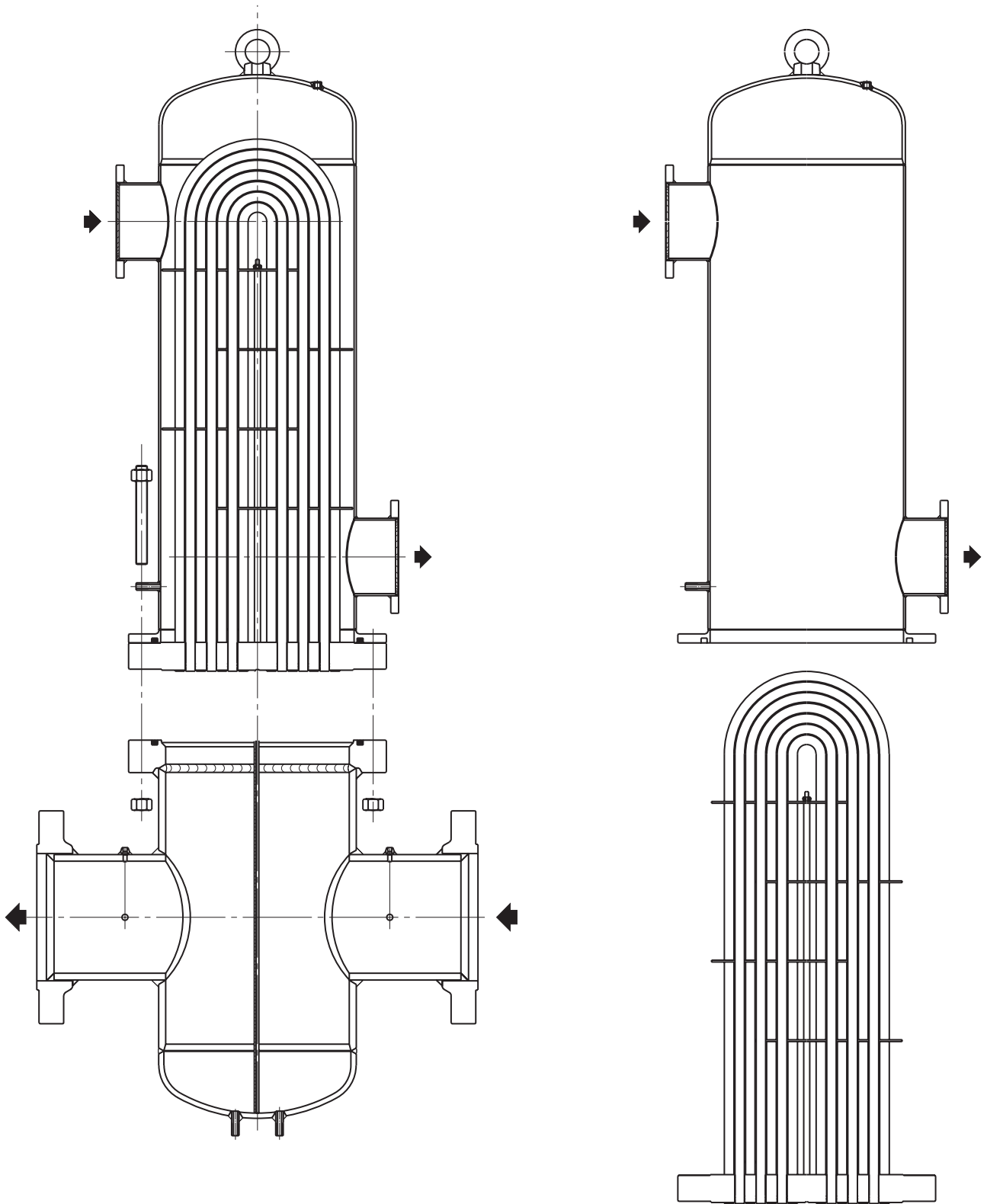


Figure 4. Tube Bundle Disassembly

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