1 Description

1.1 General Information

The fishing trawler is equipped with a cooling system for the fish processing on board.

The cooling system supplies the following consumers:

-1 pieces cargo hold
-6 pieces of Vertical Plate Freezer
-1 pieces of RSW-tanks
-1 pieces of glazing device

As the refrigerant ammonia (NH_3) is used.

Cooling cargo hold

The cooling cargo hold has a content of approx. 600 m³net and is designed for stowing of approx. 300 t packed fish. The entered fish into the cargo hold has to be cooled down from -20 °C to -30 °C.

Plate freezer, vertical design

The 6 pieces of vertical Plate freezers are appropriate for a total freezing capacity of approx. 20 t Kaspi Kilka. The 20 t fish will be cooled down from an entering temperature of + 4 °C to + 15 °C to a core temperature of appr. - 20°C in a time periode of appr. 14 hours. The Plate freezers operates with the refrigerant NH3. A refrigerant pump is continously circulating the refrigerant (at least 4: 1) through the individual plates of the plate freezers. The vertical freezing plates of the Plate freezer are loaded manuel with Kaspi Kilka. The heat exchange takes place directly between the fish and the evaporator plates. Thus a quick frosts takes place and therefore even blocks are provided. The blocks in the stations among themselves are divided by separation staffs. Unloading of the blocks take place from upward.
The blocks, as soon as they are freezed, raised by means of a duplex hydraulic unit (1 pump in operation, 1 pump to the reserve). The duplex hydraulik unit is piped to the 6 Plate freezers. The manual opening of the freezer plates as well as the immediately lifting and dropping of the hydraulic cylinders will be performed by a control lever, which is located on the valve block. Valve block including lever is attached at each freezer.

Date: 12.03.99

The Vertical Plate freezer is equipped with 20 stations, each station with 3 blocks. In contrast to the 4-block design an additional unloading auxiliary tool (hook, handle etc.) necessary for unloading the rear fourth block row is avoided for the 3-block design.
After hydraulic raising of the frozen blocks a stacking device at the operation side should be folded down in around °90 position. Taking the blocks is simplified by using this device.

Each freezer is equipped with a control panel, which is located near to the respective freezer. At the control panel the freezing procedure is switched on and off by means of push-buttons and signal lamps. In addition switching on and off of the hotgas-defrosting device will be illuminated with an add. yellow signal lamp. Fthe yellow lamp is shining, the unloading and loading procedure can be performed.
The duplex pump controlling and regulation as well as the starter devices of the pump motors are locatedated in the switchboard.

Cooling of RSW-tanks

The RSW-tank is able to store temporarily approx. 3 t fish. This equipment is installed in the fish processing area. The fish is precooled by sea water to a temperature of °+2,0 C in the RSW tank (approx. 6.0 m3). The seawater temperature is max. 30 °C. Sea water should be cooled down from appr. +30 °C to approx. +2 °C. The cooling takes place via a sea water cooler (shell and tube heat exchanger), which is piped on the refrigerant side to reciprocating compressor. The compressor unit and the sea water cooler are located in the refrigerant maschinery room area. An electronic temperature-control and the compressor capacity control guarantees that under all load conditions the sea water temperature remains constant appr. °approx. 2 C.

Glazing water precooling device

The glazing water device is installed in the processing area and is designed for a capacity of 400 to 500 l fresh water. The fresh water will be is cooled down from approx. °30 C imlet temperatur to approx. °1 C in 2 to 3 hours. After cooling down of the fresh water to approx. 1 °C approx. 80 to 100 l additional fresh water from a freshwater tank is likewise cooled down to approx. °1 C. The cooling takes place via a plate heat exchanger, which is piped on the refrigerant side to the reciprocating compressor as well.
The plate heat exchanger for the glazing water precooling device is located in the refrigerant maschinery room. A temperature-controlled capacity controll guarantees that with all load

conditions the fresh water temperature remains constant appr.
°approx. 1 °C.

2 Technical Data

Outside temperature	max. 40 °C
Sea water temperature	max. 30 °C
The refrigerant	NH3
On-board voltage	400 V/3ph/50 Hz
E-motors	IP 54
Electrical Capacity requirement for Cooling systems:	approx. 290 KW (engines for compressors Refrigerating medium pump, sea-cooling water pumps, fans, heaters)
sea water consumption:	2 x 67 m3/h
Cooling capacity for Plate freezers and cargo hold:	approx. 275 KW
Cooling capacity for RSW tank and glazing water device	approx.. 70 KW
Reserve compressor for Plate freezer	approx. 95 KW

2.1.1 Duplex-screw compressor units

Each duplex screw compressor unit consist of:

2.1.2 Screw compressor

Manufacturer	GRAM
Type	GST-41, NH3
Quantity	2
Cooling capacity	2 x 95 KW
Compressor speed	2,970 UPM
Electrical shaft power required	2 x 64 KW
E-Motor	2 x 75 KW
Condensing Temp.	+ 38C °
Evaporating Temp.	- 36C °

Capacity control for each compressor 100 - 25 steplessly

2.1.3 Electrical motor for screw compressors

Manufacturer	Leroy Sommer
Type	
Quantity	2
Rated output	75 KW
Speed	2,970 UPM
Design	IMB 3
Enclosure	IP 55
Insulating class	F

2.1.4 Turboflex coupling

Quantity	2
max. Quantity revolutions	3,000 UPM

2.1.5 Coupling guard

Manufacturer	GRAM
Quantity	2

2.1.6 Oil Separator

Manufacturer	GRAM
Type	GST / 2x80
Quantity	1
Theoretical replacement	820 m/h ^{3}

2.1.7 Oil Cooler

Manufacturer	GRAM
Type	WTÖ 2x43,6
Quantity	1
Capacity	86 KW
Oil consumption	4.2 m3/h
Oil inlet temperature	55.0 °C

2.1.8 Economizer

Manufacturer	GRAM
Type	ECO 2x26,91
Quantity	1
Eco capacity approx.	25 KW

2.1.9 Microprocessor control panel

On each duplex compressor unit is one microprocessor control panel installed for carrying out the temperature and compressor capacity regulation.
The compressor sequence of the compressor units will be selected by a sequence switch located in the switchboard door. The compressor sequential connection takes place via communication of electronics in the microprocessor control panels.

2.2 Horizontal pump arrangement including the refrigerant duplex Pump station

2.2.1 Refrigerant pumps

Design data

Manufacturer:	Hermetic
TYPE	CAM 2/4
Number:	2
Used as:	NH3 refrigerating medium pump
Replacement Q	11,5 m3/h
Speed n:	2,720 UPM
Electric capacity of the inserted electrical motor:	3,0 KW
Installation position:	HORIZONTAL
Suction connection:	DN 40
Pressure connection:	DN 32

2.2.2 Horizontal pump arrangement

Manufacturer	GRAM
Type	GST 190/2.150
Quantity of	1
Volume	2,150 l

Including all safety of stop valves as well as the control devices such as low pressure switches and level monitoring

2.2.3 Condenser

Manufacturer	Hopfgarten
Type	BXM 06 - SsSSS-25 B / 2f NH_3
Quantity	2
Condenser capacity	204 KW each
Seawater Inlet temp.	+ 30C °
Seawater Outlet temp.	+ 33,5C °
Condensing temperature	+ 38C °
Sea water flow	55 m3/h for each condenser
Pressure loss water-side	0.2 bar

Date: 12.03.99

2.2.4 Receiver

Manufacturer	GRAM
Type	GST / 2.2150
Quantity	1

2.2.5 Vertical plate freezer

Manufacturer	GRAM
Type	KVB-M-20/63, NH3
Quantity of stations	20
Quantity of blocks for each station	3
Block dimensions	790 x 240 x 63
Capacity for each charge	600 kg (60 blocks ever 10 kg)
Capacity per hour	320 kg/h
Fish inlet temperature	+ 4 bis + 15 °C
Fish core temperature	- 20 °C
Charge time	120 min (10 min loading, 90 min frosts, 20 min unloading)
Quantity plate Froster	6
Total output of the 6 Plate freezer	**20 t in 14 h**
Max. quantity of charges in 14 h	36
Quantity blocks in 14 h per day	20 stations x 3 blocks x 36 charges = **2160 blocks**
Theoretical capacity of the 6 Froster in 14 h	2,160 blocks x 10 kg/block = **21,6 t**

2.2.6 Duplex hydraulic unit

Manufacturer	GRAM
Type test specification	100-PVQ10-C6-3.0/PVQ10-C6-3.0-13-Z
Quantity	1
Tank size	100 l
Tank type	PV 100
2 pieces pressure-compensated reciprocating pumps (1x enterprise, 1 x reserve)	
Type:	PVQ10-A2R-SE1S-10-C21-11-SW2-SW1-6
2 pieces of e-engines type	QU 100L4B-V1/B5
Capacity electrical motor	3.0 KW
Speed	1,450 UPM
Discharge pressure	145 bar of factory setting
Pump capacity	9 ltr/min
Drive	Coupling type IEC 112

Date: 12.03.99