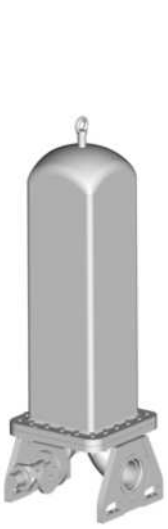
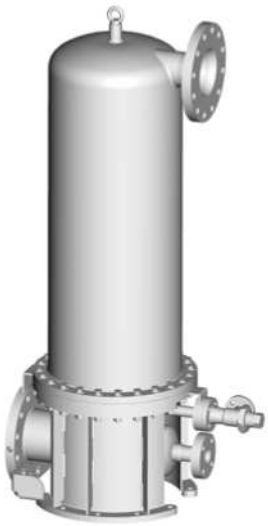
Framo
Cargo Heaters

No. 1250-0031-4
Rev.I 06Dec16

Operation manual



HE225



HE400

HE430

HE500

CONTENTS

1 GENERAL DESCRIPTION

The Framo cargo heater is a vertical deck mounted stainless steel heater for heating of viscous cargoes (must not be used for heating sea water).
The heater consists of a channel section and a cover. The channel section includes the heating elements, which are free to expand vertically inside the cover. The cover can be lifted up/removed from the heater for inspection and cleaning of the elements.

The cargo heater is equipped with a condensate temperature limiting valve on the heating medium outlet side. The valve will close if the temperature is rising above approximately 90°C. This will avoid flashing of condensate in return line. The condensate temperature limiting valve shall not be adjusted.

The Framo cargo heater is available in 4 different sizes, HE225, HE400, HE430 and HE500.
The arrangement of the connections varies for the different sizes. For additional information, see dimensional drawings.

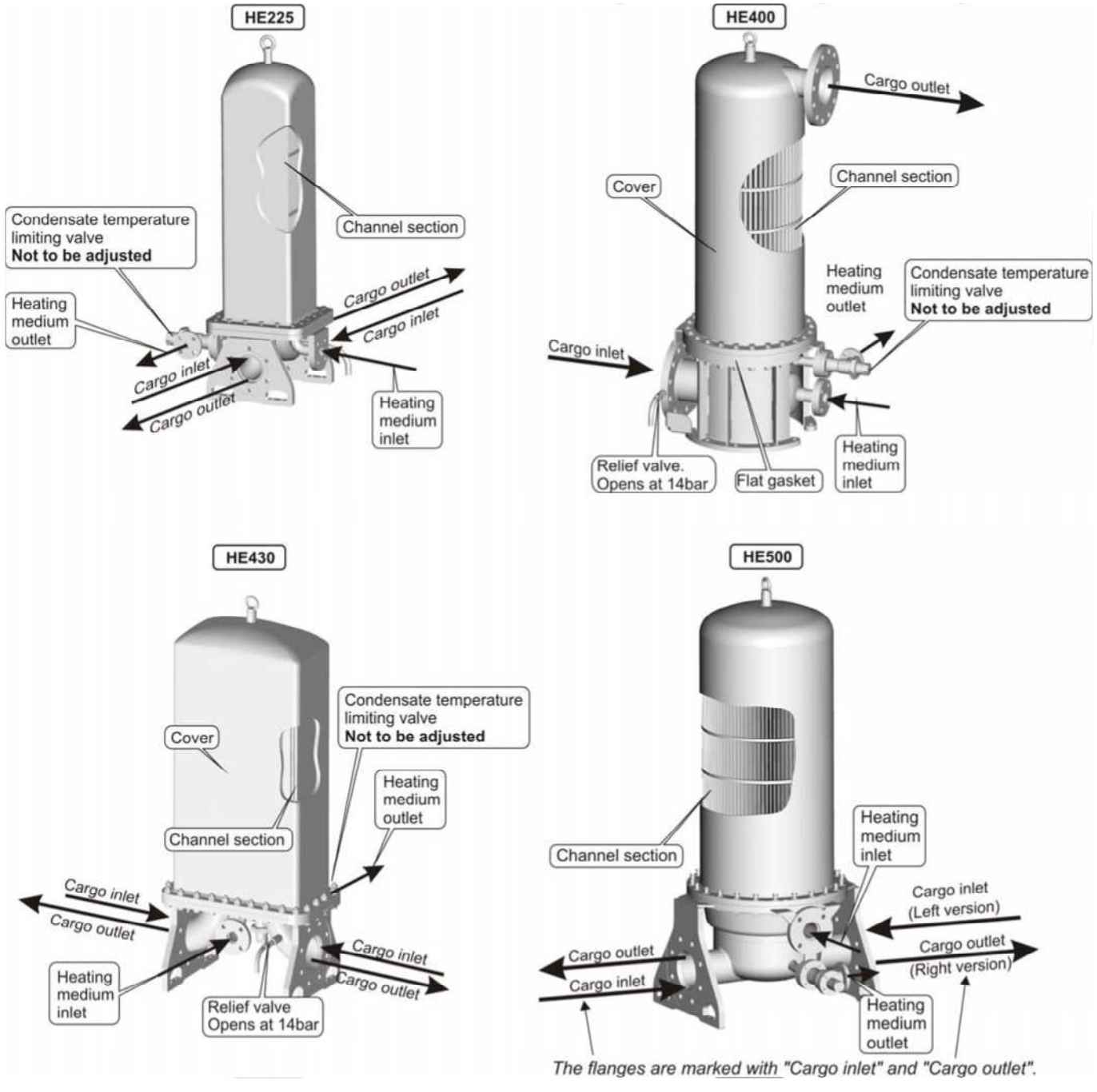


Fig. 1

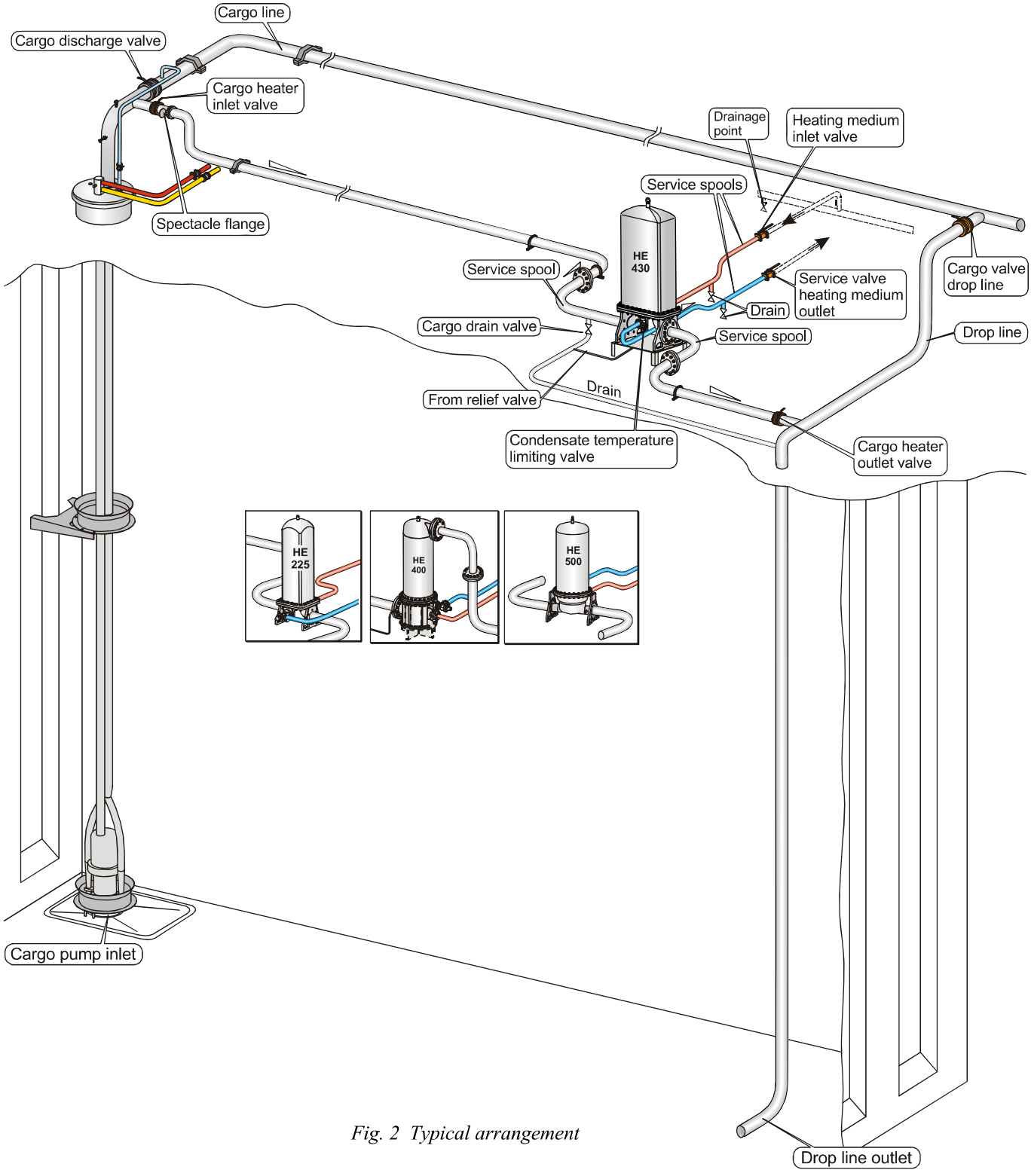


Fig. 2 Typical arrangement

The cargo heaters operate with low pressure loss and high flow, which gives good mixing in tank and low temperature increase (across the heater).
Low cargo pressure loss is favourable for all types of cargo, and it is essential when heating viscous cargoes.
Low temperature increase across the heater is favourable for sensitive cargoes.

1.1 Sectional drawing / Technical data

Max pressure /temp. cargo side: 14 bar / 100°C
Max pressure /temp. heating medium side: 10 bar / 185°C
Material: AISI 316L

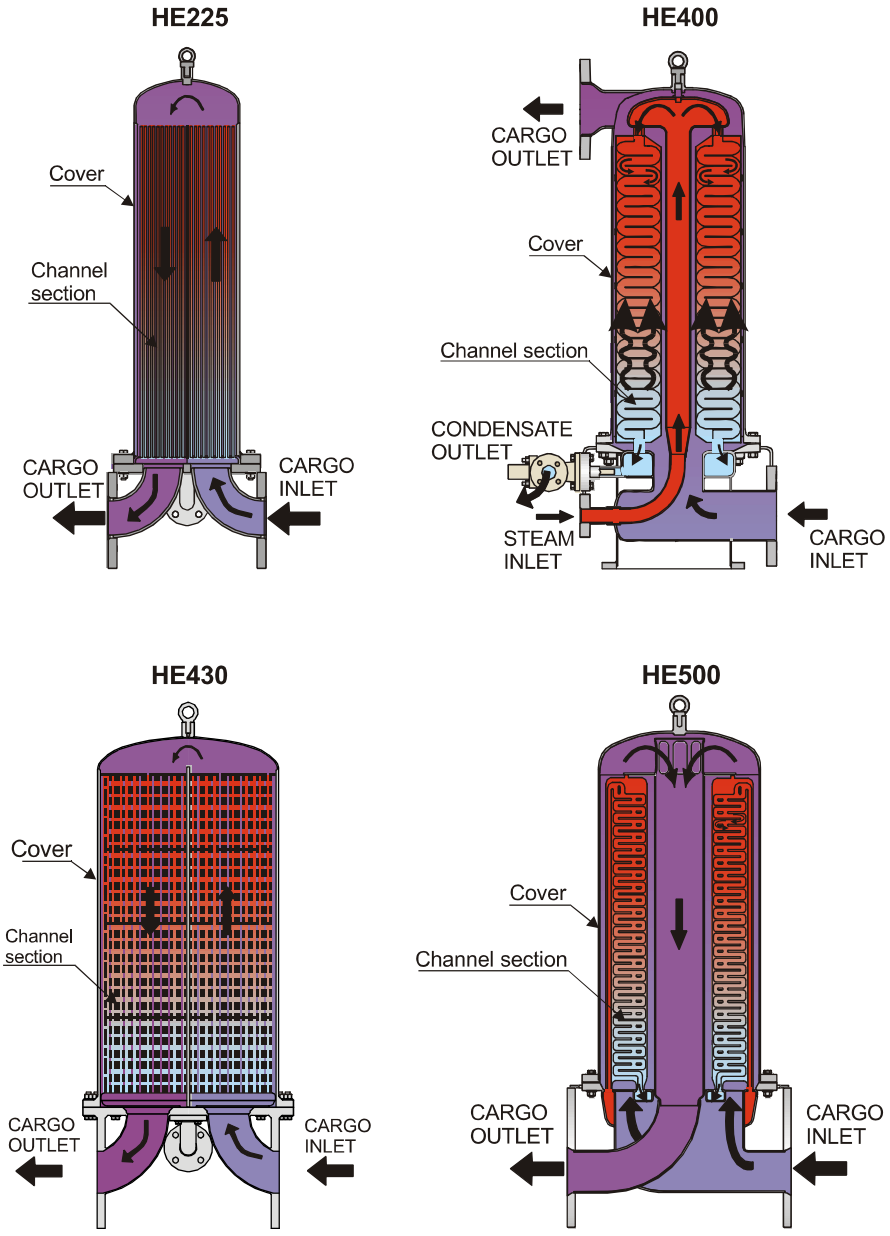
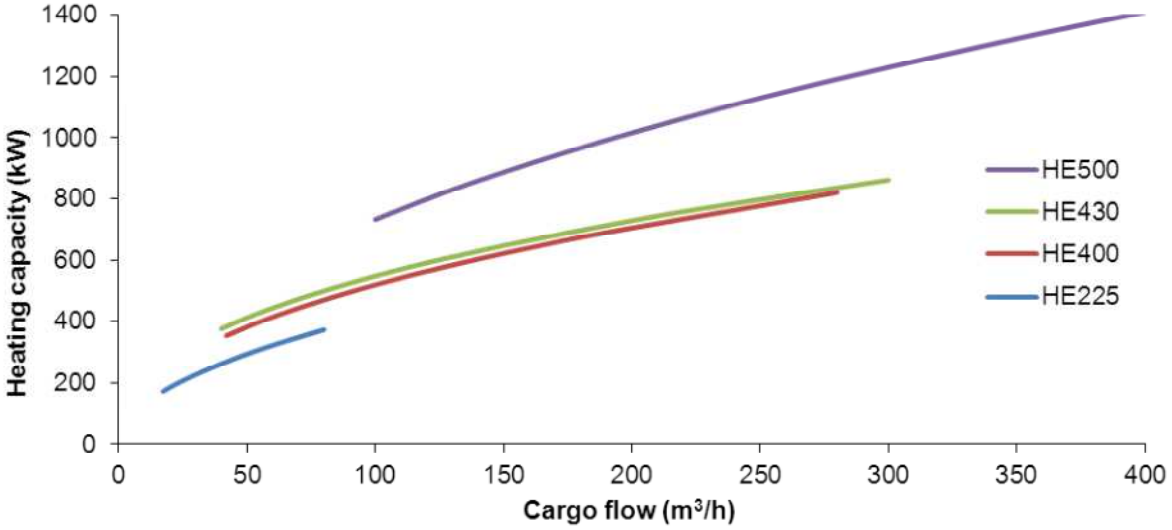


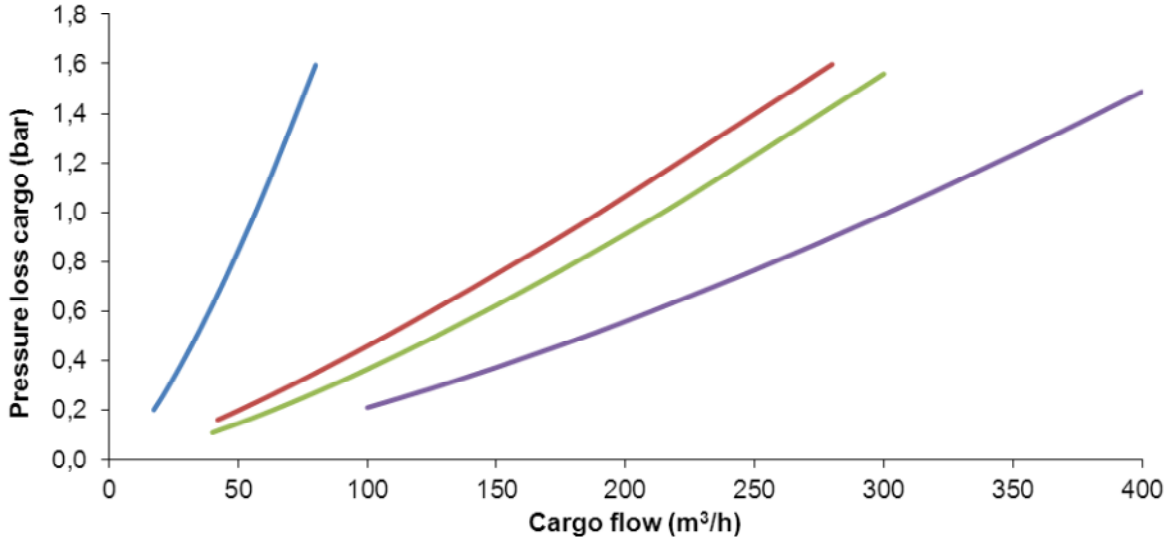
Fig. 3

Component	HE225	HE400	HE430	HE500
Cover	55 kg	70 kg	140 kg	100 kg
Complete Heater	175 kg	340 kg	425 kg	500 kg

Heating capacity and pressure drop for HFO no.6 at 55°C inlet temperature

Heating medium type: Saturated steam at 7bar/170°C





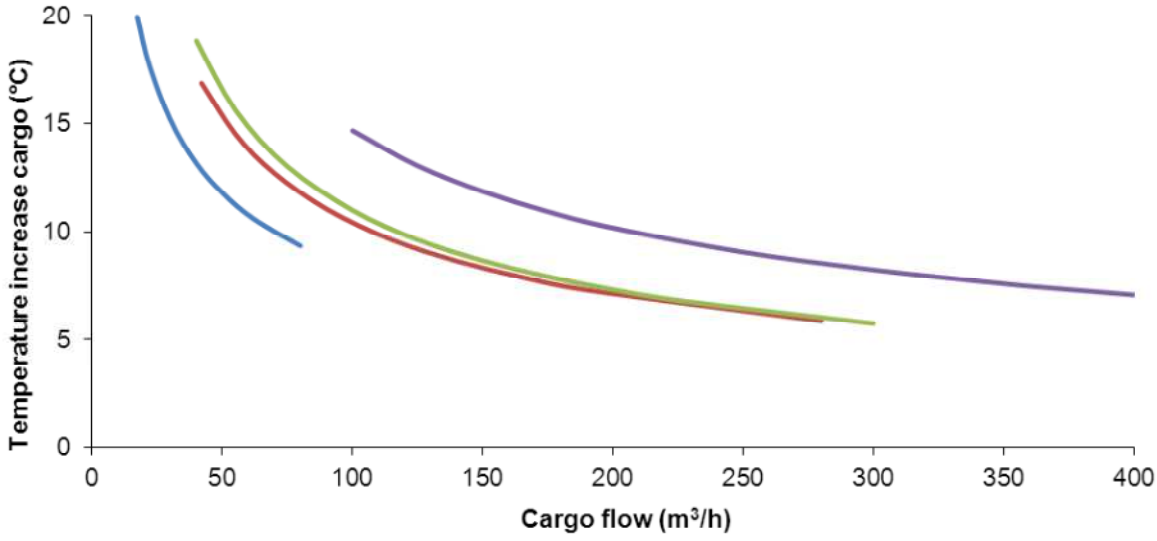


Fig.4

Lifting arrangement

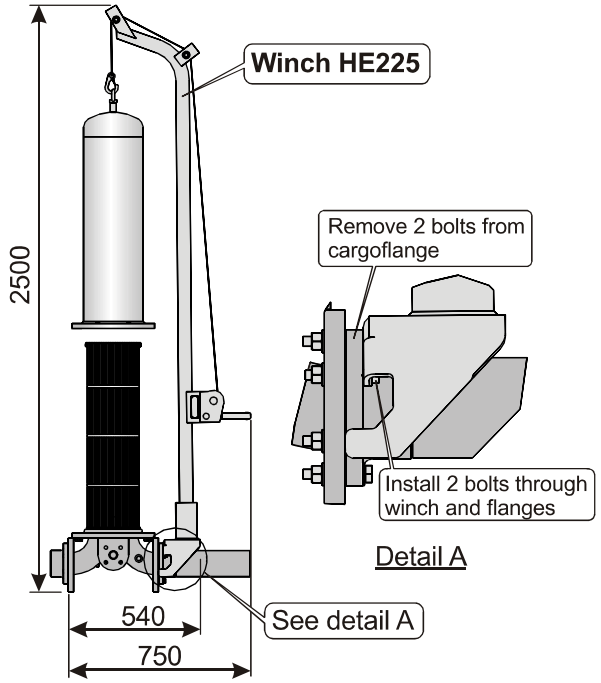


Fig. 5 HE225

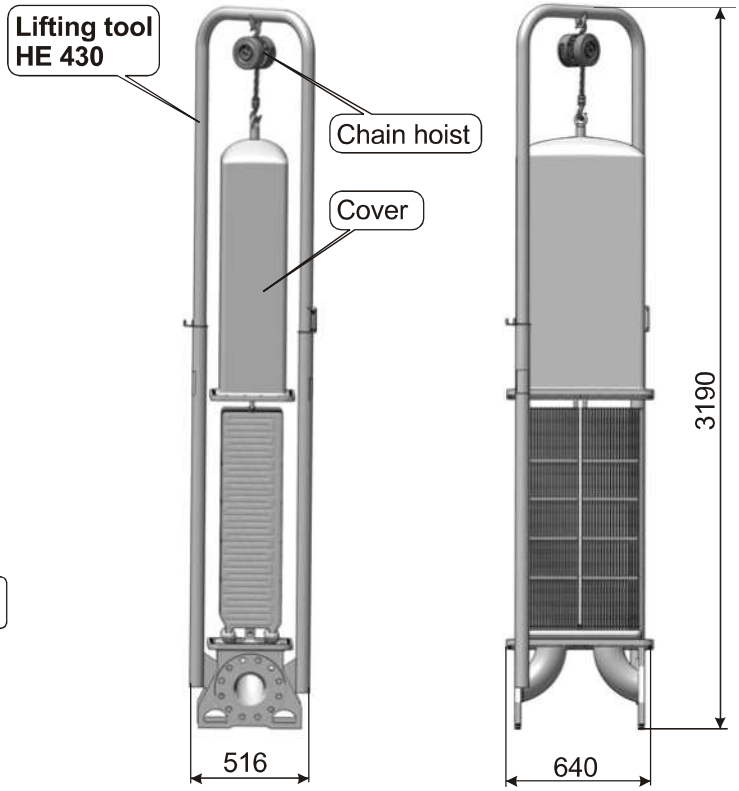


Fig. 6 HE430

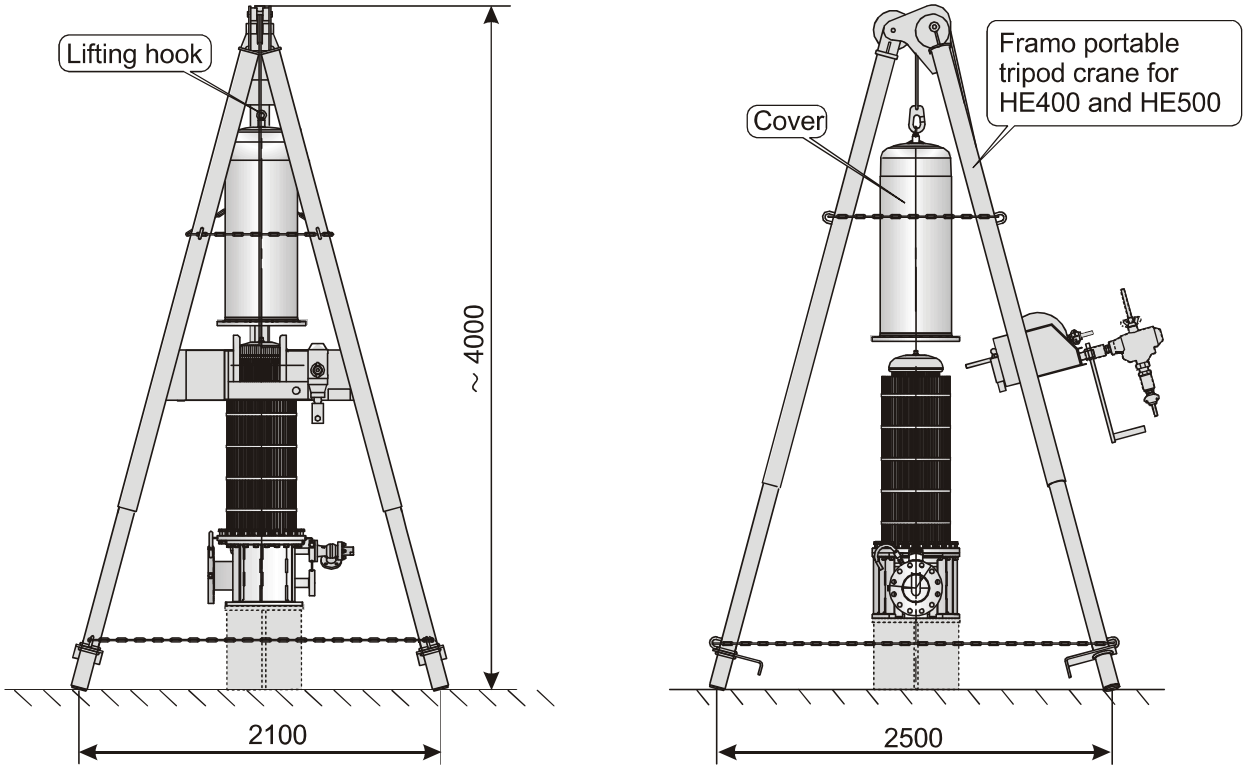


Fig. 7 HE400 /HE500

1.2 Fuel efficient cargo heating

Heat loss is basically proportional to the temperature difference between cargo and ambient air / sea. Permit temperature drop at beginning of the voyage. Then raise the temperature in due time prior to arrival at port / discharge. Cargo discharge temperature is given in Charter's Instruction. Without heating, the temperature drop will be 1-2 °C per day (24h).
Under certain conditions use of exhaust gas boiler is sufficient. Most heating systems are designed to raise temperature by 5-6 °C per day.

Note! *Never let the cargo temperature drop to a temperature that make it "unpumpable".*

The diagram below shows two different heating procedures. Cargo is received on board at 44 °C, delivered at 66 °C, sailing time 21 days.

Note! *For some cargoes sensitive to heating special heating procedure is required, see chapters 4 and 5.*

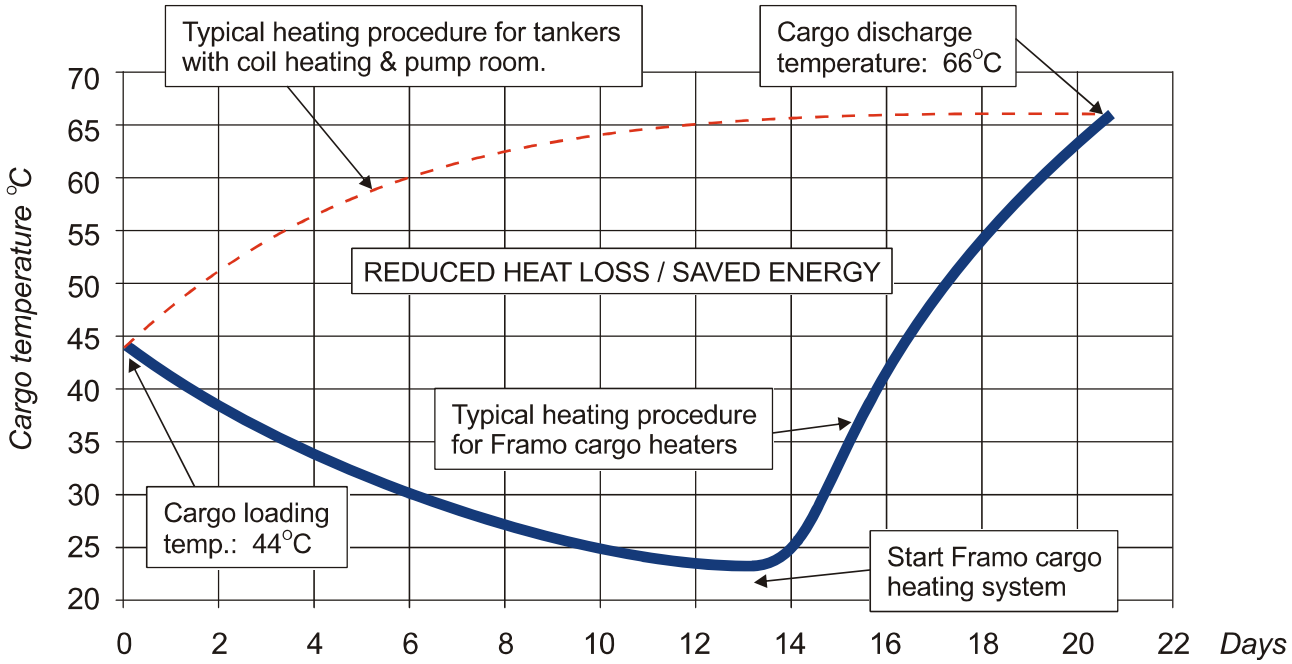


Fig. 8 Recommended heating procedure for tankers with Framo submerged cargo pumps.

2 OPERATING INSTRUCTION

2.1 Start-up and running

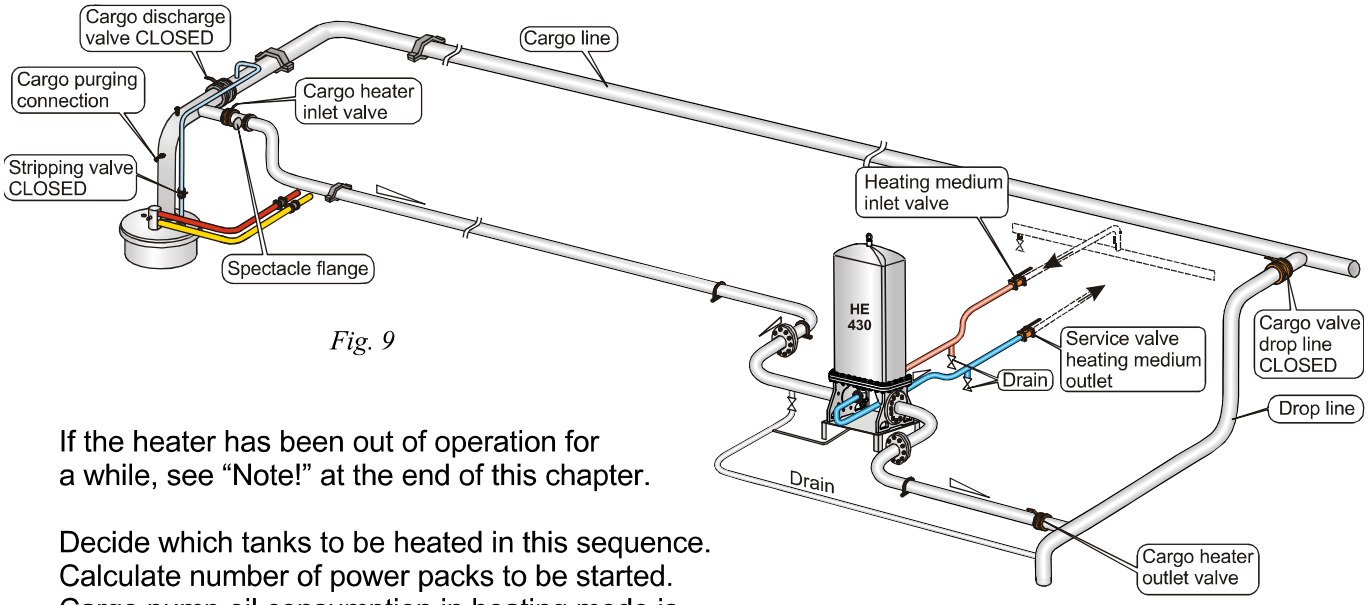


Fig. 9

If the heater has been out of operation for a while, see “Note!” at the end of this chapter.

Decide which tanks to be heated in this sequence. Calculate number of power packs to be started. Cargo pump oil consumption in heating mode is 50-70% of required hydraulic oil consumption in design point (see Technical data for the system).

Start required number of power packs. Set system pressure to minimum (approx. 70 bar).

Note!
It is essential to follow the steps below in sequence to avoid damage to the cargo and thermal shock loads to heater.

1. Ensure that the cargo discharge valves and stripping valves to the respective pumps are closed.
   Fully open the cargo heater outlet valves and cargo heater inlet valves.

2. Start the first pump and let it run with hydraulic motor pressure at approx. 50 bar for 1 minute.
   Move remote pump control handle to maximum position/local control valve closed.

3. Drain heating medium inlet pipe.

4. Start heating by slowly opening the heating medium inlet valve. Adjust the heating flow until suitable temperature increase (ΔT) across the cargo heater is achieved.
   An IR-thermometer supplied by Framo to be used for measuring the temperature increase across the heater (inlet/outlet pipe surface). Note that shiny metallic surfaces such as stainless steel may give wrong measurements. To compensate this, cover the surface to be measured with masking tape or flat black paint. Measure the temperature of the taped or painted surface.
   See Charterer's Instruction for max. cargo temperature

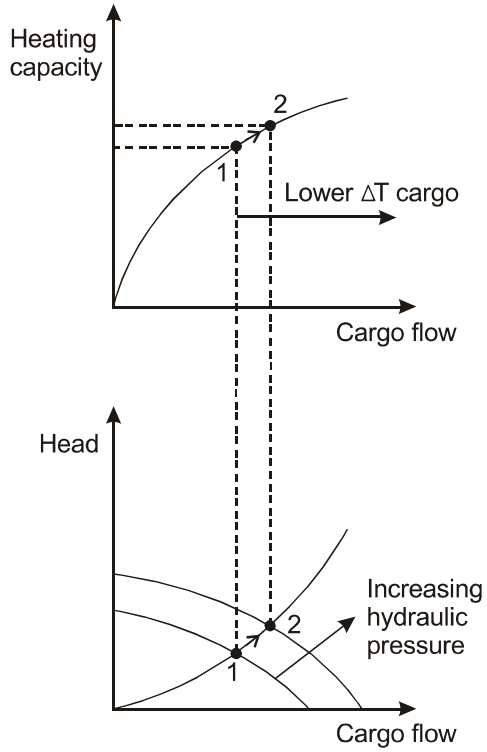


Fig. 10
By increasing the hydraulic pressure, the cargo flow and heating capacity will increase. This will result in lower temperature increase across the cargo heater.

5. Start the next pumps in this sequence, one by one, following the same procedure as described above.
6. Normally it is sufficient to run the pumps with hydraulic system pressure 100 bar.
   If cargoes with very high viscosity are handled, it is necessary to run the pumps at higher motor pressure. This is obtained by increasing the hydraulic system pressure. Start more power packs if necessary.
7. If shut down of the cargo pumps occurs, the heating must be stopped immediately by closing the heating medium inlet valve. If not, sensitive cargoes may be damaged.

Note! *If the heater has been out of operation for a while, corrosion in the heating medium branch pipes may occur. In order to avoid particles entering the heater, close heating medium outlet valve, open drain valve on heating medium inlet and open heating medium inlet valve and flush the line. Beware of steam on deck. Close heating medium inlet valve and drain valve. Open heating medium outlet valve.*

Note! *If other consumers as ballast pumps, deck machinery or tank cleaning pumps have to be started, we recommend stopping the cargo heating during this operation.*

Note! *A function test of the cargo heating system using water, will not give representative flow/pressure losses, nor heating performance. This is because the Framo cargo heater is designed for cargoes with higher viscosity than water.*

2.2 Stop and shut down

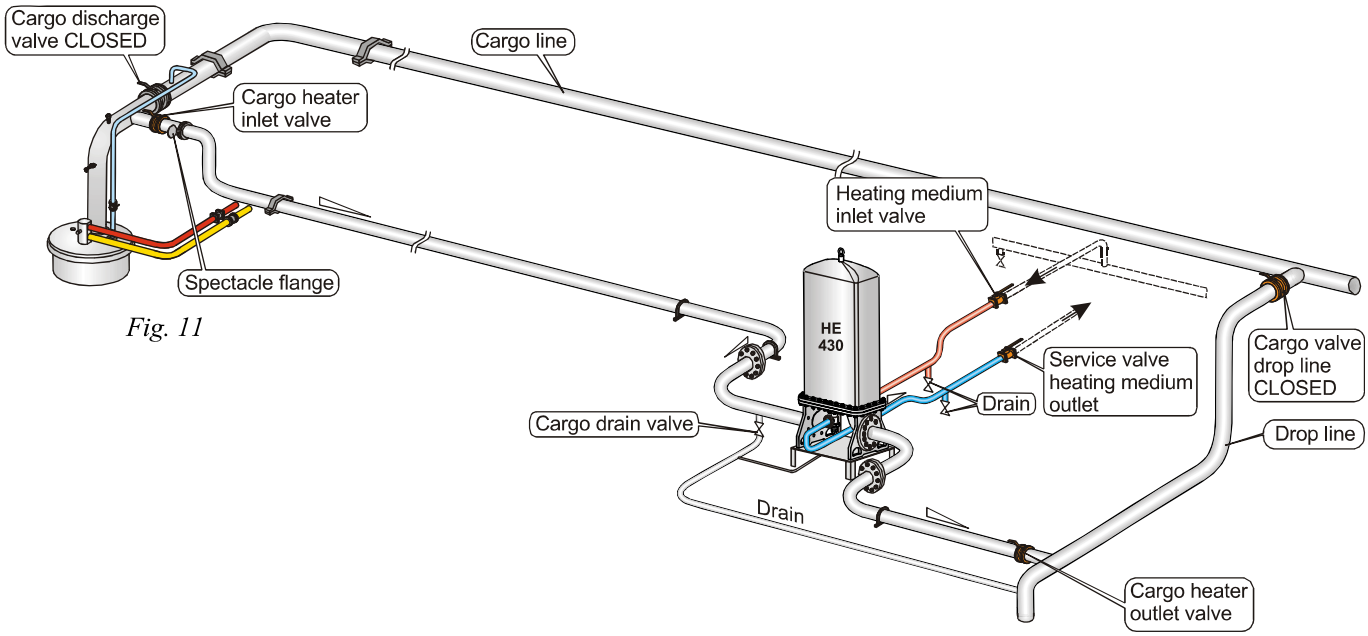


Fig. 11

1. When heating operation is completed, close the heating medium inlet valve.
2. Leave the cargo pump running for 10 minutes, in order to cool down the cargo heater.
3. Stop the respective pump from cargo control panel. (Set the remote pump control handle in minimum position.)
4. Drain the cargo heater and piping.
5. Close the cargo heater inlet and outlet valves.
6. Proceed with the above stop-procedure for the remaining tanks in this sequence.
7. Reduce the hydraulic system pressure to minimum.
8. Stop the power packs one by one.
9. Drain the heating medium side of the heater by opening both drain valves; on heating medium inlet and outlet (see fig. 11). Ensure that the heating medium inlet valve is not leaking before closing the drain valves.

<u>Arrangements with spectacle flange in the cargo heater line</u>

If the cargo heater is not to be used for a longer period of time, the heater to be isolated from the cargo line by setting the spectacle flange in closed position.

2.3 Cleaning procedure

For cleaning of stainless steel cargo heaters, fresh water is recommended.

Fresh water cleaning

1. Ensure that the heating medium inlet valve is closed and not leaking.
2. Clean the heater by circulating the fresh water/solvent being used for tank cleaning.

Sea water cleaning with fresh water flushing

Cleaning using sea water must be carried out according to qualified procedure:

1. Ensure that the heating medium inlet valve is closed and not leaking.
2. Pump through the heater continuously with seawater. Seawater shall be below 60°C.
3. Pump through the heater with cold seawater immediately after first cleaning to cool down surfaces. Drain thoroughly.
4. Finally flush thoroughly through the heater with fresh water to remove chlorides.

The nominal corrosion rate for stainless steel in sea water is low. However, under certain circumstances, local corrosion attack can take place and the corrosion rate might be severe. High chloride concentrations and low pH increase the probability of pitting and crevice corrosion as do high temperatures and stagnant solutions. A combination of chlorides from sea water on the internal surface of the cargo heater and a leaking steam valve will cause crevice/pitting corrosion.

Note! *Never use the cargo heater for heating sea water.*

Inspection after cleaning

To inspect the heater after cleaning, the cover can be lifted/removed. Use Framo lifting equipment, see page 7. Weights of heater components, see table on page 5.

3 TROUBLE SHOOTING

In case of low heating capacity, check the following:

1. Check that all cargo and heating medium valves are open.
2. Check that the actual cargo pump is running.
3. Check that the heating medium is available at the cargo heater at correct temperature.
4. Check that the heating surface is clean on the cargo side. Ref. cleaning procedure.

4 RECOMMENDED TEMPERATURES OF DIFFERENT CARGOES DURING VOYAGE

- Generally, for fuel efficient cargo heating the temperature of the cargo shall be kept as low as possible during voyage. Ref. chapter 1.2 "Fuel efficient cargo heating".
- However, some cargoes may require a different way of handling. (See chapter 5 - molasses).
- In due time before discharge, the cargo heating should start to obtain specified temperature of the cargo for discharge.
- Ensure that there is no “plug” of frozen cargo in the line.

5 HEATING OF MOLASSES

Molasses is defined as the end product of sugar production, from which no more sugar may be crystallized by conventional methods.

Exposure of molasses to high temperatures may cause crystallizing with blocked heaters as a result. Therefore, we recommend the highest precaution and attention to the heating operation and the guidelines given.

The pump capacity and discharge head can be found in the pump performance diagram. When handling cargoes with different viscosity and density the performance diagram have to be corrected for this according to instruction manual (1400-0030-4 and 1400-0032-4). Because of the huge variation in composition of the molasses, calculations of pump performance (capacity during circulation for cargo heating and/or discharge) may not be accurate.

The following procedure for cargo heating is based on general experience and can only be regarded as guidelines.

Charterer’s instructions are to be followed, if those are stricter than those given below.

1. The molasses must be kept at a temperature high enough to make it pumpable. Some molasses must be kept close to the discharge temperature during the entire voyage (35-38°C).

2. Maximum recommended temperature of the heating medium at inlet is 120 -140°C (Saturated steam at 2-3 bar). Alternative hot water may be used. With higher temperature the molasses may crystallize on the heating elements.

3. The temperature increase across the cargo heater should not exceed 10°C. This is important to avoid crystallizing and blocking of the heater, and must be carefully checked at regular intervals during heating.

If the temperature increase is too high, increase the cargo flow by adjusting the pump capacity until acceptable temperature increase is obtained. A high cargo flow will also ensure an even distribution throughout the entire cargo tank.

However, running the cargo pumps at too high speed increases the risk of crystallizing of molasses in the pump. For precautions to be taken when handling molasses and other special types of cargoes see the Cargo pumps Operation Manual.