SABROE

DELIVERY SPECIFICATION NO 196.675 OF SABROE EQUIPMENT FOR REFRIGERATING PLANT FOR RSW PROCESSING TANKS FOR TRAWLER

ONE REFRIGERATING PLANT in automatic execution, intended for direct expansion by gravity circulation of R22 and for electric motor operation at 440 volts, 3-phase, 60 cycles a.c. power supply.

During navigation in waters with a sea water temperature of 20°C the plant will be capable of:

- Chilling approx 37 tons of sea water from 20°C to 0°C per hour (cooling down in one step)

or:

During navigation in waters with a sea water temperature of 32°C the plant will be capable of:

- Chilling approx 23 tons of sea water from 32°C to 0°C per hour (cooling down in one step).

Our delivery comprises:

Item 1

ONE SCREW COMPRESSOR UNIT, comprising:

1 R22 Screw Compressor type SAB 163 H-F, with a "swept volume" of 1150 m^3/h, and with two helically cut rotors of SG-iron, mounted in a housing of special cast iron.

The screw compressor is equipped with oil injection to reduce the gap losses and sound level. This oil injection also ensures a certain cooling of the freon gas.

The screw compressor block is designed for direct coupling to electric motor and will be *mounted in a factory-assembled unit*, complete with the following equipment:

Compressor Block: 163H, female drive with manual V_i control
- Asymmetric 4+6 SRM rotor profile
- Cylindrical roller bearings for radial load
- Four-point ball bearings for axial load
- Mechanical shaft seal of metal-bellow type
- Free shaft end for female drive
- Mechanical capacity slide position indicator
- Built-in suction gas filter with 50 micron wire mesh, removable for cleaning
- Slide stop for manual adjustment of the internal volume ratio
- Built-in non-return valve on the suction side of the compressor
- Built-in oil filter with magnet column and disposable high-efficiency element
- Built-in oil flow switch
- Oil borings connected with internal piping
- Oil distribution pipes to all compressor lubrication connections
- Compressor tested with air in testrig at Sabroe
- Connection for economizer and liquid injection (HLI) - blanked off

Basic Unit SAB-163H, R22, including valves (stop, service)
- Support for compressor
- Support for motor
- Flexible coupling for motor
- Coupling guard
- Stop valve with welding flange for the suction side of the unit, mounted on the compressor
- Stop valve with welding flange on the discharge side of the unit, mounted on the oil separator
- Discharge pipe connecting compressor and oil separator
- Safety valve connected to the suction side of the compressor, back pressure compensator
- Valve system with 2 solenoid valves for capacity regulation, and valves for adjustment of the slide speed
- Piping system for oil return from the oil separator to the compressor including sight glass and regulating valve
- Oil pump for prelubrication, lubrication at low differential pressure and oil charging including electrical motor, 1.8 kW
- Horizontal oil separator which serves as base for compressor and motor, with oil separating system including oil separating element, securing that the oil residual is between 5 ppm and 30 ppm corresponding with 1-4 litres/100 hours.
  The figures mentioned in litres/100 hours are with female drive compressor equipped with sight glasses and immersion heater, service valves on the unit ie evacuation valve, oil drain valve on oil reservoir, oil drain valve on oil and refrigerant side on oil coolers OOSI and OWSG, when the unit comprises oil coolers
- Complete mounting of the above-mentioned components and customer-supplied compressor motor painted with one coat of primer and one coat of high industrial enamel according to DS/R454 corrosion class 1.

Separate Equipment:
- One non-return valve to be placed in high position to prevent condensed liquid in oil separator during stand-by period.

Monitoring, Safety and Control Equipment:
Single-UNISAB II Evolution Cabinet with emergency stop mounted on the unit including control wiring
- LCD display with back light and 4 lines each of 20 characters for indication of 3 operating values and compressor status simultaneously
  Separate keys for start/stop, manual/auto selection, alarm reset and load/unload
  Arrow keys for selecting menus and changing settings
- Indication of:
  - Suction pressure (Bar or °C)
  - Discharge pressure (Bar or °C)
  - Differential pressure
  - Superheat
  - Discharge temperature
  - Oil temperature
  - Capacity slide position
  - Motor current
  - Hours in operation
- Safety cut-out and prewarning function for high discharge pressure, low suction pressure, differential pressure, high and low oil temperature, high dis- charge gas temperature, high and low superheat

- The following functions are included:
  - Suction pressure regulator
  - Brine temperature regulator
  - Input 4-20 mA for external control of compressor
  - Control loop for manual capacity slide position lock
  - Automatic V_i control
  - Suction and discharge pressure limiter
  - Motor current limiter
  - High/low suction pressure or brine temperature setpoint externally operated
  - High/low current limiter setpoint externally operated
  - Energy optimizing parallelly operating system for 2-14 compressors
  - Thermistor input for compressor motor protection
  - Emergency stop
  - Separate relay output for common alarm
  - Separate relay for common warning
  - Pressure and temperature sensor system mounted and wired on the unit comprising:
    - One low pressure and three high pressure transducers
    - Three temperature sensors
    - Electrical slide position sensor
  - Oil pump control included. (No wiring to oil pump motor)

Oil Cooling System:

- Refrigerant cooled oil cooler of shell-and-tube design type OOSI 2714 with brackets mounted on the unit
- Connections to refrigerant pipes with welding connections.

NOTE: The oil cooler is supplied with double safety valve including double stop valve mounted.

- Oil temperature regulation system including a two-way main valve controlled by a thermostatic pilot valve, with fittings mounted on the unit

Capacity and Power Consumption for the compressor will be as follows at the below temperatures:

20°C Sea Water:

Condensing Temp. °C	Sat. Suction Pressure °C	Capacity kcal/h	Power Consumption kW
27.9	-4	812,100	174

32°C Sea Water:

Condensing Temp. °C	Sat. Suction Pressure °C	Capacity kcal/h	Power Consumption kW
39.5	-4	717,200	221

The above condensing temperatures are based on a fouling factor of 0.0002 m^2 K/W.

1 ELECTRIC MOTOR, 300 kW, to be delivered by the yard and mounted by Sabroe.

Item 2

1 R22 CONDENSER of horizontal shell-and-tube type - marine type CONC - for sea water, complete with connections for refrigerant inlet and outlet and flanges for sea water inlet and outlet.

The tubes through which the cooling water circulates, are low-finned metal tubes, alloy 90/10 Cu/Ni, expanded into steel tube plates with explosion-compounded water resistant surfaces, also of 90/10 Cu/Ni.

The outer shell is of steel plate, and the end covers - easily removable for cleaning of the tubes - are of coated cast iron.

The condenser is provided with corrosion plugs, and with separately delivered pressure equalizing valve, safety valve and air relief valve.

Necessary quantity of cooling water for each condenser: 250 m^3/h.

Approx. pressure drop for the cooling water flow through the condenser: 6.4 m w.g.

Item 3

1 AUTOMATIC SEAWATER VALVE of motor type for regulation of the cooling water flow through the condenser, for maintaining minimum condensing pressure.

Item 4

1 R22 PILOT RECEIVER of vertical marine type, made of steel, complete with necessary connections for R22 inlet and outlet, liquid sight glass and with separately delivered pressure equalizing valve and air purge valve.

The pilot receiver has a volume of 65 litres.

Item 5

1 R22 DRIER consisting of drier with replaceable insert, and separately delivered stop valves, charging valve and liquid indicator for the liquid line.

Item 6

1 R22 LIQUID SEPARATOR of vertical marine type, made of steel, complete with necessary connections for R22 inlet and outlet, and with separately delivered equipment for automatic regulation of the R22 supply to the liquid separator.

The separator has a volume of approx 1900 litres.

Item 7

1 LIQUID LEVEL GLASS for separator/chiller.

Item 8

1 OIL RECTIFIER for automatic oil return to the compressor.

Item 9

1 SEA WATER CHILLER, intended for gravity circulation of R22.

The chiller is of compact shell-and-tube type RSWR, with tubes of special sea water resistant high alloy stainless steel, arranged in tube plates and shell, also of stainless steel.

After installation on board, the chiller must have a slope of min. 15° (no matter whether the ship is loaded or not).

The refrigerant circulates/evaporates inside the tubes, and the sea water circulates outside and across the cold tubes.

Refrigerated sea water circulation through the chiller at 32°C: flow approx 23 m^3/h.
Refrigerated sea water circulation through the chiller at 16°C: flow approx 46 m^3/h.

Approx pressure drop of the water flow through the chiller: 10 m w.g.

Please Note: Max sea water temperature inside the chiller is 45°C, this means that if the compressor is stopped for a couple of weeks, the cooler must be emptied of water if there is a risk of temperatures over 45°C.

Item 10

1 AUTOMATIC SEAWATER VALVE of motor type for regulation of the process water.

Item 11

- NECESSARY VALVES AND AUTOMATICS for the R22 for the plant, comprising stop valves, hand regulating valves, safety valves, double safety valves, solenoid valves, thermostats etc., to ensure correct operation of the plant, and for safety purposes.

Item 12

- PIPES AND FITTINGS for the R22 between the compressor unit, condenser, pilot receiver, drier, liquid separator, oil rectifier, liquid level glass and seawater chiller.

The pipes are delivered in straight lengths with necessary fittings. The pipes and fittings will be delivered in non-galvanized execution.

Item 13

- COMPLETE FIRST CHARGE of the plant with compressor oil.

Item 14

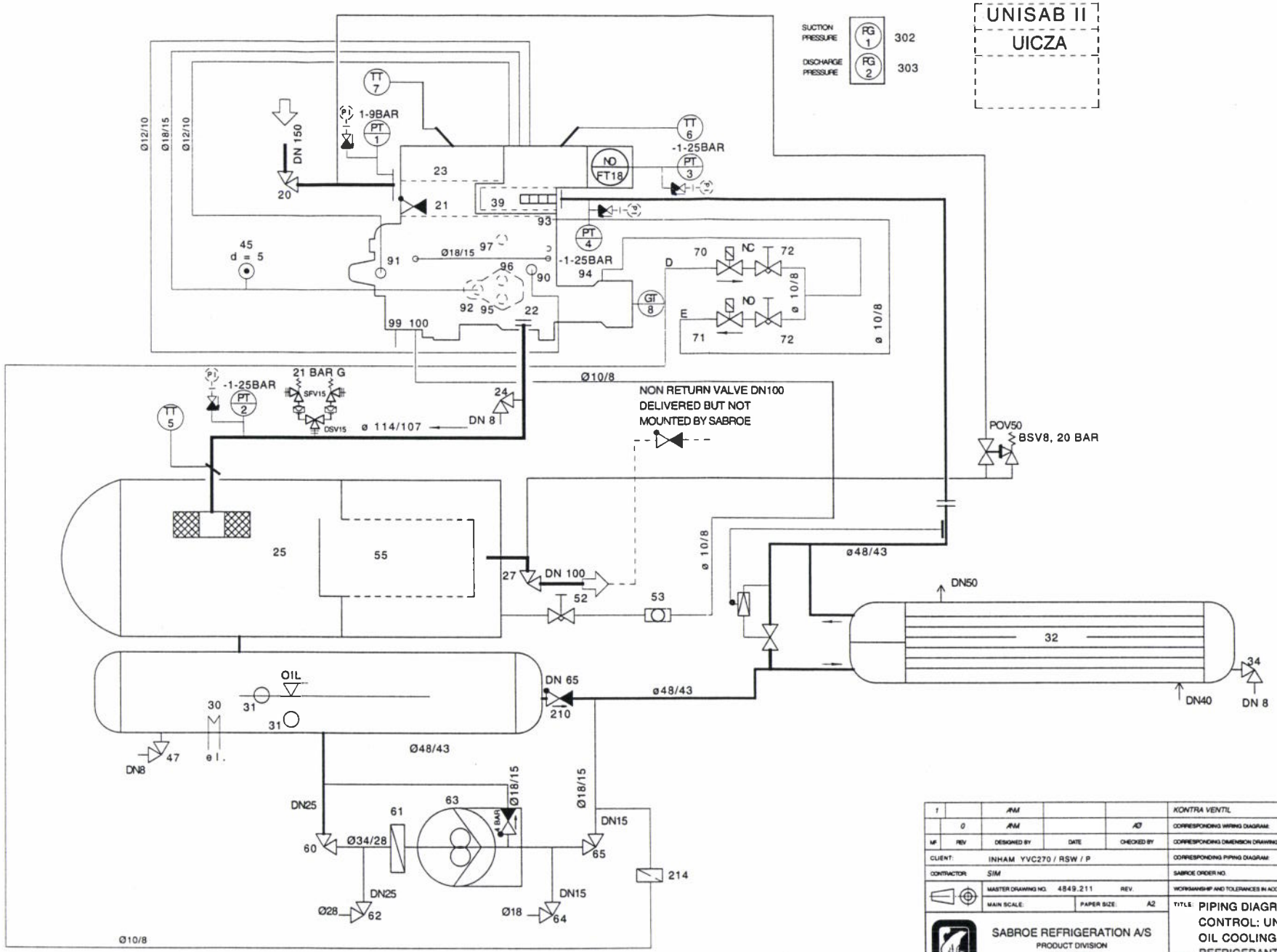
1 SWITCHBOARD, in sheet steel execution, ready-mounted with:

- motor starter (star-delta) with no-voltage relay and 3-phase thermal overcurrent relay with single-phase protection for compressor motor

VIEW 0 1

GRAPHICAL SYMBOLS ACC. TO DIN 28004 AND ISO 3511

UNISAB II
UICZA



1		AHM			KONTRA VENTIL
	0	AHM		AØ	CORRESPONDING WIRING DIAGRAM: REV.
MF	REV	DESIGNED BY	DATE	CHECKED BY	CORRESPONDING DIMENSION DRAWING: REV.
CLIENT:		INHAM YVC270 / RSW / P			CORRESPONDING PIPING DIAGRAM: REV.
CONTRACTOR:		SIM			SABROE ORDER NO. 10440 / 545774.0501
		MASTER DRAWING NO. 4849.211 REV.			WORKMANSHIP AND TOLERANCES IN ACCORDANCE WITH SABROE MANUFACTURING STANDARD
		MAIN SCALE:	PAPER SIZE: A2		

SABROE REFRIGERATION A/S
PRODUCT DIVISION
AARHUS, DENMARK

TITLE: PIPING DIAGRAM SAB 163H
CONTROL: UNISAB II
OIL COOLING: OOSI 21142A
REFRIGERANT: R22

NO. 300493 REV 1 SHEET NO. 1/1

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ON 25/03/97 AT 13:44
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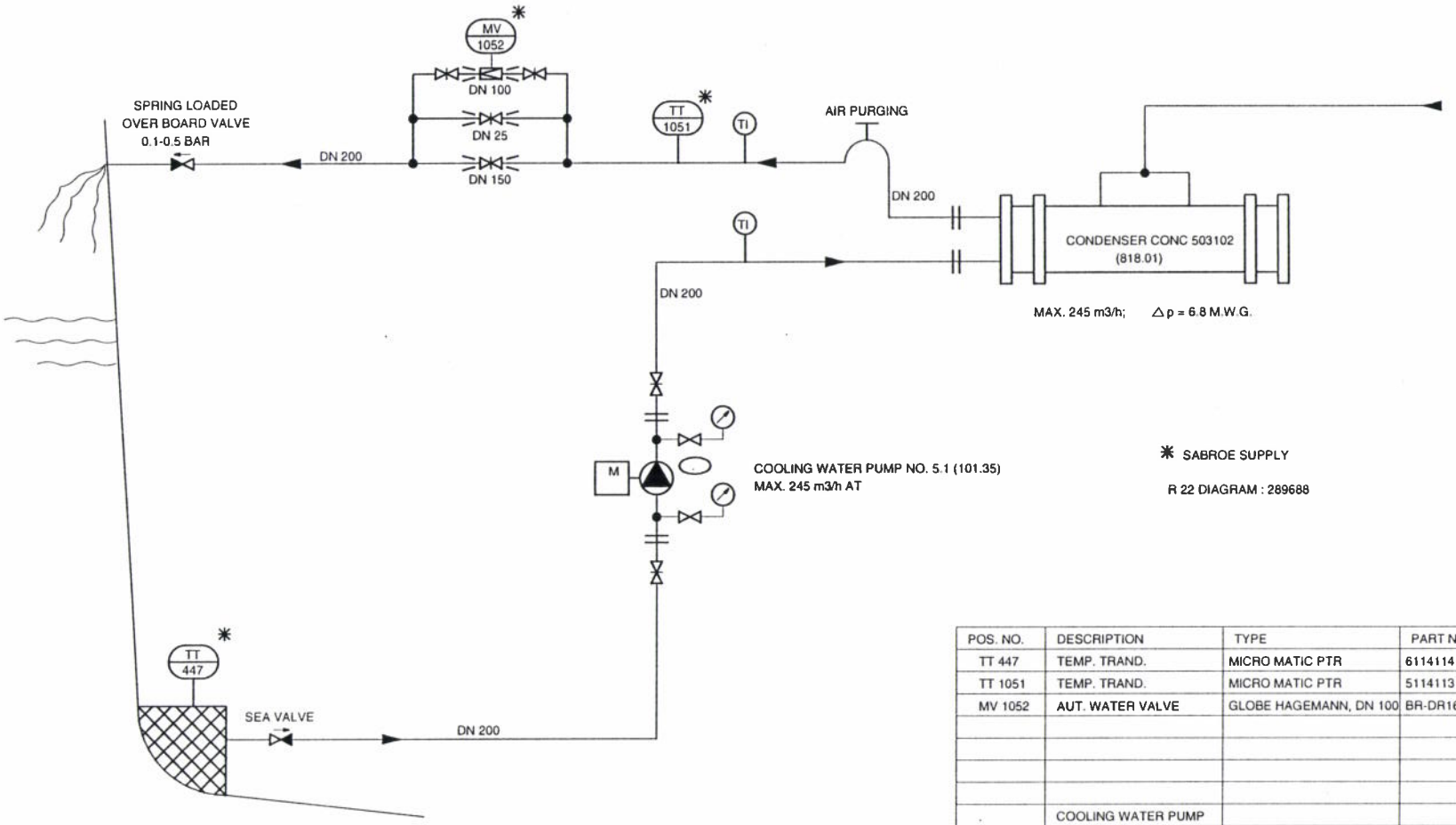

✳ SABROE SUPPLY

R 22 DIAGRAM : 289688

POS. NO.	DESCRIPTION	TYPE	PART NO.	REMARKS
TT 447	TEMP. TRAND.	MICRO MATIC PTR	61141141	COMMON SEA WATER INLET
TT 1051	TEMP. TRAND.	MICRO MATIC PTR	51141131	DIN 1/3 B
MV 1052	AUT. WATER VALVE	GLOBE HAGEMANN, DN 100	BR-DR16-EVS-100-M150	
.	COOLING WATER PUMP			245 M3/H AT 15 M.W.G.
M	ELECTRIC MOTOR	-		-

DESIGNED BY: HHT | DRAWN BY: HMK
MAIN SCALE: - | DATE:
ORG. SIZE: A3 | ORD.NO.: -

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REF. NAME: YSSELWERF YARD NO. 270

TITLE: PROPOSAL FOR
COOLING WATER DIAGRAM.
RSW/P-PLANT.

DRAW. NO.: 304086 | REV.: 2 | SHEET NO.: 1/1

PRODUCED BY HMK PL
ON 20 / 11 / 97 AT 08 : 59

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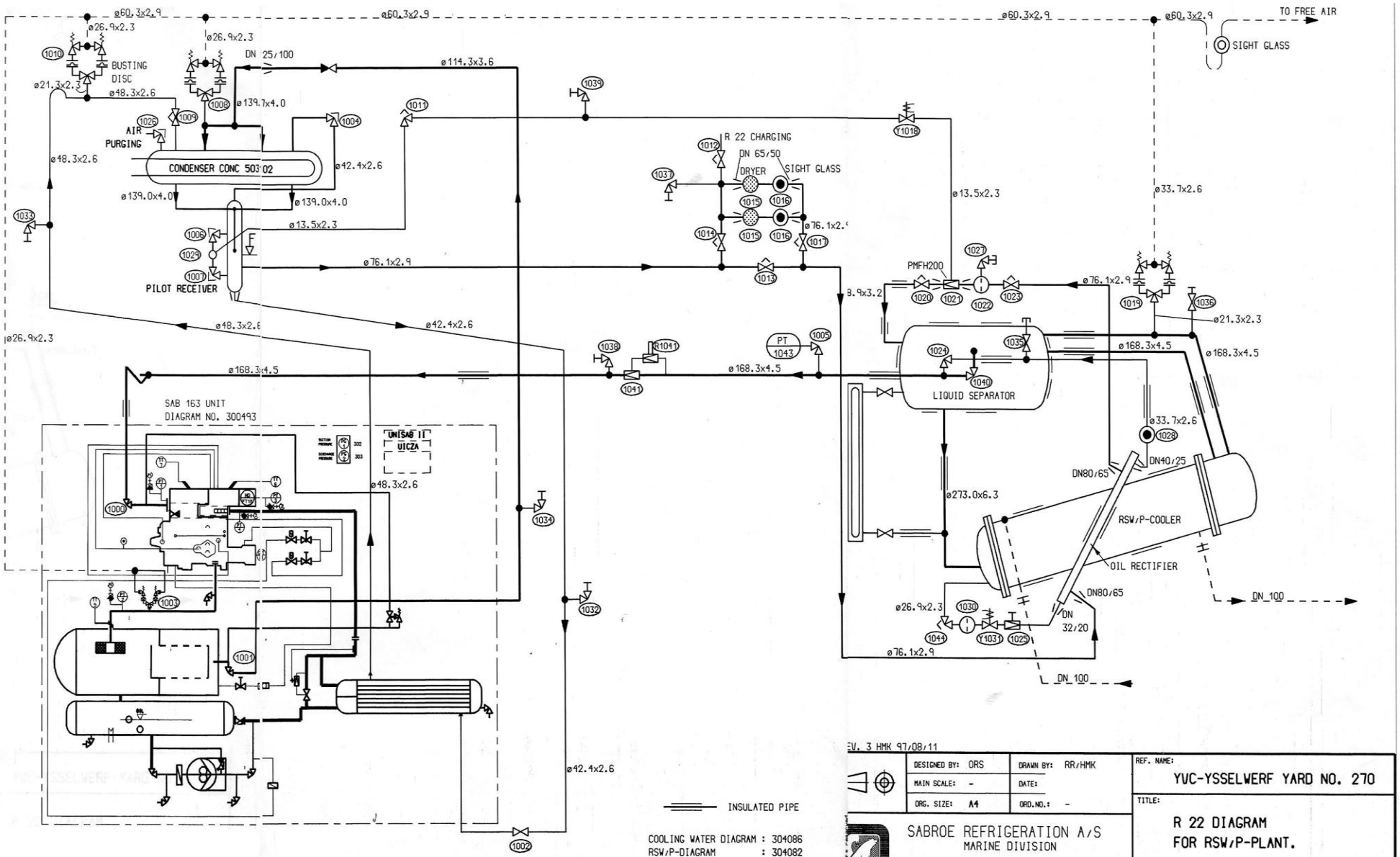
PLOTTED AT SCALE 1/1



REV. 3 HMK 97/08/11

DESIGNED BY: ORS	DRAWN BY: RR/HMK	REF. NAME: YVC-YSSELWERF YARD NO. 270	
MAIN SCALE: -	DATE:		
ORG. SIZE: A4	ORD.NO.: -	TITLE: R 22 DIAGRAM FOR RSW/P-PLANT.	

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TELETEX: 362288, TELEX: 65580

DRAW. NO.: 289688 | REV.: 3 | SHEET NO.: 1/1

POS. NO.	DESCRIPTION	TYPE	PART NO.	REMARKS
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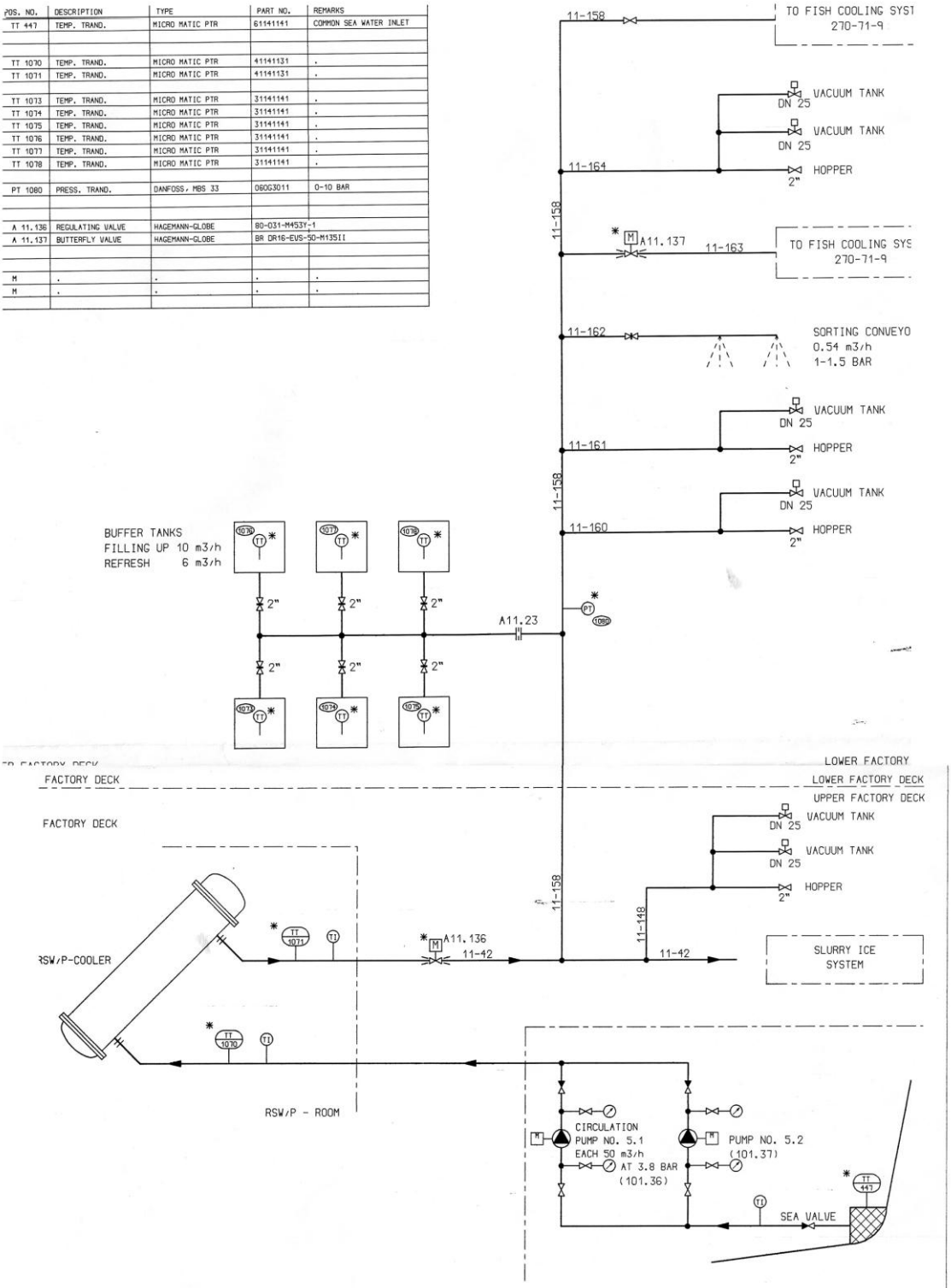
TT 1071	TEMP. TRAND.	MICRO MATIC PTR	41141131	.
TT 1073	TEMP. TRAND.	MICRO MATIC PTR	31141141	.
TT 1074	TEMP. TRAND.	MICRO MATIC PTR	31141141	.
TT 1075	TEMP. TRAND.	MICRO MATIC PTR	31141141	.
TT 1076	TEMP. TRAND.	MICRO MATIC PTR	31141141	.
TT 1077	TEMP. TRAND.	MICRO MATIC PTR	31141141	.
TT 1078	TEMP. TRAND.	MICRO MATIC PTR	31141141	.
PT 1080	PRESS. TRAND.	DANFOSS, MBS 33	060G3011	0-10 BAR
A 11.136	REGULATING VALVE	HAGEMANN-GLOBE	80-031-M453Y-1	
A 11.137	BUTTERFLY VALVE	HAGEMANN-GLOBE	BR DR16-EVS-50-M1351I	
M	.	.	.	.
M	.	.	.	.



* SABROE SUPPLY

	DESIGNED BY: HHT	DRAWN BY: HMK	REF. NAME: YVC-YSSELWERF YARD NO. 270
	MAIN SCALE: -	DATE:	
	ORG. SIZE: A2	ORG.NO.: -	TITLE: PROPOSAL FOR RSW/P DIAGRAM.

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TELETEX: 362288, TELEX: 65580

DRAW. NO.: 304082 | REV.: 4 | SHEET NO.: 1/1

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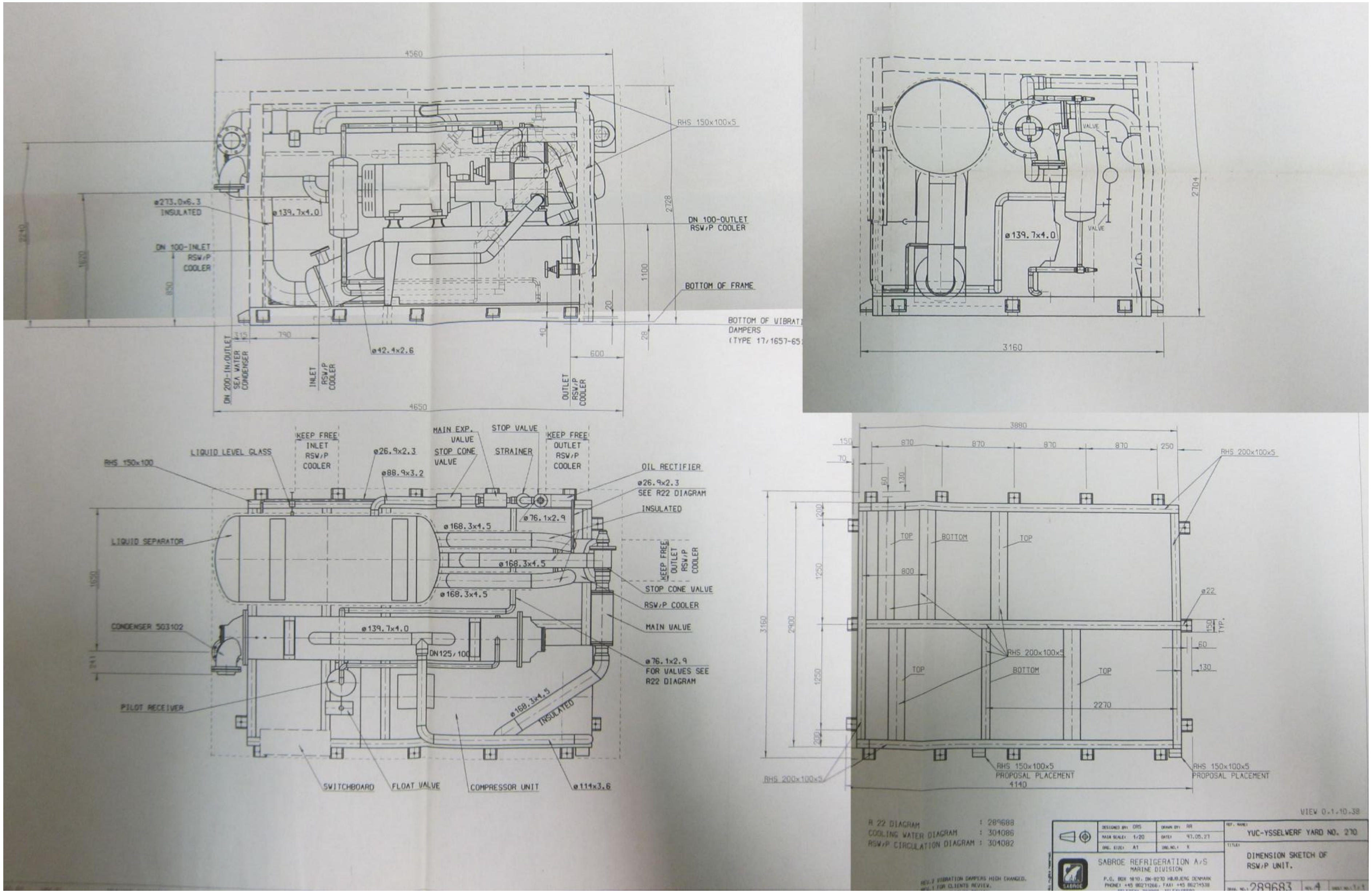

4560
RHS 150x100x5
ø273.0x6.3
INSULATED
ø139.7x4.0
DN 100-INLET
RSW/P
COOLER
DN 100-OUTLET
RSW/P COOLER
BOTTOM OF FRAME
BOTTOM OF VIBRATI
DAMPERS
(TYPE 17/1657-65)
ø42.4x2.6
DN 200-IN/OUTLET
SEA WATER
CONDENSER
INLET
RSW/P
COOLER
OUTLET
RSW/P
COOLER
4650
3160
VALUE
ø139.7x4.0
RHS 150x100
LIQUID LEVEL GLASS
KEEP FREE
INLET
RSW/P
COOLER
ø26.9x2.3
ø88.9x3.2
MAIN EXP.
VALUE
STOP CONE
VALUE
STOP VALUE
STRAINER
KEEP FREE
OUTLET
RSW/P
COOLER
OIL RECTIFIER
ø26.9x2.3
SEE R22 DIAGRAM
INSULATED
LIQUID SEPARATOR
ø168.3x4.5
ø76.1x2.9
KEEP FREE
OUTLET
RSW/P
COOLER
STOP CONE VALUE
RSW/P COOLER
MAIN VALUE
CONDENSER 503102
ø139.7x4.0
DN125/100
ø76.1x2.9
FOR VALUES SEE
R22 DIAGRAM
PILOT RECEIVER
ø168.3x4.5
INSULATED
SWITCHBOARD
FLOAT VALVE
COMPRESSOR UNIT
ø114x3.6
3880
RHS 200x100x5
TOP
BOTTOM
ø22
TYP.
2270
RHS 150x100x5
PROPOSAL PLACEMENT
4140
RHS 200x100x5
VIEW 0.1.10.38
R 22 DIAGRAM : 289688
COOLING WATER DIAGRAM : 304086
RSW/P CIRCULATION DIAGRAM : 304082
REV.2 VIBRATION DAMPERS HIGH CHANGED.
REV.1 FOR CLIENTS REVIEW.
DESIGNED BY: ORS
DRAWN BY: RR
MAIN SCALE: 1/20
DATE: 97.05.27
DWG. SIZE: A1
DWG. NO.: X
SABROE REFRIGERATION A/S
MARINE DIVISION
P.O. BOX 1810, DK-8270 HØJBJERG DENMARK
PHONE: +45 86271266, FAX: +45 86271538
REF. NAME: YVC-YSSELWERF YARD NO. 270
TITLE: DIMENSION SKETCH OF
RSW/P UNIT.
DRAW. NO.: 289683
REV. 4