

COOL DOWN THE GLOBAL WARMING

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PRODUCT CATALOGUE



TEKNOTHERM

MARINE

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MARINE

CARE FOR THE ENVIRONMENT - knowledge and responsibility

TEKNOTHERM has for years been focusing on environmentally friendly installations. Meeting international- and national regulations and standards, as well as the classification societies requirements for environmental notations.

- ◆ Correct system design
- ◆ Correct refrigerant medium
- ◆ Minimum refrigerant charge
- ◆ Optimized C.O.P
- ◆ Zero ozone depletion refrigerant
- ◆ Low GWP refrigerants
- ◆ Natural refrigerants
- ◆ Free cooling arrangement
- ◆ Heat recovery arrangement
- ◆ Questioning extreme design criteria

Let TEKNOTHERM be your experienced adviser

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AIR-CONDITIONING

Our range of refrigerating units will cover every need for refrigeration onboard a modern vessel. Tailor made to fulfil all requirements from shipyards, ship-owners, classification and national authorities.



Our refrigeration machineries are constructed for marine applications. Components and materials are chosen on the basis of our long experience in the marine refrigeration business.

Emphasis is put on small dimensions, low weight and easy maintenance as well as site installation friendly solutions.

The refrigeration plants can be delivered either as direct expansion systems or as chilling-water plants for indirect cooling. Depending on your specific demands or required capacity, our plants can be delivered with compressors for reciprocating- or screw type systems, or as multi compressor units fitted with several compressors and different degree of prefabrication, for instance so-called "Deck-units".

Whatever the requirements, TEKNOTHERM will provide an optimal designed plant that meets your demands.

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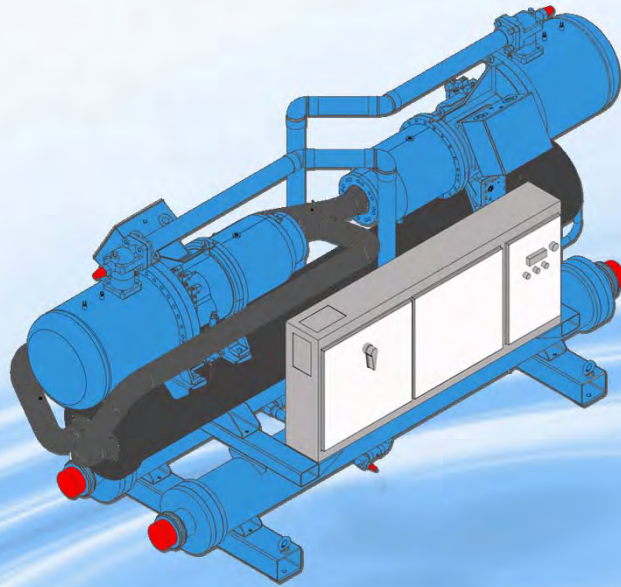
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MWC - Marine Water Chiller Twin- and single compressor serie

**MWC – Marine Water Chiller is specially designed HVAC-chillers
for all kind of merchant ships.
The unit is designed for future environmental expectations.**

-  **Wide capacity range from 180 kW to 1376 kW**
-  **Twin- and single compressor arrangement**
-  **Compact type screw compressor with capacity regulation**
-  **Dry expansion shell & tube evaporator**
-  **Fresh- or seawater cooled shell & tube condenser**
-  **Factory assembled packages including
internal piping and electric cabling**
-  **Low refrigerant charge**
-  **Refrigerant R-134a**
-  **Motorstarter of direct- or star-delta type**
-  **Meet environmental class requirement**

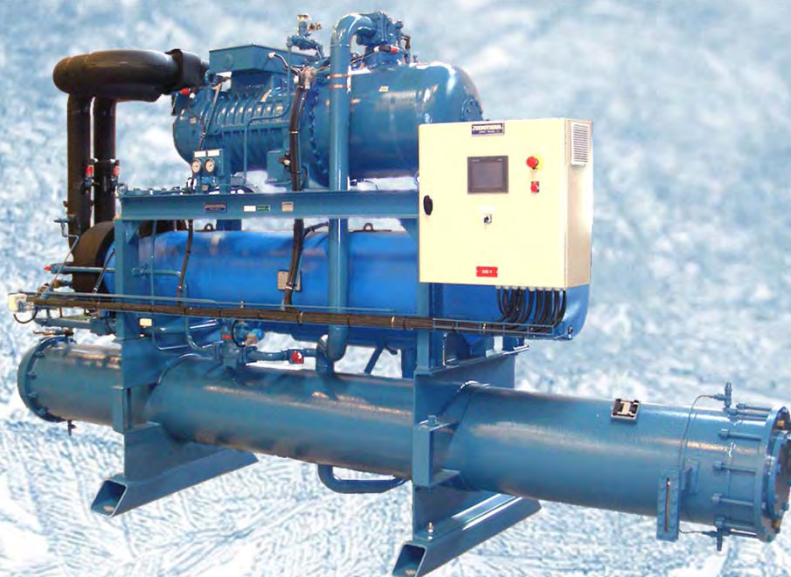
MWC-C-520-T-E	2	520	3500	2500	1500
MWC-C-660-T-E	2	660	3500	2500	1500
MWC-C-760-T-E	2	760	3500	2500	1500
MWC-C-800-T-E	2	880	3500	2700	1500
MWC-C-1010-T-E	2	1010	3500	2700	1700
MWC-C-1140-T-E	2	1140	4100	2700	1700
MWC-C-1280-T-E	2	1280	4100	2700	1700
MWC-C-1380-T-E	2	1370	4100	2700	1700






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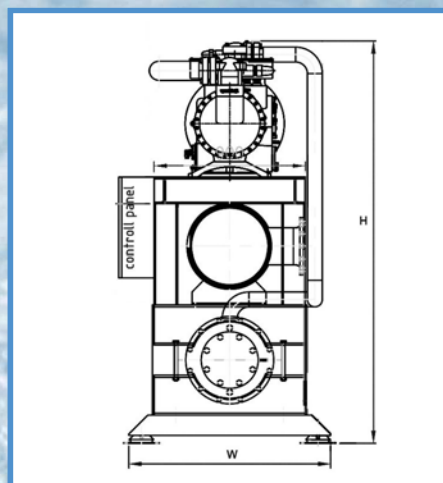
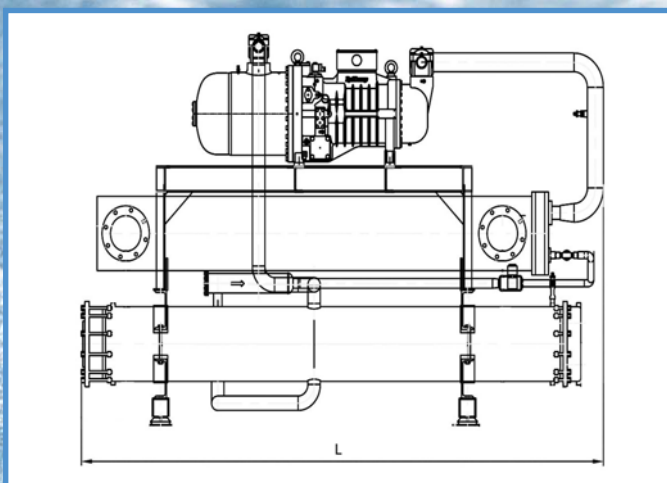
MWC - Marine Water Chiller Single compressor serie

MWC - Marine Water Chiller is specially designed HVAC-chillers for passenger ferries, small cruise ships, and oil- and offshore vessels.

- ◆ Wide capacity range from 140 kW to 1050 kW
- ◆ Single compressor arrangement
- ◆ Compact type screw compressor with capacity regulation
- ◆ Dry expansion shell & tube evaporator
- ◆ Fresh- or seawater cooled shell & tube condenser
- ◆ Factory assembled packages including internal piping and electric cabling
- ◆ Low refrigerant charge
- ◆ Refrigerant R-407c (R-134a as option)
- ◆  **TEKNO-TRONIC**® touch-screen monitoring and control
- ◆ Motorstarter of direct- or star-delta type (for separate installation)
- ◆ Custom-built to meet all major classification societies
- ◆ Meet environmental class requirement

MWC – Marine Water Chiller

Single compressor serie



Model	kW		m ³ /h		Overall dimensions in mm		
	Refr. Capacity	Power consumpt.	Chilled Water flow	Condenser Water flow	Length	Height	Width
MWC 140 S	140	57	21	47	3200	1700	1100
MWC 160 S	160	67	24	47	3700	1700	1100
MWC 180 S	180	76	27	68	3200	1800	1200
MWC 225 S	225	92	33	68	3200	1800	1200
MWC 245 S	245	102	36	68	3700	1800	1200
MWC 270 S	270	111	41	87	3200	1800	1100
MWC 310 S	310	130	47	87	3700	2100	1200
MWC 370 S	370	143	55	115	3200	2200	1200
MWC 410 S	410	158	62	115	3700	2200	1200
MWC 460 S	460	174	68	115	4200	2400	1200
MWC 490 S	90	186	73	147	3700	2400	1200
MWC 620 S	620	227	92	147	3700	2400	1200
MWC 850 S	850	308	127	222	4700	2400	1200
MWC 960 S	960	348	143	222	4800	2400	1200
MWC 1050 S	1050	389	157	272	4800	2500	1400

Reference data based on:

Chilled water	: ETG 10%
Water temp. in	: +12°C
Water temp. out	: + 6°C
Refrigerant	: R-407c
Condenser cooling water	: Fresh water, +38°C
Supply voltage	: 3 x 440V-60Hz

Note! All data and measures are subject to final design.

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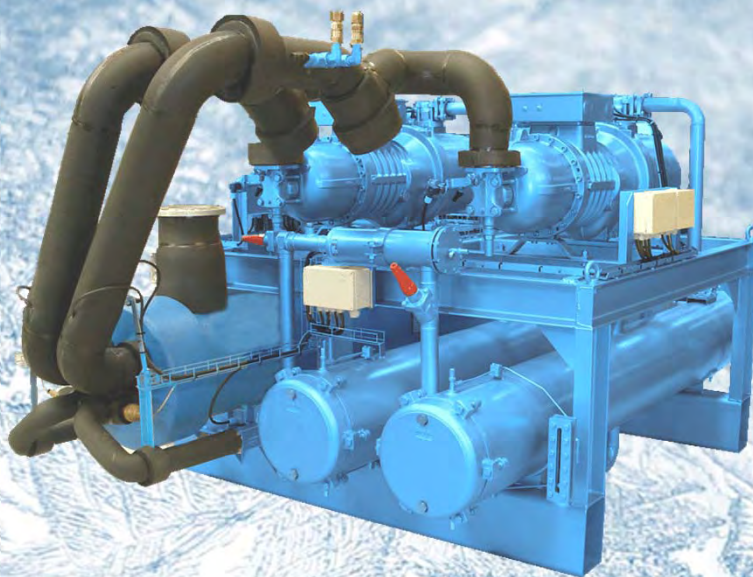


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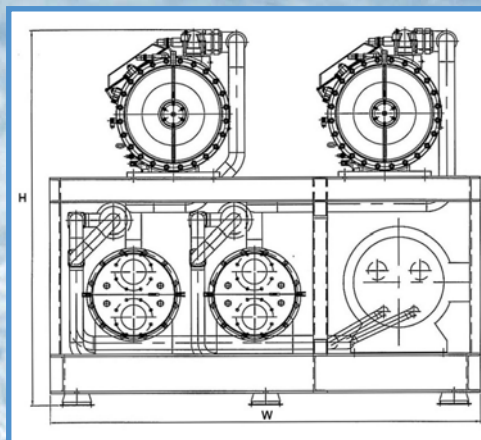
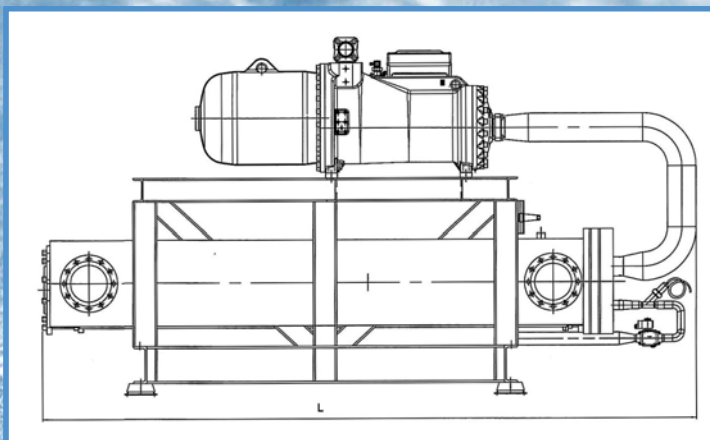
MWC - Marine Water Chiller Twin compressor serie

MWC – Marine Water Chiller is specially designed HVAC-chillers for passenger ferries, small cruise ships, and oil- and offshore vessels.

- ◆ Wide capacity range from 270 kW to 2150 kW
- ◆ Twin compressor arrangement
- ◆ Compact type screw compressor with capacity regulation
- ◆ Dry expansion shell & tube evaporator
- ◆ Fresh- or seawater cooled shell & tube condenser
- ◆ Factory assembled packages including internal piping and electric cabling
- ◆ Low refrigerant charge
- ◆ Refrigerant R-407c (R-134a as option)
- ◆  **TEKNO-TRONIC**® touch-screen monitoring and control
- ◆ Motorstarter of direct- or star-delta type (for separate installation)
- ◆ Custom-built to meet all major classification societies
- ◆ Meet environmental class requirement

MWC – Marine Water Chiller

Twin compressor serie



Model	Total kW		Total m ³ /h		Overall dimensions in mm		
	Refr. Capacity	Power consumpt.	Chilled Water flow	Condenser Water flow	Length	Height	Width
MWC 270 TW	270	114	41	94	3200	2200	2000
MWC 310 TW	310	134	46	94	3200	2200	2000
MWC 370 TW	370	152	54,5	136	3200	2200	2000
MWC 450 TW	450	184	67	136	3200	2200	2000
MWC 510 TW	510	204	76	136	3300	2300	2000
MWC 540 TW	540	222	81	174	3300	2300	2000
MWC 650 TW	650	260	96	174	3300	2300	2000
MWC 720 TW	720	286	107	230	3300	2300	2200
MWC 800 TW	800	316	121	230	3700	2300	2200
MWC 910 TW	910	348	137	230	3700	2300	2300
MWC 960 TW	960	372	143	294	3700	2300	2400
MWC 1210 TW	1210	454	181	294	4400	2300	2400
MWC 1630 TW	1630	616	244	444	4400	2400	2400
MWC 1920 TW	1920	696	287	444	4800	2500	2400
MWC 2150 TW	2150	778	320	544	4800	2500	2500

Reference data based on:

Chilled water	: ETG 10%
Water temp. in	: +12°C
Water temp. out	: + 6°C
Refrigerant	: R-407c
Condenser cooling water	: Fresh water, +38°C
Supply voltage	: 3 x 440V-60Hz

Note! All data and measures are subject to final design.

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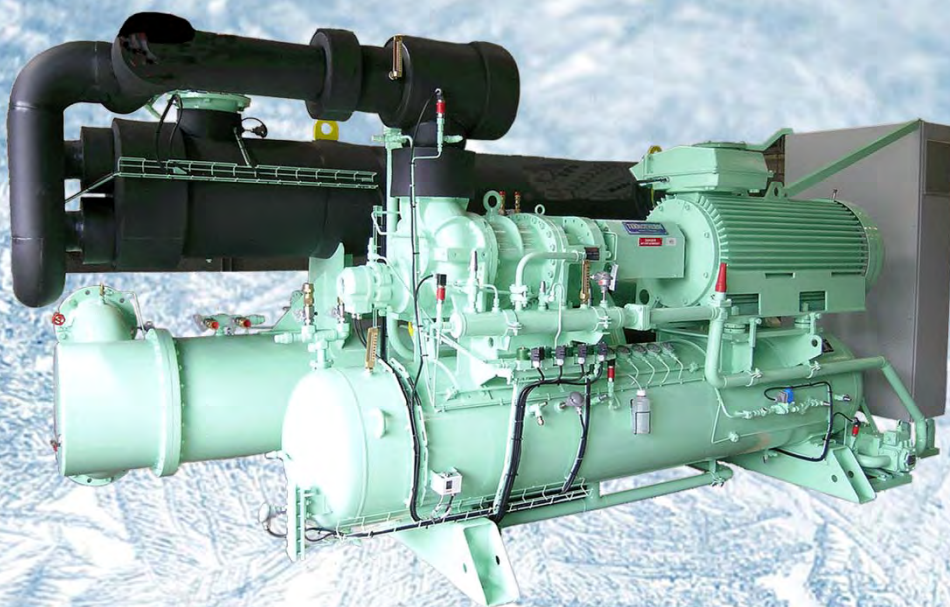
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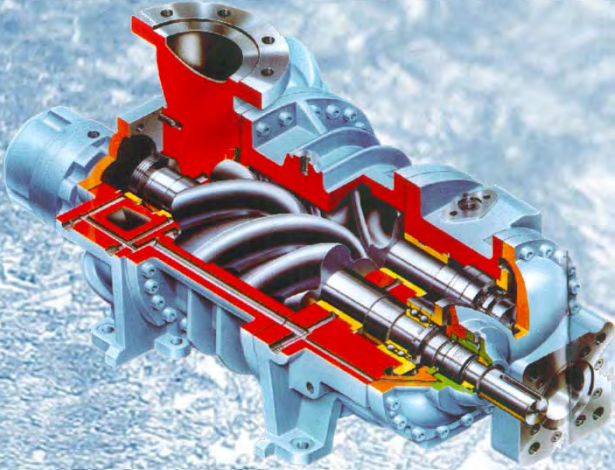


MWC - Marine Water Chillers Open drive compressor

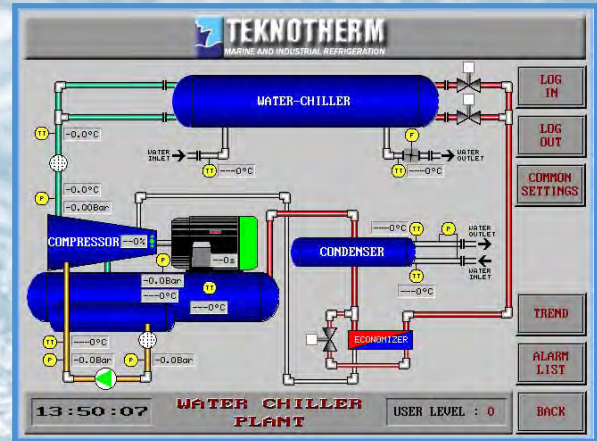
MWC - Marine Water Chillers are specially designed HVAC-chillers for Passenger Ferries, small Cruise Ships, RoPax and RoRo vessels.

- ◆ Wide capacity range from 500 kW to 3000 kW
- ◆ Factory assembled packages including all internal piping and electric cabling
- ◆ Open drive screw compressor with forced lubrication
- ◆ Standard or high voltage electric drive motor
- ◆ Dry expansion shell & tube evaporator
- ◆ Fresh- or seawatercooled shell & tube condenser
- ◆ Low refrigerant charge
- ◆ Refrigerant R-407c or R-404a (R-134a as option)
- ◆ Motorstarter of direct, star-delta or soft-start type
- ◆  **TEKNO-TRONIC**® touch-screen monitoring and control
- ◆ Custom-built to meet all major classification societies

MWC - Marine Water Chillers - standard features



Screwcompressor with male drive,
sleeve bearings and balance piston



TEKNO-TRONIC® touch-screen
operating- and monitoring system



Rear view of MWC-chiller

**Consult Teknotherm for full
specification for your project.**

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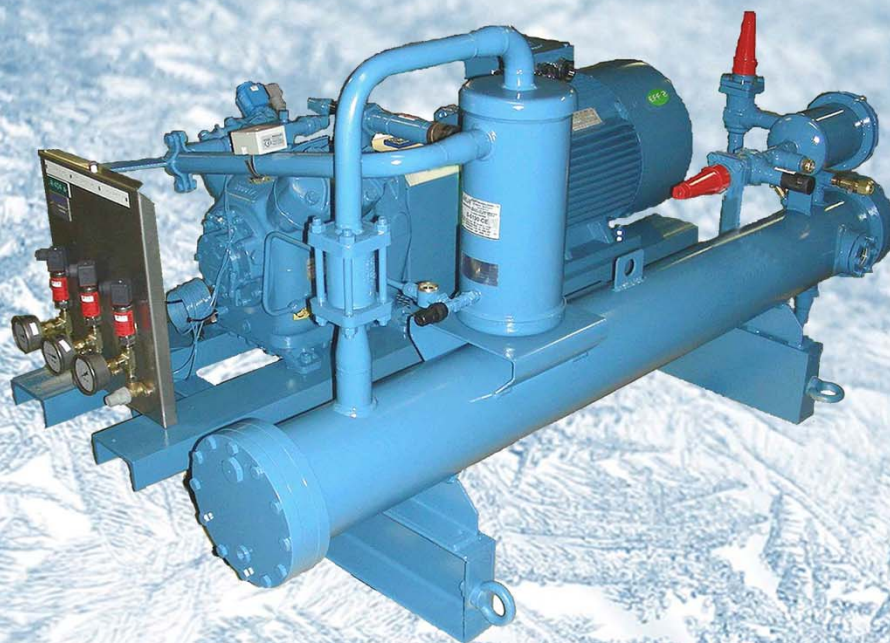
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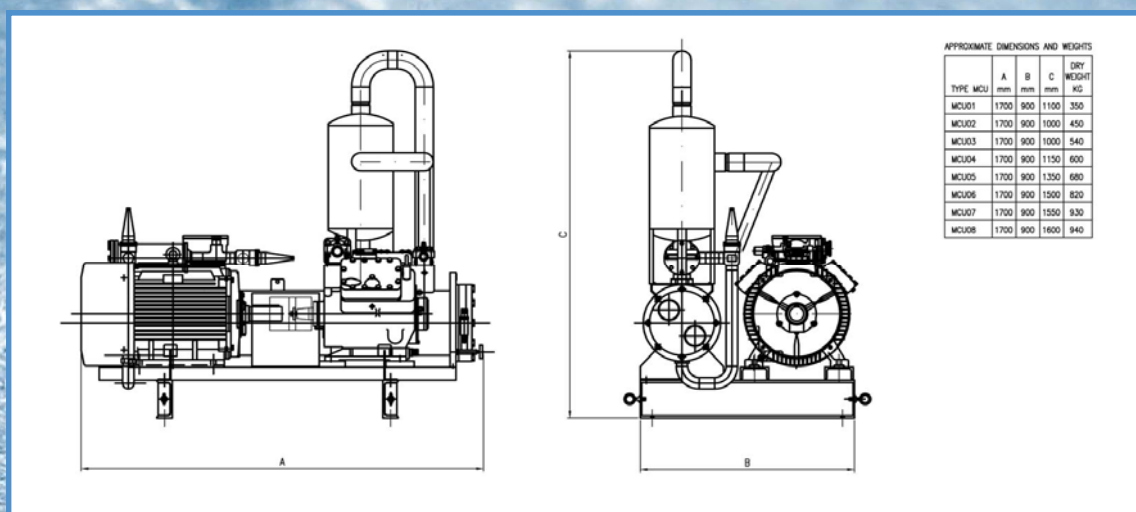
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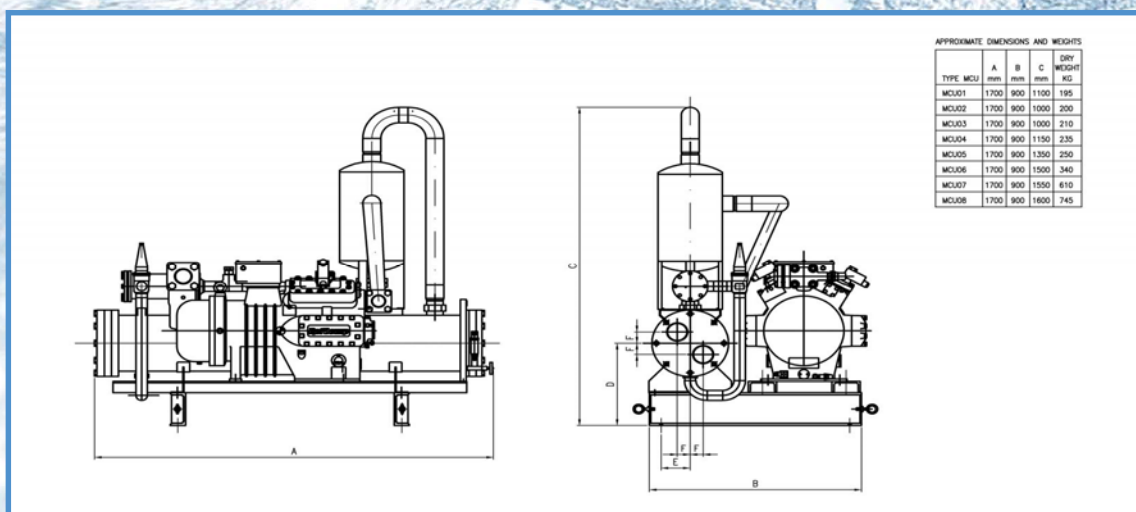
MCU - Marine Condensing Unit

- ◆ Capacity range 3 kW to 200 kW
- ◆ Open or semihermetic piston compressor
- ◆ Designed for marine use
- ◆ Environmental friendly refrigerants
- ◆ Typical installations:
 - Airconditioning
 - Provision stores

MCU - Marine Condensing Unit



MCU with open type compressor



MCU with semihermetic type compressor

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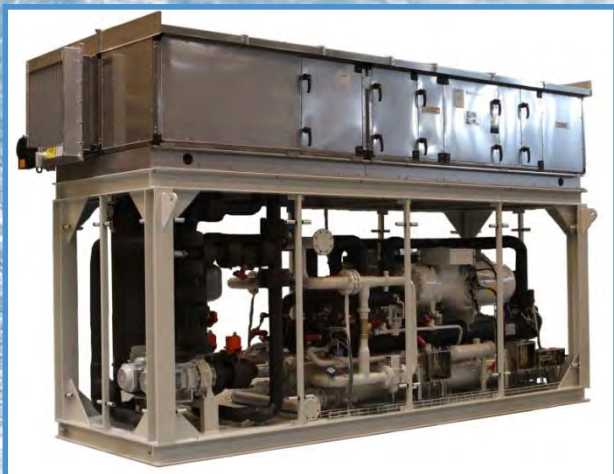
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Self Contained Unit - Type RKA

- Custom built self-contained unit
- Control rooms, computer rooms, workshops etc.
- Several models
- Seawater-cooled
- Free blow or ducted
- Cooling capacity, 20 - 200 kW
- Heating as option
- All types of refrigerant

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Cooling unit - 90MA

The selfcontained cooling units are specially designed for marine application and are complete with compressor, condenser, evaporator and fan built together in a casing. All electrical wiring and refrigerant piping made. To be delivered with R-407c and R-404a as refrigerant. Designed as seawatercooled.

The units can either be delivered for duct mounting or be equipped with plenum chamber accessory.

The compressor is a welded type for 90MA004 and 90MA006, serviceable hermetic type for 90MA008 and 90MA012, and is equipped with suitable vibration isolators and filter drier.

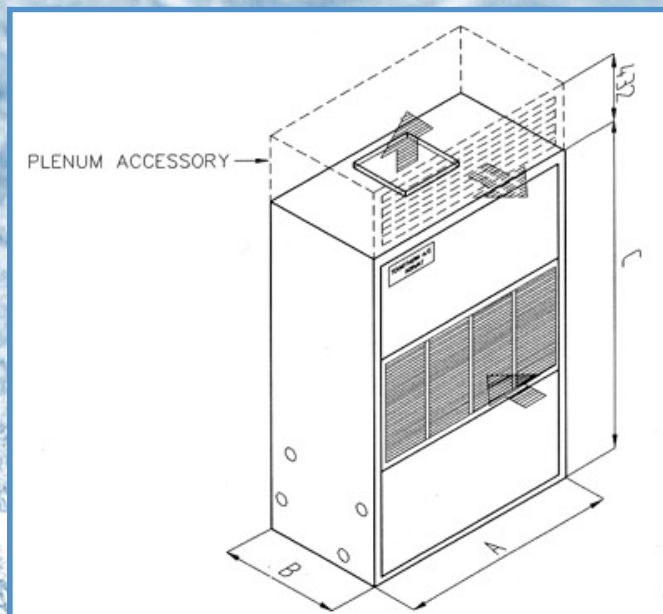
The condenser is a tube-in-tube type with seamless cupro-nicle seawater tubes. For seawater use, the units are equipped with an automatic seawater valve for regulation of condenser pressure.

The evaporator coil is of direct expansion type equipped with thermostatic expansion valve. The construction is aluminium plate fins mechanically bonded to seamless copper tubes.

Further, the units are delivered with el.board containing starter for compressor and fan motor and necessary terminal blocks.

Airfilter and thermostat are standard delivery.

Teknotherm/Carrier Self-Contained Marine Cooling Unit - Type 90MA



		90MA004		90MA006		90MA008		90MA012	
		R-404a	R-407c	R-404a	R-407c	R-404a	R-407c	R-404a	R-407c
Nom. cooling cap.	kW	10,0	10,0	17,0	17,0	26,0	26,0	34,0	34,0
Motor power input	kW	3,17	3,33	4,92	4,83	6,82	7,04	9,71	9,86
Condenser water	m ³ /h	2,05	2,05	3,42	3,42	5,11	5,11	6,84	6,84
Pressure drop	kPa	69,98	69,98	65,5	65,5	29,64	29,64	30,34	30,34
Air amount	m ³ /h	2040	2040	3400	3400	3800	5100	6800	6800
Shipping weight unit	kg	188	188	208	208	423	423	466	466
Shipping volume unit	m ³	0,86					1,8		
Shipping weight plenum chamber	kg	23,5					36,5		
Shipping volume plenum chamber	m ³	0,26					0,45		
Dimensions	mm								
A		919					1219		
B		556					752		
C		1501					1835		

The nominal cooling capacities are based on 60Hz, 32°C seawater-temperature, 27°C dry bulb and 19°C wet bulb temperature entering the coil.

The units can be delivered for voltage 3x460V-60Hz and 3x400V-50Hz.

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PROVISION PLANT

We have long experience of various type of Provision Refrigeration Plant. It could be from small types as well as very big ones.

All depending on the vessel and its operation purpose and the amount of people, as shall be served with provisions from the stores. For these plants we calculate the cooling demand and design the entire plant and comprised components. Normally the plant is designed for automatically operation with direct expansion of refrigerant. Today we are used to operate with all type of environmentally friendly refrigerant as is applicable with a low-temperature system.

The most common way to build up a provision refrigeration plant is to utilize 2-two identical condensing units. Under normal automatic operation one condensing unit has sufficient capacity to maintain the specified temperatures while the second unit acts as stand-by.



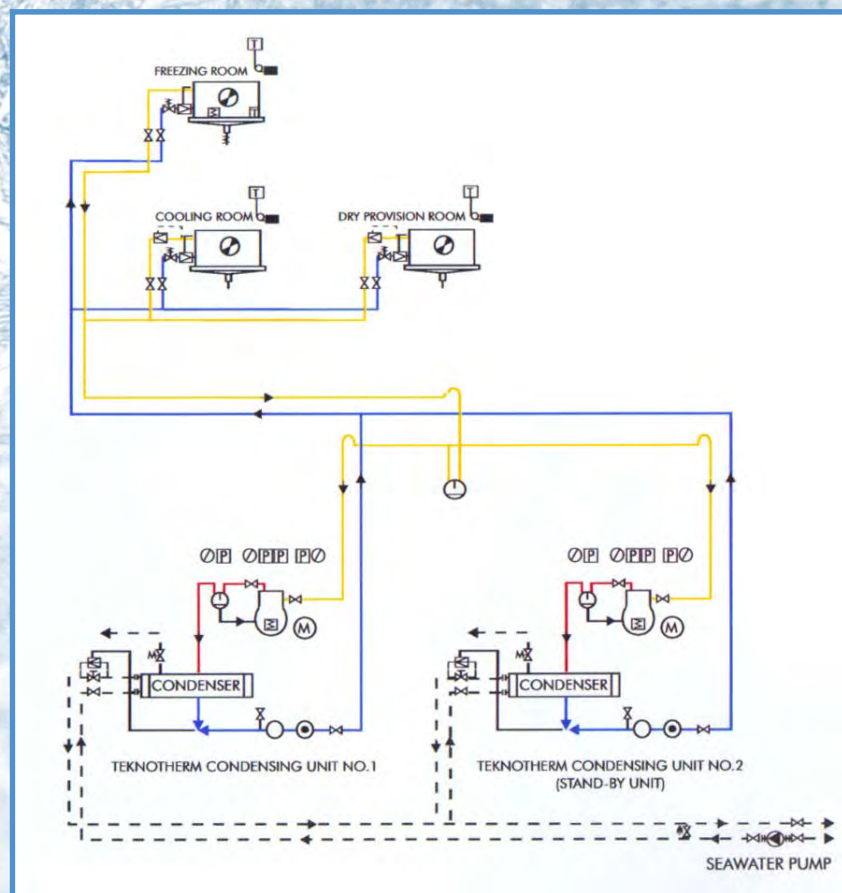
The evaporators for the cooling- and freezing rooms are of forced draft type with element in Cu/Al, housing and drip tray in epoxy-coated aluminium with built in fans. Defrosting of evaporators to be automatic by means of timer. Evaporator for freezing room has electric defrosting element. Freezing room has self-regulating heater in the drainpipe from drip tray.

Whatever the requirements, TEKNOTHERM will provide an optimal designed plant that meets your demands.

Temperatures in freezing- and cooling rooms are individually controlled by room thermostats, which activate a solenoid valve mounted in liquid line to each room's air-cooler. When there is no cooling demand in the room the thermostat will close the solenoid valve, and the liquid supply to the actual evaporator will be stopped. This according to so-called "pump-down" function secures a min. of refrigerant to be trapped in the air-cooler at non-cooling mode.

When there is no cooling demand, all solenoid valves to the air-coolers will be closed and the "pump-down" sequence takes place. After a while the low-pressure cutout will stop the compressor.

The compressor will start automatically when the cooling demand increases.



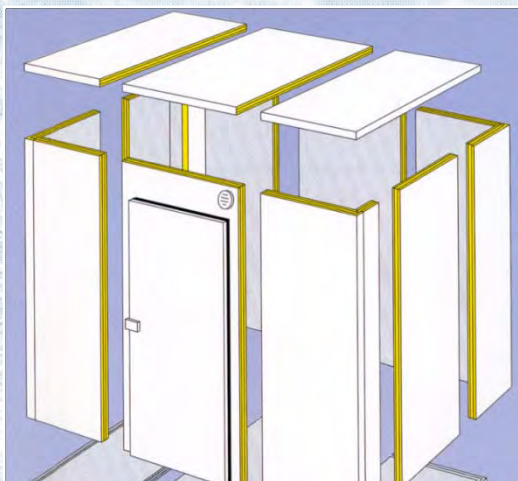
**This is a typical refrigeration plant for Provision stores,
with seawater cooled condenser**



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PROVISION STORAGE



- ◆ May be assembled many times without any loss of condition
- ◆ The corner-less structural limits the number of joints, as decreases leaks and energy consumption
- ◆ Panel joining using special hook clamps guaranteeing appropriate pressure

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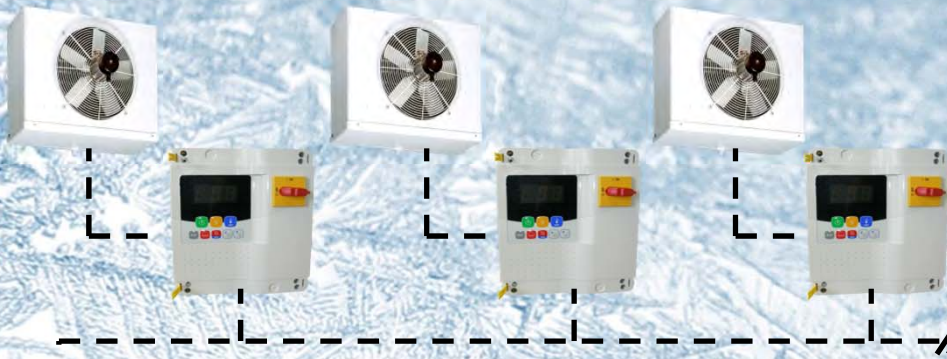
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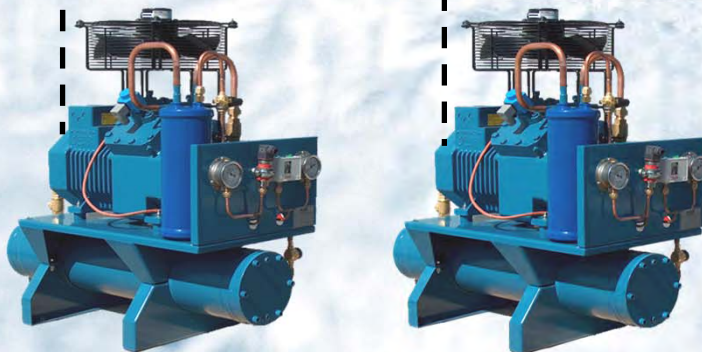
Provision Room Refrigeration System



Individual provision room control panels



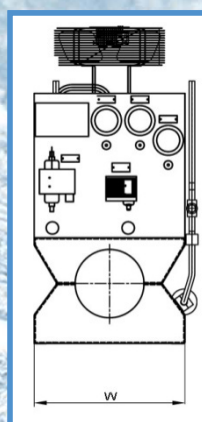
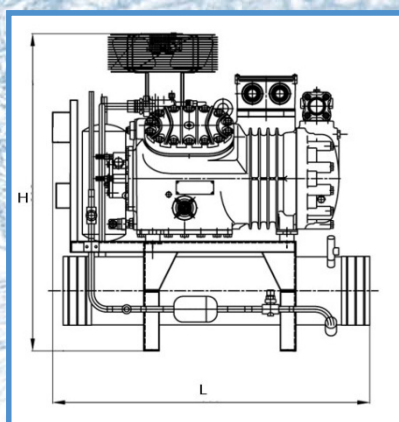
Compressor starter-
and control panel



MCU-condensing units

- ◆ Designed for marine use
- ◆ Environmental friendly refrigerants
- ◆ Designed for decentralized operating-
and monitoring system

MCU Condensing Unit



Type	Refr. capacity	Length	Width	Height
MCU-P-00	1,3 kW	900 mm	425 mm	898 mm
MCU-P-01	2,3 kW	900 mm	425 mm	898 mm
MCU-P-02	3,1 kW	900 mm	425 mm	898 mm
MCU-P-03	4,0 kW	900 mm	425 mm	898 mm
MCU-P-04	4,8 kW	900 mm	425 mm	898 mm
MCU-P-05	6,1 kW	900 mm	425 mm	898 mm
MCU-P-06	8,3 kW	900 mm	425 mm	898 mm
MCU-P-07	12,0 kW	900 mm	425 mm	898 mm

Capacities based on:

Condenser cooling water : Fresh water, +38°C

Freezing room temp. : -25°C

Refrigerant : R-404a

Supply voltage : 3 x 440V-60Hz

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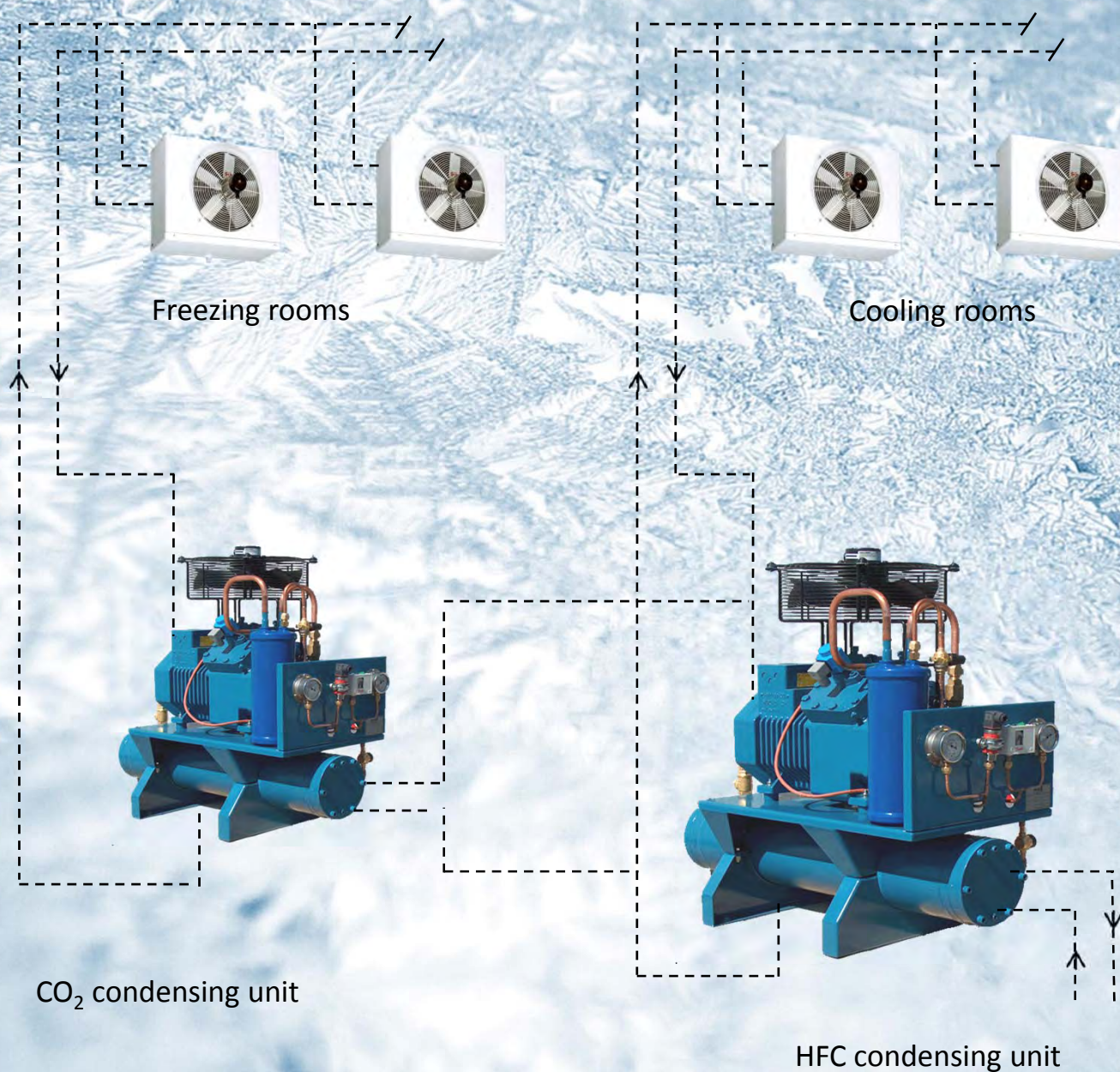
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Provision Room Refrigeration CO₂ – HFC Cascade System



CO₂ as a refrigerant

Within refrigeration technology, carbon dioxide (CO₂) is recognized by the name R-744 and has a long history. It is a colourless gas which liquefies under pressure, and has a slightly acidic smell and taste. Carbon dioxide has no ozone depletion potential (ODP=0) and a negligible direct effect on global warming (GWP=1) when used as a refrigerant in closed systems. It is not combustible, is chemically inactive and heavier than air.

Carbon dioxide is available naturally in large quantities.

CO₂ in a provision refrigeration plant

CO₂ is also known for high pressures and low critical point which requires special measures when used onboard a ship as well as for general installations.

For a typical provision plant, the refrigeration system will be designed as a so-called 2-stage cascade system. A cascade system will include minimum one compressor for the freezing (low temp.) rooms using CO₂ as refrigerant, while the cooling (high temp.) rooms need minimum one designated compressor which may use an ordinary HFC refrigerant, typical R-134a.

The CO₂ low temperature compressor will be cooled by high temperature compressor via a so-called cascade heat exchanger. This arrangement will give an improved plant efficiency (COP) compared with a traditional single stage arrangement.

The complete plant will operate with positive (over) pressures for both low- and high temperature side while the highest environmental standards of the classification societies will be achieved.

CO₂ is preferably to be used in larger provision systems, typical for cruise- and ferry vessels.

Features for CO₂/HFC cascade plant

- Reduced power consumption
- Reduced overall global warming impact
- Environmentally friendly installation
- Reduced components dimensions
- Low temperature capacities from 10 kW and up

COP – Coefficient Of Performance comparison with some typical refrigerants

CO ₂ /R-134a, cascade	$T_E/T_M/T_C$: -35/-8/45°C	semi. recip. compressor	COP : 1,5
R-134a, single stage	T_E/T_C	: -35/45°C	semi. recip. compressor	COP : 0,8
R-134a, single stage	T_E/T_C	: -35/45°C	open screw compressor, eco	COP : 1,25
R-404A, single stage	T_E/T_C	: -35/45°C	semi. recip. compressor	COP : 1,0
R-404A, single stage	T_E/T_C	: -35/45°C	open screw compressor, eco	COP : 1,2

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TEKNOTHERM
MARINE



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SCREW COMPRESSOR UNIT

The compressor unit is specially designed for marine application. Components and materials are chosen with reference to long experience in marine refrigeration. Special care has been given to dimensions, weights and easy maintenance. Suitable for all common refrigerants.

The unit is, as standard, delivered complete assembled with compressor, motor, oilcooler, oilpump, oilfilter, suction strainer, check valves etc. Further is provided gauge-panel with safety devices for pressure and temperatures. The unit has internal oilpiping and el.wiring. The units can be delivered in a number of variants.

The screw compressor, of Mycom make, is a positive displacement rotary machine having two rotors - male and female, made of special forged steel, mounted in a casing of high grade cast iron. The main bearing are sleeve type lined with metal. The balance piston practically eliminates thrust on the bearing, resulting in long service. The compressor has built-in capacity control by 100-10% by stepless slide valve mechanism, and manual adjustable volumetric ratio.

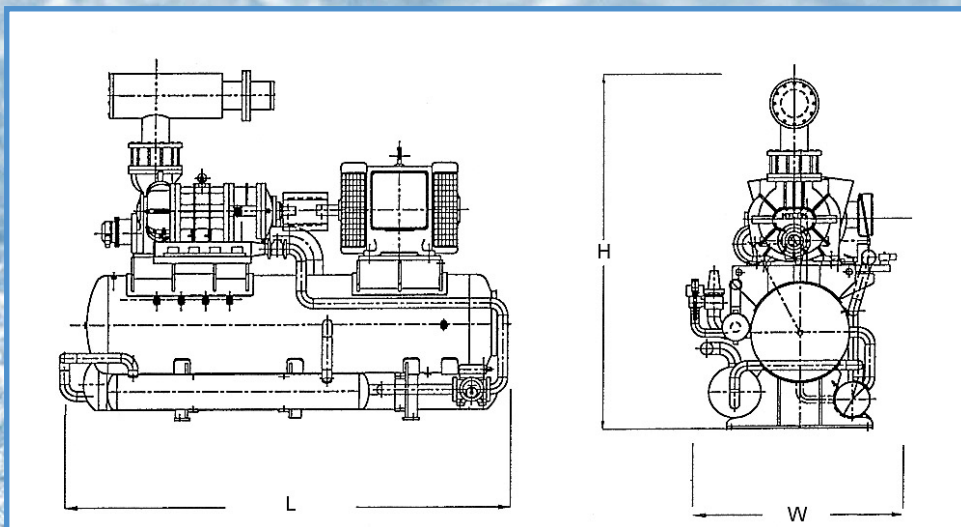
The oil separator is of two stage type with special coalescing elements, effectively separating oil from the discharge gas.

The oil cooler is as standard of shell & tube type. Either in seawater cooled execution or of thermosyphon type. Oil cooling by refrigerant injection is also available. Oil temperature will be kept stable by thermostatic controllers.

The oil pump is a highly efficient gear type with double helical gears and built-in relief valve.

The electric control panel is fully PLC based, consists of necessary control, protection and safety devices and automatic capacity control. All circuits are interlocked to protect the system from malfunction. The panel contains automatic capacity controller and current limiter function, run time indicator, ampermeters and pilot lights. The control panel to be either built-on the unit, or supplied separately.

SCREW COMPRESSOR UNIT



Compr. type		Swept volume m ³ /h at 50Hz operation	Swept volume m ³ /h at 60Hz operation	L mm	W mm	H mm	Approx. weight Kg with motor
F/N 125	S	197	237	1900	800	1500	1200
	L	295	356	1900	800	1500	1250
F/N 160V	S	415	499	2350	900	1910	2050
	M	519	624	2550	900	1910	2100
	L	622	749	2550	900	1910	2150
F/N 200V	S	810	975	2750	1000	2300	2750
	M	1020	1220	2750	1000	2300	2800
	L	1210	1460	2750	1000	2300	2850
F/N 250V	S	1580	1900	Appr. 4500	Appr. 1500		Appr. 7000
	M	1980	2380				
	L	2360	2840				

Data for F/N 320 and F/N 400 series on request.

- Capacities for various operating conditions on request
- Economizer operation is available on all models
- Booster and compound models available



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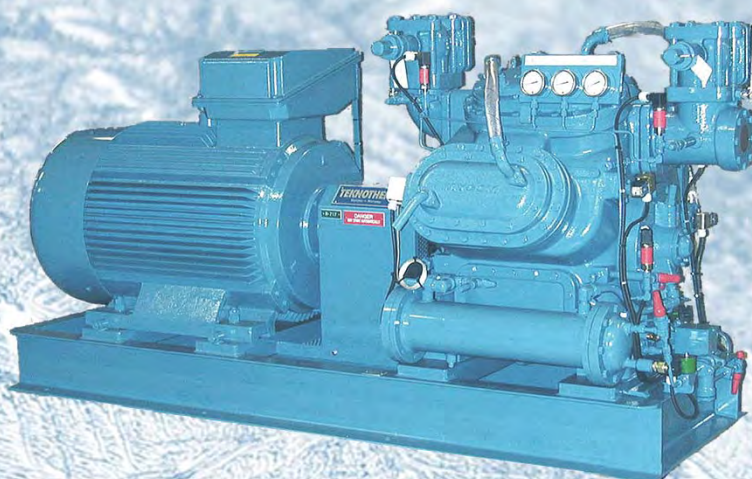
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RECIPROCATING COMPRESSOR UNIT K - WA - L

The compressor unit is specially designed for marine application. Components and materials are chosen with reference to long experience in marine refrigeration. Special care has been given to dimensions, weights and easy maintenance.

The unit is, as standard, delivered complete assembled on steel frame with compressor, el. motor, gauge-panel and cut-outs for HP, LP and OP. V-belt or direct drive with protection guard.

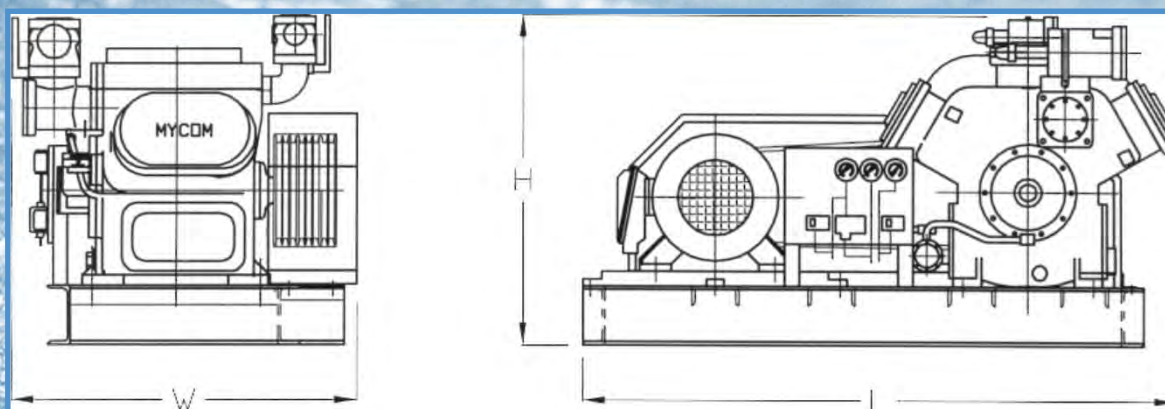
The units can be delivered in 3 models with 3 basic variants with 4, 6 or 8 cylinders for refrigerant HCFC, HFC and ammonia.

The compressor, of Mycom make, has crankcase of highgrade cast iron, forced lubrication with oilpump and oilstrainer, spring-loaded safety heads (WA and L), suction- and discharge valve of ring type. Removable pistons and cylinder sleeves. Crankshaft of ductile iron - dynamically and statically balanced for smooth operation.

Capacity regulation is operated hydraulically by solenoid valves. Suction strainer of fine mesh type and crankcase heater.

Externally the compressor is fitted with suction- and discharge stop valves. Aircooled headcovers and oilcooler of refrigerant cooled DX type. Safety valve is provided as protection against abnormal refrigerant gas pressure increase.

RECIPROCATING COMPRESSOR UNIT



Compressor type	Svept volume m ³ /h - 1450 rpm	L mm	W mm	H mm	Approx. weight Kg with motor
Mycom 4K	128	1450	600	800	530
Mycom 6K	193	1550	650	850	650
Mycom 8K	257	1600	700	900	720
Mycom 4WA	187	1700	1070	1170	980
Mycom 6WA	281	1750	1100	1220	1250
Mycom 8WA	375	1800	1120	1290	1450
Mycom 4L	325	1800	950	1070	1100
Mycom 6L	488	1900	1150	1110	1420
Mycom 8L	651	1950	1200	1190	1600

Note

Ammonia models will have watercooled heads.
 Oilseparator may be supplied separate or mounted.
 PLC-control with pressure transmitters is optional.
 V-belt or direct drive.

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Refrigerant Transfer Unit

- Dimensioned to hold refrigerant charge of one MWC-unit
- Reduces refrigerant loss and emission during maintenance
- Suitable for all CFC and HCFC refrigerants
- Service valves built-on unit
- Semihermetic compressor with oil separator
- Shell & tube condenser, sea- or freshwater cooled
- Electric start- and control panel built-on unit

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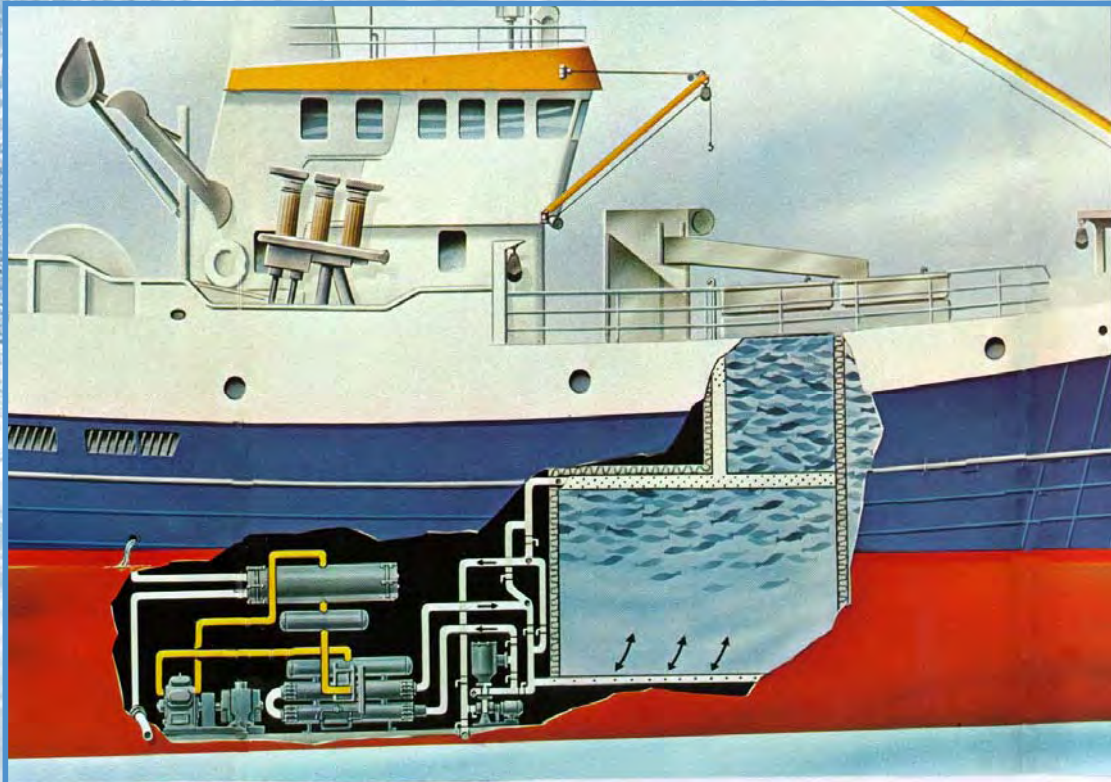
MARINE



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TEKNOTHERM RSW-SYSTEM



RSW - Refrigerated SeaWater

- ◆ Ideal for pelagic (purse seining and mid-water trawling)
- ◆ Enables preservation of large catches, by cooling the catch rapidly to a temperature that allows storage on board over time, without significant reduction in quality
- ◆ Has enabled large quality of mackerel, horse mackerel and herring to be used for human consumption
- ◆ Improves quality on fishmeal by better rawmaterial
- ◆ Reduced quotas set higher standards - better product means better price

RSW - Refrigerated SeaWater

Teknotherm RSW-system

Teknotherm RSW plants mean rapid chill-down and storage of the catch in Refrigerated Sea Water. Storing the catch in RSW is an effective and cost-saving method of preserving the catch until landing ashore or further processing on board. The catch is brought down close to the freezing point of seawater in a minimum time by Teknotherm's highly efficient RSW-chillers of flooded shell & tube type.

The RSW-principle

In simple terms, a RSW-system functions as follows: Seawater is recirculated by pumps through the tanks (therefore product) and the chilling system. The seawater is chilled by the refrigeration machinery before it enters the tanks in the bottom and is distributed evenly over the complete bottom cross-section of the tanks through a set of perforated plates or similar distribution devices. The chilled seawater passes upwards through the tank and layers of fish, thus keeping the fish semi-floating (in suspense) and at the same time cooling it. The water returns through suction screens in the top of the tanks to the chilling unit of the system, passing through this and repeating the circulation process through the system. To keep the circulating water in good condition, a limited amount of feedwater may be added, and "dirty" water bled off.

The water circulating system is arranged as such that the flow can be reversed by the operating certain valves in the main water distribution manifold.

The storage tanks

The RSW tanks are normally constructed side by side to cover the width (beam) of the vessel. There are usually 3, 6, 9 etc. storage tanks. The storage tanks are normally loaded to a capacity of approximately 80% fish and 20% water, depending on type of fish. The tanks must be properly insulated from the hull, deckheads, machinery- and accommodation spaces to limit the possibility of heat ingress as far as possible. The tanks must further be equipped with over-flow and equalizing pipes. It is essential that the interior surfaces of the tanks have a smooth finish, with no obstructions or sharp edges.

Flexible refrigeration installations

The necessary machinery, including chillers, compressors, receivers condensers and pumps, can either be installed as one or several self-contained unit(s) or as individual and separate components.

The machinery can be placed according to individual needs; in the engine room, a dedicated refrigeration compartment, under the shelterdeck or in the bow of the vessel, or anywhere else where practical on board. The pumps however, should be situated as low as possible.

The refrigeration machinery

The machinery will include heavy duty compressors of either reciprocating- or screwtype. The condenser(s) may be of shell & tube- or platetype. The RSW-chiller will be constructed as a flooded shell & tube type evaporator, i.e. seawater to be cooled, will be passing inside the innertubes while the refrigerant is evaporating on the outside side (shell side) of the tubes, thereby cooling the seawater.

The electric panel will include motor starters of various type according to customers request, and the controls will either be of the traditional electromechanical type or the up to date PLC type with all vital parameters and functions shown on LCD display.

The water pumps for condenser cooling- and RSW-circulation system are included as standard items, of end-suction design or according to customers request for special design and materials. Drives can be either electric or hydraulic.

Teknotherm refrigeration equipment can be supplied with class- or works in-house certification. Teknotherm RSW-plant can be supplied to operate on various types of refrigerants of the most modern halocarbon type or ammonia.

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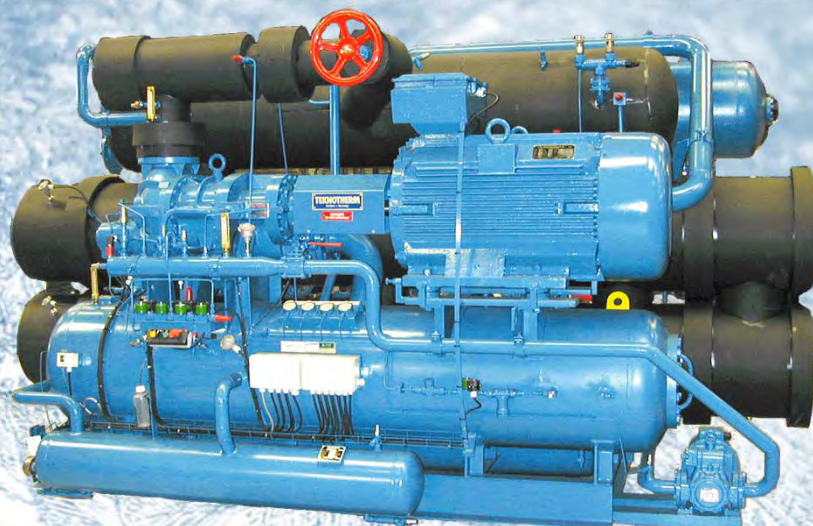


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RSW UNIT with screw compressor

Factory assembled RSW-unit

- ◆ Reduced installation time on board
- ◆ Wide capacity range from 250 kW to 1500 kW
- ◆ Screw compressor with capacity regulation
- ◆ Ammonia or Halocarbons as refrigerant
- ◆ Shell & tube chiller with seawater inside the tubes and refrigerant evaporating outside
- ◆ Shell & tube condensers
- ◆ Easy cleanable waterside
- ◆ High corrosion resistance with titanium or al-brass tubes in chiller and condenser
- ◆ Units are shop piped and wired
- ◆ Optional factory mounted insulation

Teknotherm RSW-system

Teknotherm RSW plants mean rapid chill-down and storage of the catch in Refrigerated Sea Water. Storing the catch in RSW is an effective and cost-saving method of preserving the catch until landing ashore or further processing on board. The catch is brought down close to the freezing point of seawater or freshwater in a minimum time by Teknotherm's highly efficient RSW-chillers of flooded shell & tube type.

RSW UNIT with screw compressor



**Consult Teknotherm for full specification
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RSW UNIT with reciprocating compressor

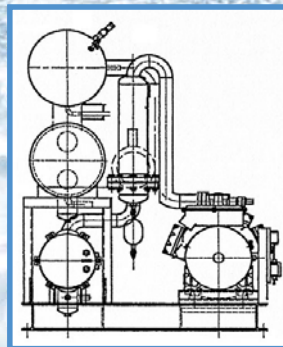
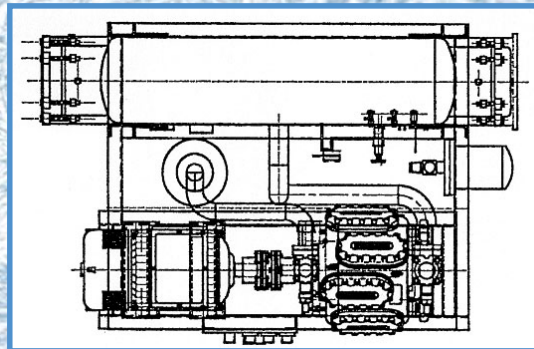
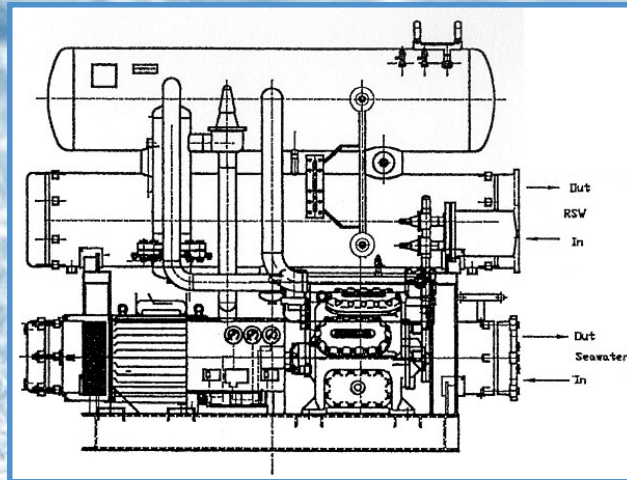
Factory assembled RSW-unit

- ◆ Reduced installation time onboard
- ◆ Wide capacity range from 50 kW to 600 kW
- ◆ Ammonia or Halocarbons as refrigerant
- ◆ Shell & tube chiller with seawater inside the tubes and refrigerant evaporating outside
- ◆ Shell & tube condensers
- ◆ Easy cleanable waterside
- ◆ High corrosion resistance with titanium or al-brass tubes in chiller and condenser
- ◆ Units are shop piped and wired
- ◆ Reciprocating compressor with capacity regulation
- ◆ Optional factory mounted insulation

Teknotherm RSW-system

Teknotherm RSW plants mean rapid chill-down and storage of the catch in Refrigerated Sea Water. Storing the catch in RSW is an effective and cost-saving method of preserving the catch until landing ashore or further processing on board. The catch is brought down close to the freezing point of seawater or freshwater in a minimum time by Teknotherm's highly efficient RSW-chillers of flooded shell & tube type.

RSW UNIT with reciprocating compressor



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RSW - LIQUID CHILLER VK

Type VK

Flooded Shell & Tube design for seawater and brackish water. Designed for halocarbons.

Shell

Made of seamless steeltube in quality St. 35 according to Det Norske Veritas requirements.

End plates

These are made of solid, stainless, acid resistant steel. The plates are welded to the shell. The holes for the tubes are exactly made, with grooves to assure a safety tightening as tubes are rolled in.

The tubes for halocarbons are made of aluminium-brass in the well known alloy for seawater, 76% copper, 2% aluminium and 22% zinc. This alloy has proved to have extremely high resistance against corrosion from seawater and brackish water.

The tubes are of "low fin" construction with external fins made from the tube itself. Outside surface then increases considerably, resulting in a high efficiency compact cooler. The tubes are rolled into the endplates, and are replaceable.

Supporting plates

For support of the tubes and to avoid vibration and noise, supporting plates are mounted in the chiller.

End covers

The end covers are in standard execution of cast iron or galvanized steel, for flange connections. For protection against corrosion, end covers are equipped with corrosion plugs.

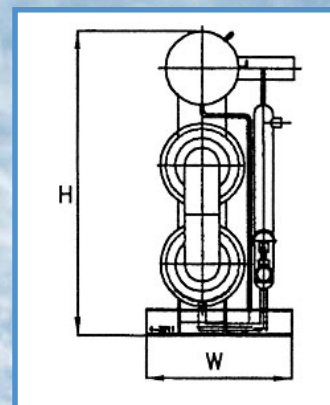
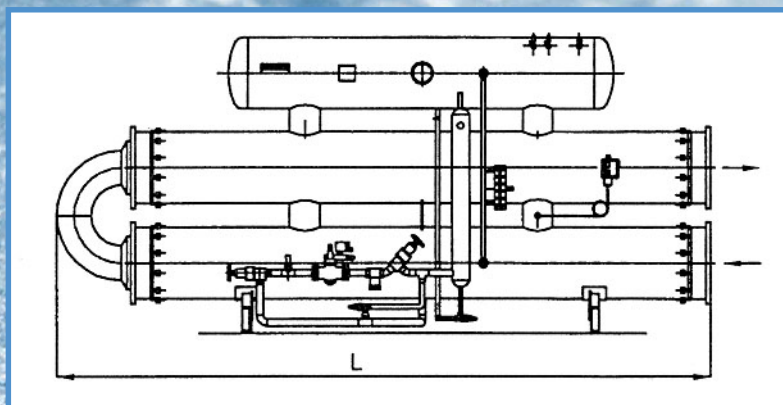
Suction vessel

Suction vessel of ample size constructed with inside baffles to give extremely good separation of refrigerant drops and oil, which is of great importance onboard ships.

Standard equipment

Oil separator, refrigerant injection valve, liquid level glass, safety valve, purge valve, low-temp. safety thermostat. Standard chiller delivered with separate HP pilot floatvalve. Alternatively built-on LP floatvalve with level safety float switch. Ammonia models will have oil drain.

RSW - LIQUID CHILLER VK



Type	Nom.cap. kW LMTD = 4,5°C	Water side			Refr. side			Unit dimensions			Weight kg	
		m³/h	dP M.W. G	D.N	Connections		appr. charge ltr.	L mm	W mm	H mm	Net	Oper- ating
					Suction	Liquid						
VK2 x 22/3,5 2F212	875	500	5,00	250	169,3	76,1	595	4520	1000	2070	4400	5150
VK2 x 22/3 2F212	750	500	4,55	250	169,3	76,1	510	4000	1000	2070	3750	4410
VK2 x 18/3,5 2F142	585	320	4,60	200	139,7	60,3	395	4230	900	1841	2600	3120
VK2 x 18/3 2F142	500 455	320 255	4,30 2,70	200	139,7	60,3	340	3740	900	1841	2200	2640
VK2 x 18/2 2F142	330 300	320 255	3,50 2,20	200	139,7	60,3	225	2730	900	1841	1560	1850
VK2 x 16/3 2F100	350 315	225 180	4,75 3,00	150 or 2x100	114,3	42,4	295	3565	900	1580	1670	2050
VK2 x 16/2 2F100	235 210	225 180	3,95 2,50	150 or 2x100	88,9	42,4	195	2575	900	1580	1160	1420
VK1 x 16/3 F100	175 160	115 90	5,35 3,30	100	88,9	42,4	105	3200	900	1200	860	1000
VK1 x 16/2 F100	120 105	115 90	4,50 2,75	100	88,9	42,4	70	2240	900	1200	680	770
VK2 x 14/2 2F80	190 170	180 145	4,50 2,95	125 or 2x80	88,9	42,4	145	2575	800	1520	970	1160
VK x 14/2 F80	95 65	90 55	6,00 2,25	80	88,9	33,7	55	2200	800	1100	670	740

Note:

- * Capacities are based on R-22/R-507
- * Stated capacities are nominal
- * Other capacities on request
- * Type VK2 x 22" is standardized with galv. Steel waterheads
- * HC tubes

Optionals:

- * Ammonia models
- * Other refrigerants on request
- * Low temp. brine models
- * Classification certificates
- * Small series, 10 - 100 kW

Exmpl.of conversion:

- 1 mm = 0,04"
- 1 m³/h = 0,59 ft³/min
- 1 kg = 2,205 lb
- 1 kW = 860 kcal/h
- = 0,285 tons of refr.

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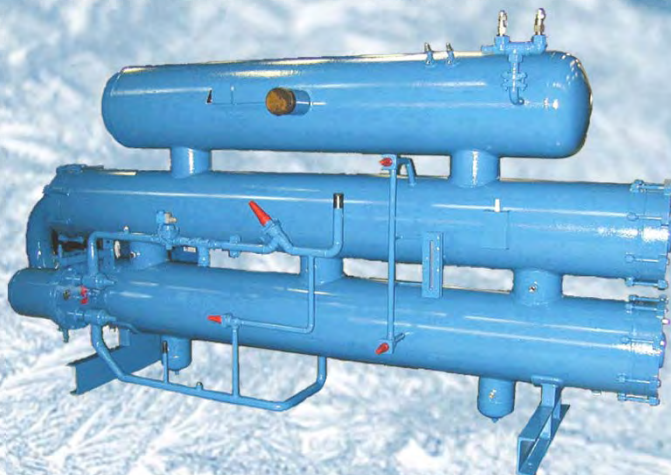


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RSW - LIQUID CHILLER VKN

Type VKN

Flooded Shell & Tube design for seawater, brine and other fluids. Designed for ammonia and halocarbons as refrigerant.

Shell

Made of seamless steel tube in quality St. 35 according to class requirements.

Tube End Plates

These are plates in stainless steel SIS 2343 and are electrically welded to the chiller shell. The holes for the tubes are exactly made with grooves to assure a safe tightening when tubes are rolled in.

The tubes are made of titanium Grade 2. ASTM 355. Titanium is extremely qualified in resisting corrosion from sea water and brackish water.

Supporting Plates

For support of the tubes and to avoid vibration and noise.

Water endcovers

The water endcovers are in standard design of cast iron, and are made for flange connections. The larger models will have endcovers in hot dipped galvanized steel. For corrosion protection the water endcovers are equipped with corrosion anodes.

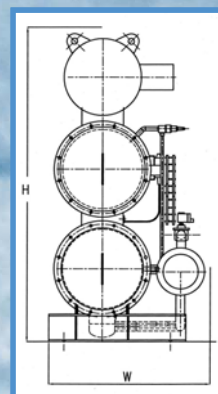
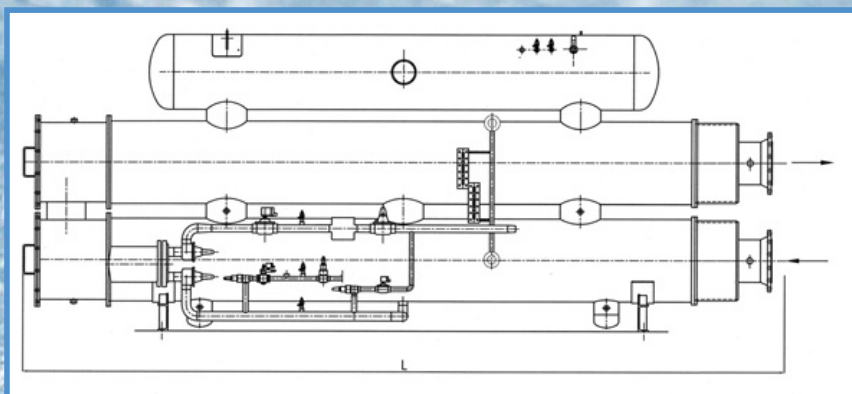
Suction vessel

Suction vessel of ample size constructed with inside baffles to give extremely good separation of refrigerant drops and oil from the suction gas.

Design and testing

This is performed according to Det Norske Veritas' and most major classification societies' requirements. After testing, the chiller is sealed and charged with nitrogen gas with a small overpressure. The chiller external surface is painted with a protecting paint.

RSW - LIQUID CHILLER VKN



Type	Nom.cap.	Water side		Unit dimensions			Weight kg
	kW	m ³ /h	D.N	L mm	W mm	H mm	Net
VKN2 x 24"/4 2 x F330	1500	900	300	5020	1100	2220	4400
VKN2 x 24"/3,5 2 x F330	1250	900	300	4520	1100	2220	3900
VKN2 x 24"/3 2 x F330	1000	850	300	4520	1100	2220	3400
VKN2 x 22"/4 2 x F268	1160	600	250	5020	1000	2120	3350
VKN2 x 22"/3,5 2 x F268	950	550	250	4520	1000	2120	3350
VKN2 x 22"/3 2 x F268	800	550	250	4000	1000	2120	2875
VKN2 x 18"/3,5 2 x F180	650	400	200	4230	900	1850	1900
VKN2 x 18"/3 2 x F180	540	350	200	3740	900	1850	1600
VKN1 x 18"/3,5 1 x F180	325	200	125	4230	900	1350	1350
VKN1 x 18"/3 1 x F180	290	200	125	3740	900	1350	1100
VKN2 x 16"/3 2 x F126	390	280	150	3565	900	1580	1245
VKN2 x 16"/2 2 x F126	240	230	150	2575	900	1580	875
VKN1 x 16"/3 1 x F126	205	140	100	3200	900	1200	650
VKN1 x 16"/2 1 x F126	145	150	100	2240	900	1200	600
VKN2 x 14"/2 2 x F98	205	220	125	2575	800	1520	700
VKN1 x 14"/2 1 x F98	100	100	80	2200	800	1100	550

**Consult Teknotherm for dimensioning of chiller
for a specific installation.**

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VF - STRAINER

Type VF

For seawater and brackish water.

The strainer designed for self cleaning by reversing water flow.

Shell

Made of 6 mm rolled steelplate. Topcover of 12 mm steelplate, flanged to the shell with o-ring tightning.

Water connections with flanges.

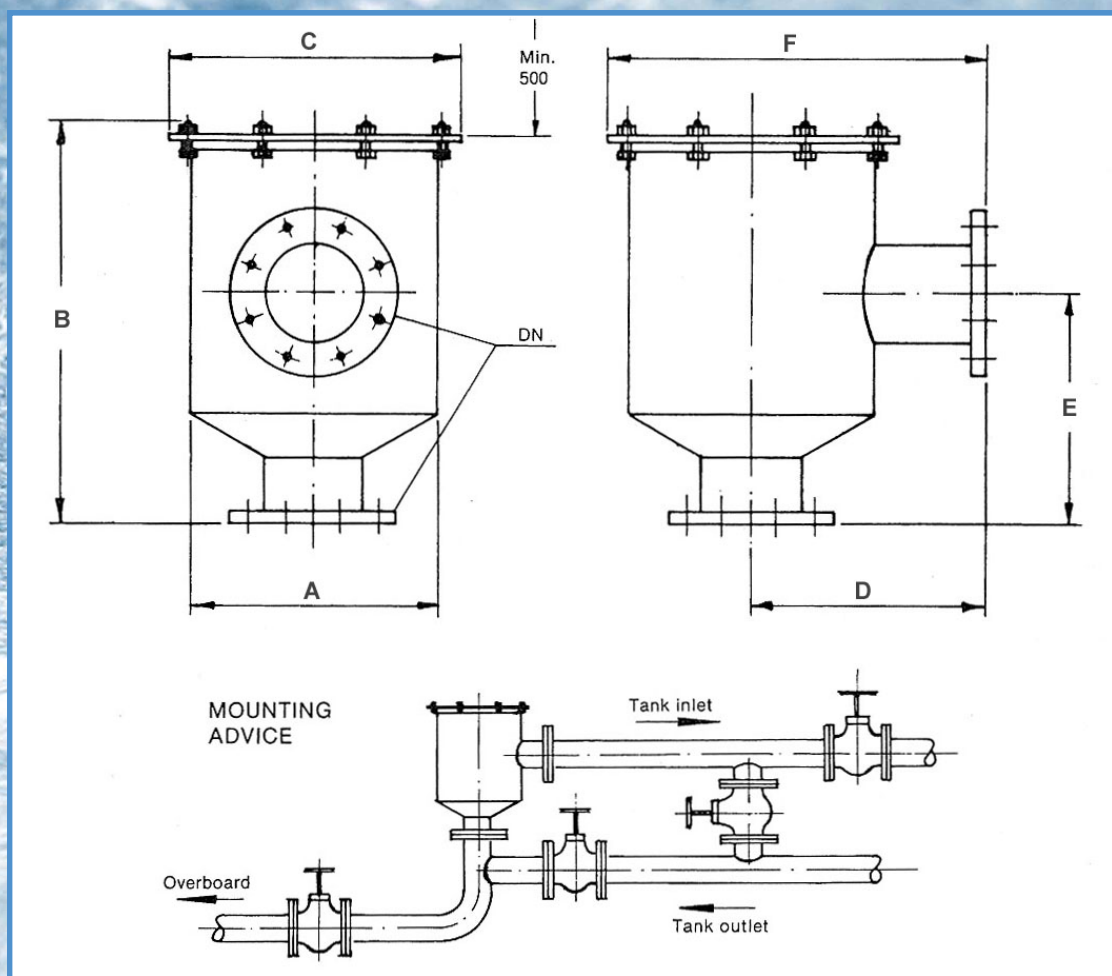
Strainer

Made of 1,5 mm perforated stainless steelplate with a 12 mm perforation.

Water circulation

Inlet at center of strainer. The water forcing itself through perforation, leaving dirt, fishscales etc. in scuter.

VF - STRAINER



Strainer type	DN Flange NS 2527 PN 16 DIN 2501	No. of bolts	Bolt size	Waterflow m ³ /h at rate 2 m/sec.	Dimensions in mm						Weight kg
					A	B	C	D	E	F	
VF 100	DN 100	8	M 16	57							95
VF 125	DN 125	8	M 16	84							100
VF 150	DN 150	8	M 20	126	420	690	500	350	400	600	105
VF 200	DN 200	12	M 20	250							110
VF 200	DN 250	12	M 24	400							120
VF 250	DN 250	12	M 24	400	570	945	660	455	550	785	155
VF 250	DN 300	12	M 24	550		1015			620		165

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REFRIGERATED CARGO HOLDS

*Gill-finned tube air coolers for
natural air circulation*

The air coolers are designed for mounting below the deckhead and operates by means of gravity (natural) air circulation.

- ◆ Even temperature throughout the hold
- ◆ No ducting is required
- ◆ No electric installation required
- ◆ No moving parts (fans, etc.)
- ◆ Less de-hydration of un-wrapped or un-boxed product
- ◆ Sturdy construction
- ◆ Reduced energy consumption
- ◆ Better working environment
- ◆ Suitable for halocarbon, ammonia or brine systems
- ◆ Simple-, quick and low installation cost

REFRIGERATED CARGO HOLDS

Dimensions

Standard coils for natural air circulation with the following dimensions:

Total length of the coil L_T : 1370, 1970, 2570, 3770 and 4970 mm
 Gilled length of the coil L_B : 1150, 1750, 2350, 3550 and 4750 mm

Center distance between the supporting plate L_C is 1200 mm on all coils, except coil with $L_B = 1750$ mm, where $L_C = 900$ mm. This gives the following number of supporting plates for the different coil-lengths:

Coil with L_B = 1150 mm has 2 supporting plates
 Coil with L_B = 1750 mm has 3 supporting plates

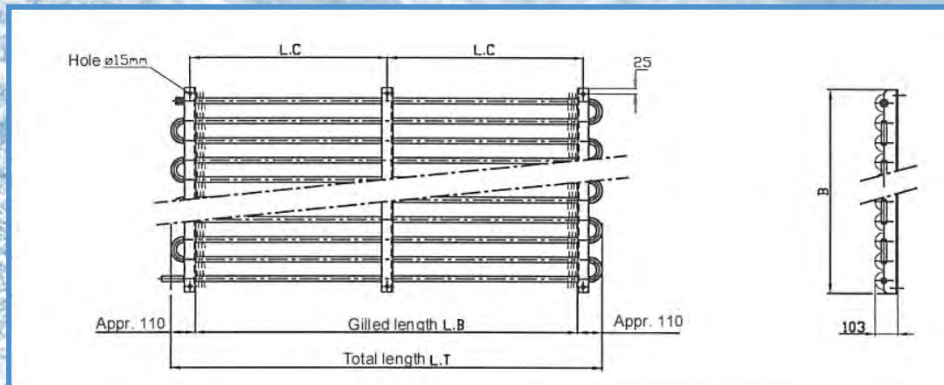
The width of
the coil B:

6 tubes in width = 570 mm
 8 tubes in width = 750 mm

Coil with L_B = 2350 mm has 3 supporting plates
 Coil with L_B = 3550 mm has 4 supporting plates

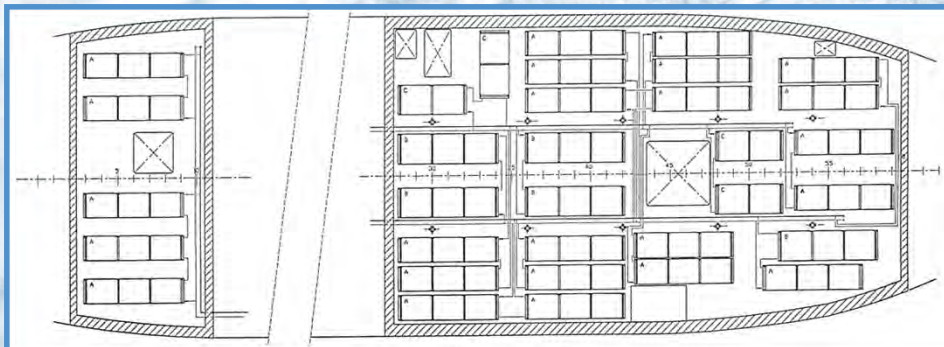
10 tubes in width = 930 mm
 12 tubes in width = 1110 mm

The height of the coil is appr. 103 mm.



In the following table there are given some data for the coils.

	Number of tubes in width	External cooling surface in m ²				Internal volume in dm ³	Weight of coil in kg			
		8 mm pitch	10 mm pitch	12 mm pitch	15 mm pitch		8 mm pitch	10 mm pitch	12 mm pitch	15 mm pitch
Gilled tube-length $L_B = 1150$ mm	6	11	9	7	6	3	44	40	36	33
	8	15	12	10	8	4	59	53	48	44
	10	18	15	12	10	5	73	65	60	54
	12	22	18	15	12	6	88	78	72	66
Gilled tube-length $L_B = 1750$ mm	6	17	13	11	9	5	66	59	54	49
	8	22	18	15	12	6	88	78	71	65
	10	28	22	19	15	8	110	97	89	81
	12	33	27	23	18	9	131	117	106	98
Gilled tube-length $L_B = 2350$ mm	6	22	18	15	12	6	84	74	68	61
	8	30	24	20	17	8	112	99	90	81
	10	37	30	25	21	10	140	123	113	102
	12	45	36	30	25	12	167	147	135	121
Gilled tube-length $L_B = 3550$ mm	6	34	27	23	19	9	124	109	99	89
	8	45	36	31	25	12	165	144	131	119
	10	56	45	38	31	15	205	180	164	148
	12	67	55	46	37	18	245	216	197	178
Gilled tube-length $L_B = 4750$ mm	6	45	36	31	25	12	163	143	130	117
	8	60	49	41	33	16	218	189	173	155
	10	75	61	51	42	19	270	238	216	194
	12	90	73	62	50	23	324	284	258	233



Typical air cooler arrangement in cargo hold

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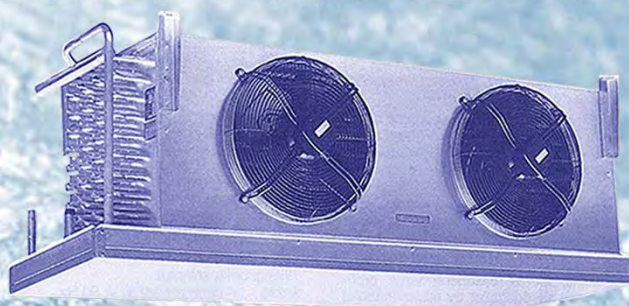
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REFRIGERATED FISH HOLD PLANTS



Gil-fin tube aircoolers, hot dipped galvanized for gravity air circulation. Preferably for deckhead mounting. High efficiency, combined with rigid construction for the severe conditions in the fish holds and no electrical components - makes these evaporators the most recommended system for fishing vessels.



Aircoolers with forced air circulation for deck-head mounting. Aluminium enclosure with electric propeller fans with or without electric defrosting. High efficiency and small space requirements. Suitable for fish holds where no bulk storage of fish occurs.



Compressor unit with aircooled condenser for electric drive. Simple and easy installation when installed in good ventilated space. Can also be combined as a heat resource in the shelter deck area.



Compressor unit with seawater cooled condenser for electric drive - specially constructed for world wide operation marine applications.

Refrigeration system

Refrigeration system design may be arranged with direct expansion of refrigerant in the aircooler or as an indirect system with recirculation of chilled coolant through the aircoolers.

TEKNOTHERM REFRIGERATION FOR THE FISHING FLEET:

RSW system

Platefreezers

Blast freezers

IQF-freezers

Cargo holds



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HORIZONTAL PLATE FREEZER

The horizontal contact plate freezer is ideal for block freezing and preserving portioned products.

- ◆ The products are placed into trays or freezing frames and these are slid between the freezing plates
- ◆ Frozen blocks, flat and uniform, are easily stacked and stored
- ◆ Minimal energy consumption, easy installation and low capital and maintenance costs
Rapid freezing preserves products quality and minimizes production time
- ◆ Wide range of models

Framework

The all steel welded heavy duty framework is fully hot dipped galvanized for protection and is designed with hygiene in mind and the whole freezer can be quickly and easily hosed down if required.

Freezing plates

The freezing plates are manufactured from extruded aluminium alloy sections with internal passages for refrigerant. The freezing plate surfaces coming into contacts with the product are flat and smooth which ensures good contact for heat transfer and high standards of hygiene.

Refrigerant hoses

Flexible refrigerant hoses are connected between the freezing plates and refrigerant headers. The hose consists of a PTFE material covered externally with a double braided stainless steel with stainless steel fittings.

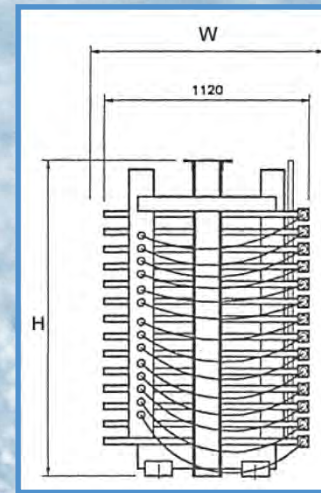
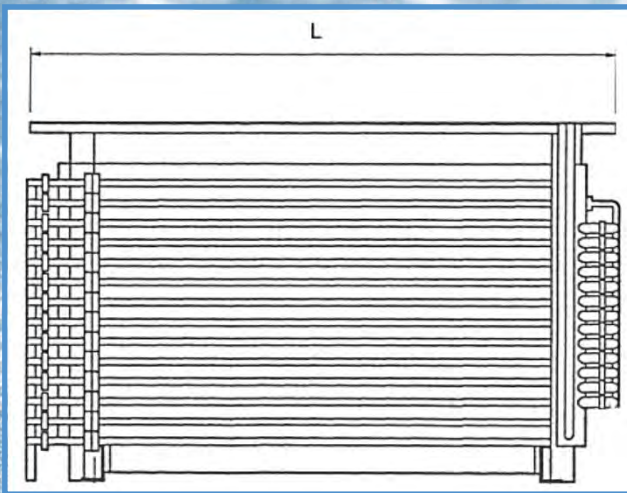
Hydraulic cylinders

Hydraulic cylinders perform the functions of opening and closing the freezing plates. The provision of twin hydraulic cylinders reduces the overall height of the freezer enabling it to satisfy the low headroom requirements of a fishing vessel. The cylinders will have stainless steel rods.

Anti-roll bars

Anti-roll bars, designed to retain freezing trays or frames in the freezing stations when plates are open, allow the freezer to be safely loaded and unloaded in the roughest of sea conditions.

HORIZONTAL PLATE FREEZER



Standard dimensions for marine execution

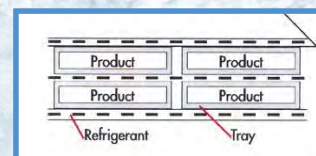
Plate dim. in mm	No. of stations	Length O/A (L) in mm	Width in mm (W) anti-roll bar	Height O/A (H) in mm
1550 x 1120	5 - 15	2250	1280	x
1750 x 1120	5 - 17	2450	1280	x
1850 x 1120	5 - 17	2550	1280	x
1930 x 1120	10 - 20	2650	1280	x

x - Overall height depends on number of stations and max/min plate opening.

All measures are subject to final design.

Options

- Alternative plate dimensions
- Alternative plate pressure
- Insulated cabinet w. doors or curtains
- Uninsulated cabinet w. doors or curtains
- Brine as cooling medium
- Industrial version



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VERTICAL PLATE FREEZER

- ◆ Products are simply placed or poured into vertical pockets between aluminium freezing plates
- ◆ Symmetrical frozen blocks stack easily, maximising on amount of available storage space
- ◆ Minimal energy consumption, easy installation and low capital and maintenance costs
- ◆ Rapid freezing preserves products quality and minimises production time
- ◆ Wide range of models

Framework

The all steel welded heavy duty framework is fully hot dipped galvanized for protection and is designed with hygiene in mind and the whole freezer can be quickly and easily hosed down if required.

Freezing plates

These are manufactured from extruded aluminium alloy sections with internal passages for refrigerant. The freezing plate surfaces coming into contacts with the product are flat and smooth which ensures good contact for heat transfer and high standards of hygiene.

Refrigerant hoses

Flexible refrigerant hoses are connected between the freezing plates and refrigerant headers. The hose consists of a PTFE material covered externally with a double braided stainless steel with stainless steel fittings.

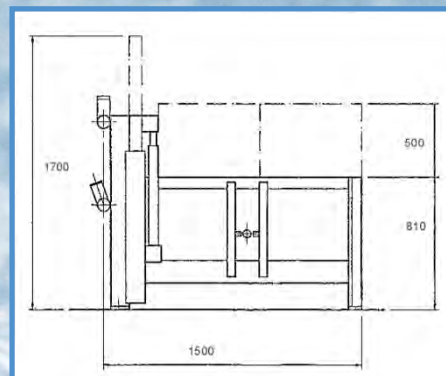
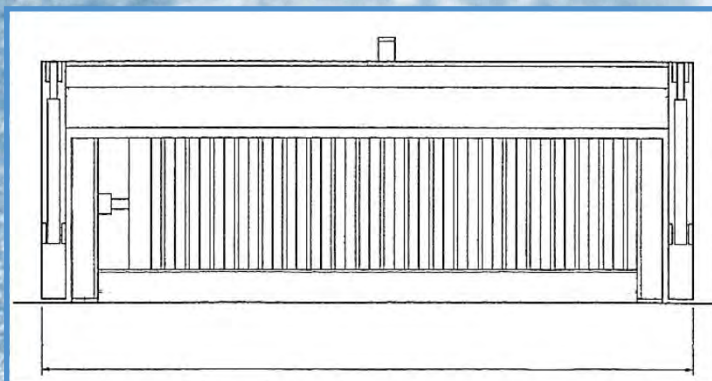
Hydraulic cylinders

Hydraulic cylinders perform the functions of opening and closing the freezing plates and raising the lowering the lifting arms. The hydraulic cylinders will have stainless steel rods.

Lifting arms

The horizontal and vertical members of each lifting arm are fitted with a high density polyethylene extrusion, forming the bottom of the freezing station.

VERTICAL PLATEFREEZER

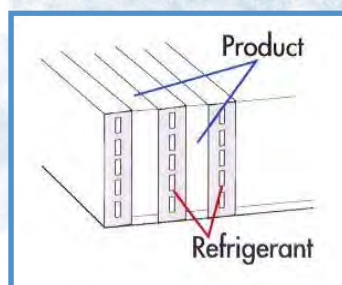


- Standard dimensions
- Top loading and unloading
- Typical block dimension, all models - L x H : 1060 x 520 mm x thickness
- Refrigerant : HCFC, HFC and Ammonia

Model	Normal block thickness	Length O/A in mm
VPF 12/100	100	2250
VPF 16/100	100	2750
VPF 16/75	75	2475
VPF 20/100	100	3250
VPF 20/75	75	2750
VPF 20/50	50	2250
VPF 25/75	75	3250
VPF 25/50	50	2500
VPF 26/100	100	3995
VPF 32/75	75	3995

Options

- Alternative no. of stations
- Alternative block thickness
- Brine as cooling medium
- Fruit and pulp models
- Liquid freezing models



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BLAST FREEZER

- ◆ Versatile
- ◆ Batch-freezing of all kind of products
- ◆ Individual freezing of whole fish
- ◆ Unlimited range of models

Air blast freezing

Batches of normally packed product are stacked in "tunnels", where high velocity cold air is forced (blown) over the product.

**Consult Teknotherm for full specification
for your project.**

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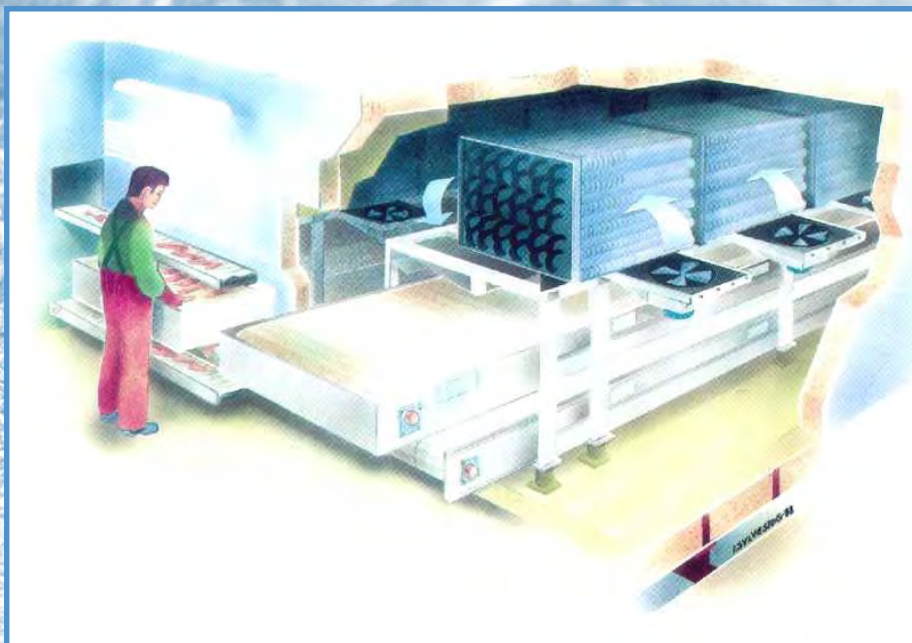
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IQF FREEZER

- ◆ Single-freezing of most types of products
- ◆ Single or twin belt models
- ◆ Almost unlimited range of models

IQF blast freezing

Individual quick freezing. Single filets, whole fish or prawns are placed on a conveyour belt with high velocity cold air blown over the product, obtaining short freezing time and a naturally shaped frozen product.

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FLOW-ICE MAKER

Complete factory mounted unit, consisting of:

- ◆ Compressor
- ◆ Shell & tube condenser, seawater cooled
- ◆ Precooler
- ◆ Flow-ice generators
- ◆ Electrical starting panel
- ◆ Valves and controls
- ◆ Insulation
- ◆ Base frame
- ◆ Refrigerant R-717 or R-404a / R-507

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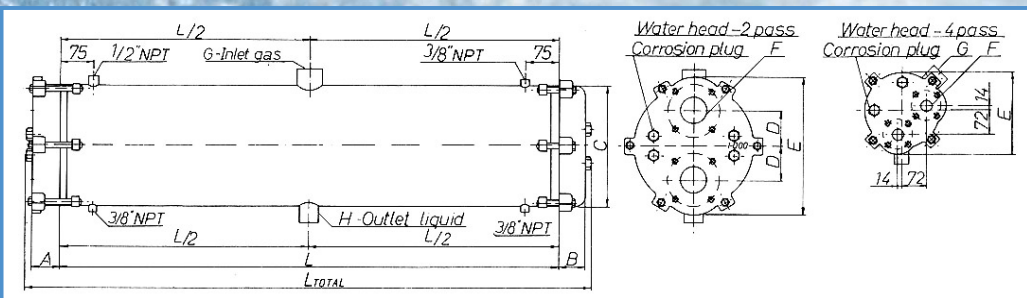
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WATERCOOLED CONDENSER

Type SK8: Shell & Tube design for halocarbon refrigerants, cooled by seawater or freshwater. (Type SKN for ammonia on request.)

Condenser Shell: This is made of seamless steel tubes in marine quality P235GH according to Det Norske Veritas' and mostly other classification societies' requirements.

Tube End Plates: These are plates in stainless steel AISI 316L and are electrically welded to the condenser shell. The holes for the tubes are exactly made with grooves to assure a safe tightening when tubes are rolled in.

The tubes are made of aluminium-brass in the well known alloy for sea water, 76% copper, 2% aluminium and 22% zinc. This alloy has turned out to be extremely qualified in resisting corrosion from sea water and brackish water. The tubes are in high capacity construction with external fins and internal grooves made from the tube itself. Outside surface is then increased considerably, and thereby efficiency is increased, and we get a compact, efficient condenser.

Supporting Plates: For support of the tubes and to avoid vibration and noise, supporting plates are mounted in the condenser.

Water end covers: The water end covers are in standard design in cast iron, and are made for flange connections. For corrosion protection the water end covers are equipped with corrosion plugs. If wanted, the water end covers can be delivered in marine brass.

Connections: For the refrigerant side, the condensers are prepared with steel connections for welding steel tubes. For the water connections standard flanges are used, PN 10 - 16 for the bigger types, and PN 6 for the smallest. The condensers are further equipped with connections for safety valve, for gas equalization to possible receiver, for liquid level glass and for water valve.

Pressure and leakage testing: This is performed according to Det Norske Veritas' and mostly other classification societies' requirements.

After testing, the condenser is sealed and charged with nitrogen gas with a small overpressure. The condenser external surface is painted with rust protecting paint.

2-pass

SK8-8.5/8" F-45

L	L tot	A	B	C	D	E	F	G	H	Weight appr. kg	Pump down capacity dm ³	Internal net volume ltr.
1500	1700						DN 50			140	25.8	30.3
2000	2200						PN 6			175	34.5	40.6
2500	2700	75	75	219,1	71	282	DIN 2631	48,3	48,3	215	43.4	51.0
2750	2950									230	47.7	56.1
3000	3200									250	52.1	61.3

SK8-10.3/4" F-72

1500	1700						DN 50			205	40.9	48.1
2000	2200						PN 16			255	54.8	64.5
2500	2700	75	75	273,0	85	336	DIN 2633	60,3	48,3	310	68.8	80.9
3000	3200									365	82.6	97.2

SK8-12.3/4" F-105

1500	1700						DN 65			290	56.7	66.7
2000	2200						PN 16			360	76.0	89.4
2500	2700	85	77	323,9	96	380	DIN 2633	76,1	60,3	440	95.3	112.1
2750	2950									475	105.0	123.5
3000	3200									515	114.6	134.8

SK8-14" F-134

1500	1700						DN 80			360	65.5	77.0
2000	2200						PN 6			450	87.7	103.2
2500	2700	85	78	355,6	103	408	DIN 2633	76,1	60,3	615	110.0	129.4
2750	2950									595	120.7	142.5
3000	3200									640	132.3	155.6

SK8-16" F-175

2000	2250	95	100	406,4	111	442	DN 100			590	115,3	135,6
2500	2750						PN 16			715	144,5	170,0
2750	3000						DIN 2633	88,9	76,1	775	159,2	187,3
3000	3250									835	173,8	204,5

SK8-18" F-227

3000	3250	125	125	457	127,5	523	DN 125			1085	215,3	253,3
3500	3750						PN 16			1240	251,5	295,9
4000	4250						DIN 2633	114,3	88,9	1400	287,8	338,6

SK8-22" F-342

3000	3750	450	295	559	147,5	635	DN 150			1470	326,3	383,9
3500	4250						PN 16			1690	381,2	448,5
4000	4750						DIN 2633	125	100	1920	436,2	513,2

SK8-24" F-424

3000	3750	450	295	559	147,5	635	DN 150			1470	326,3	383,9
3500	4250						PN 16			1690	381,2	448,5
4000	4750						DIN 2633	125	100	1920	436,2	513,2

4-pass

SK8-8.5/8" F-28

1100	1290	75	75	219,1		247	DN 32			100	23,8	28,0
1500	1700						PN 6			120	32,3	38,0
							DIN 2631	42,4	42,4			

SK8-8.5/8" F-40

1100	1290	75	75	219,1		247	DN 32			110	20,4	24,0
1500	1700						PN 6			135	28,1	33,0
2000	2200						DIN 2631	42,4	42,4	170	37,4	44,0

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SK8-condensers from Teknotherm are constructed with the following important details to be observed:

- Small dimensions** by using high capacity condenser tubes with external finned surface.
The ratio inside/outside surface is approx. the same ratio as the heat transfer figures outside/inside.
- Materials in tubes and end plates** against the water side are chosen to give a smallest possible corrosion at the electrolytic action, which arises when seawater is used. The combination of the selected materials, aluminium-brass and stainless steel for the quality used here, gives little voltage difference and thereby little electrolytical corroion. As a further protection the water endcovers are equipped with zinc or soft iron corrosion plugs.
- Gas inlet:** The condenser has one gas inlet only and inside distribution of the gas.
- Liquid outlet:** The condenser has as standard one outlet dimensioned to cover the various types max. capacity.
- Flange-connections on the waterside for all types:**
The water is going in 2 passes for all bigger sizes of condensers. This is suitable for ship and cooling tower with small temperature rise of water.
2 types, SK8-8.5/8" F28 with L1100-L1500 and F40 with L100-L1500 and L2000, are made for 4 passes and are well suited at capacities from 20-100 kW.
- All materials** are according to the requirements of Det Norske Veritas and and mostly other classification societies' requirements.
When ordering, certificate can be delivered according to agreement at cost price.
- Condenser tubes can be replaced.**

CONDENSER SELECTION

Rating tables for condenser capacities are worked out covering all conditions. To select a condenser, the following data must be known:

- * Condenser capacity (kW)
- * Condensing temperature (°C)
- * Water temperature inlet (°C)
- * Water type (Scale factor)
- * Water amount allowed used (L/min.)

Selection procedure:

- Condenser capacity is calculated in kW/°C difference between condensing temperature and water inlet temperature, and we get the condenser loading factor.

$$\text{Condensing loading factor} = \frac{\text{Condenser capacity in kW}}{\text{Cond. temp. - Water inlet temp.}}$$

The capacities are calculated with scale factors 0,000086 and 0,000172 m²/°C/W.
The first figure is for seawater and the second figure is for brackish water and fresh water.

- Entering the tables, the condenser capacity can be determined according to this equation:
Condenser capacity = loading factor x (condensing temperature - water inlet temperature).

- Water temperature outlet =

$$\text{water temperature inlet} + \frac{\text{Condenser capacity} \times 860}{\text{l/min.} \times 60}$$

The loading factor is for each condenser calculated for 4 different water amounts and K-values. Pressure loss in m. W.G. is given in the table for the water amount in question. Interpolation between loading factor and water amount as well as scale factor is allowed.

Type SK8 2 pass	Cooling surface m ²	Press. loss mWG	l/min	Cond. loading factor kW/°C		Type SK8 2 pass	Cooling surface m ²	Press. loss mWG	l/min	Cond. loading factor kW/°C	
				0,000086	0,000172					0,000086	0,000172
8.5/8" F45	14,22	0,3	115	5,01	4,54	14" F134		0,3	336	17,25	15,88
L 1500		0,9	230	7,89	6,70	L 2000	56,46	1,2	673	28,17	24,39
		2	346	9,80	8,05			2,6	1009	35,76	29,88
		3,5	461	11,15	8,93			4,6	1345	41,26	33,57
8.5/8" F45	19,37	0,3	115	5,91	5,45	14" F134	71,34	0,4	336	19,08	17,83
L 2000		1,1	230	9,66	8,36	L 2500		1,4	673	32,20	28,35
		2,3	346	12,26	10,25			2,7	1009	41,66	35,36
		4	461	14,15	11,51			5,1	1345	48,70	40,20
8.5/8" F45	24,22	0,3	115	6,51	6,08	14" F134	78,79	0,4	336	19,78	18,61
L 2500		1,2	230	10,97	9,66	L 2750		1,5	673	33,87	30,06
		2,6	346	14,19	12,04			3,1	1009	44,22	37,82
		4,5	461	16,58	13,68			5,4	1345	52,01	43,24
8.5/8" F45	26,79	0,4	115	6,75	6,35	14" F134	86,23	0,4	336	20,37	19,25
L 2750		1,3	230	11,56	10,25	L 3000		1,5	673	35,35	31,61
		2,8	346	15,08	12,89			3,3	1009	46,56	40,10
		4,8	461	17,73	14,73			5,6	1345	55,08	46,11
8.5/8" F45	29,37	0,4	115	6,97	6,59	16" F175	74	0,3	439	22,53	20,74
L 3000		1,4	230	12,08	10,79	L 2000		1,1	878	36,79	31,85
		3	346	15,90	13,69			2,3	1318	46,71	39,02
		5,1	461	18,80	15,73			4	1757	53,88	43,84
10.3/4" F72		0,3	181	7,96	7,21	16" F175	93	0,3	439	24,92	23,29
L 1500	22,75	1,2	361	12,54	10,67	L 2500		1,2	878	42,05	37,02
		2,7	542	15,61	12,83			2,6	1318	54,41	46,18
		4,7	723	17,77	14,25			4,5	1757	63,60	52,50
10.3/4" F72		0,4	181	9,36	8,63	16" F175	103	0,4	439	25,83	24,30
L 2000	31	1,4	361	19,34	13,30	L 2750		1,4	878	44,23	40,45
		3	542	19,50	16,31			2,8	1318	57,76	49,39
		5,3	723	22,52	18,35			4,8	1757	67,92	56,47
10.3/4" F72		0,4	181	10,29	9,63	16" F175	113	0,4	439	26,60	25,17
L 2500	38,75	1,6	361	17,40	15,33	L 3000		1,4	878	46,17	41,28
		3,4	542	22,53	19,14			3	1318	60,80	52,37
		5,8	723	26,35	21,77			5,1	1757	71,93	60,21
10.3/4" F72		0,4	181	10,67	10,05	16" F175	132	0,4	439	29,46	28,40
L 2750	42,87	1,6	361	18,31	16,27	L 3500		1,6	878	52,13	47,36
		3,5	542	23,94	20,49			3,3	1318	68,83	59,95
		6,1	723	28,17	23,45			5,6	1757	81,76	69,18
10.3/4" F72		0,5	181	10,99	10,41	16" F175	151	0,5	439	28,62	27,61
L 3000	47	1,7	361	19,12	17,11	L 4000		1,7	878	51,94	47,68
		4	542	25,21	21,74			3,6	1318	70,49	62,35
		6,4	723	29,86	25,02			6,1	1757	85,23	73,17
12.3/4" F105		0,3	264	11,48	10,39	18" F227	145	0,4	565	34,20	32,37
L 1500	32,58	1,1	527	18,06	15,35	L 3000		1,3	1129	59,36	53,07
		2,4	791	22,45	18,44			2,9	1694	78,17	67,34
		4,2	1054	25,53	20,46			4,9	2259	92,49	77,42
12.3/4" F105		0,3	264	12,52	12,44	18" F227	170	0,4	565	35,73	34,17
L 2000	44,24	1,3	527	22,08	19,11	L 3500		1,5	1129	63,52	57,59
		2,8	791	28,02	23,41			3,2	1694	84,98	74,22
		4,8	1054	32,33	26,30			5,4	2259	101,69	86,24
12.3/4" F105		0,4	264	14,95	13,91	18" F227	195	0,5	565	36,80	35,50
L 2500	55,90	1,4	527	25,23	22,21	L 4000		1,7	1129	66,78	61,30
		3,1	791	32,65	27,71			3,5	1694	90,63	80,17
		5,3	1054	38,16	31,50			6	2259	109,58	94,08
12.3/4" F105		0,4	264	15,30	14,58	22" F342	225	0,4	878	53,20	50,35
L 2750	61,74	1,5	527	26,54	23,55	L 3000		1,4	1757	92,34	82,56
		3,2	791	34,65	29,63			2,9	2635	121,60	104,75
		5,6	1054	40,75	33,88			4,9	3514	143,87	120,43
12.3/4" F105		0,4	264	15,96	15,10	22" F342	264	0,4	878	55,57	53,15
L 3000	67,57	1,6	527	27,70	24,77	L 3500		1,5	1757	98,81	89,58
		3,4	791	36,48	31,42			3,2	2635	132,20	115,45
		5,8	1054	43,16	36,13			5,5	3514	158,18	134,14
14" F134		0,3	336	14,65	13,26	22" F342	303	0,5	878	57,24	55,23
L 1500	41,58	1,1	673	23,05	19,59	L 4000		1,7	1757	103,88	95,36
		2,3	1009	28,65	23,53			3,5	2635	140,98	124,70
		4	1345	32,59	26,11			6	3514	170,46	146,35
						24" F424		0,4	878	55,57	53,15
								1,1	878	98,81	89,58
						L 3000		2,9	2635	132,20	115,45
								4,9	3514	158,18	134,14
						24" F424		0,4	1757	103,88	95,36
						L 3500		1,5	2635	140,98	124,70
								3,2	3514	170,46	146,35
								5,5	4392	194,76	163,52
						24" F424		0,5	0	0,00	0,00
								1,7	0	0,00	0,00
						L 4000		3,5	0	0,00	0,00
								6	0	0,00	0,00

Type SK8 4 pass	Cooling surface m ²	Press. loss m WG	Cond. loading factor kW/°C				Type SK8 4 pass	Cooling surface m ²	Press. loss m WG	Cond. loading factor kW/°C			
			l/min	0,000086	0,000172				l/min	0,000086	0,000172		
8 5/8" F28 L 1100	6,09	0,4	35	1,83	1,69	8 5/8" F40 L 1100	8,70	0,4	50	2,61	2,41		
		1,4	70	3,00	2,60			1,5	100	4,29	3,72		
		3	105	3,82	3,20			3,2	151	5,46	4,57		
		5,2	141	4,41	3,60			5,6	201	6,30	5,14		
8 5/8" F28 L 1500	8,85	0,5	35	2,12	2,00	8 5/8" F40 L 1500	12,64	0,5	50	3,02	2,86		
		1,6	70	3,66	3,27			1,7	100	5,38	4,67		
		3,5	105	4,82	4,14			3,7	151	6,88	5,92		
		6	141	5,69	4,76			6,4	201	8,13	6,80		
						8 5/8" F40 L 2000	17,22	0,6	50	3,27	3,15		
								2,1	100	5,93	5,44		
								4,4	151	8,04	7,11		
								7,5	201	9,71	8,34		

Notes:

The connections for refrigerant for the gas- and liquid side are pipe connections intended for welding.
Flanges for welding or soldering can be delivered at an additional price. For connections for water, all types are delivered with flange connections. Pumping down capacity is based on appr. 85% free volume.

CONDENSER SELECTION

Rating tables for condenser capacities are worked out covering all conditions. To select a condenser, the following data must be known:

- * Condenser capacity (kW)
- * Condensing temperature (°C)
- * Water temperature inlet (°C)
- * Water type (Fouling)
- * Water amount allowed used (L/min.)

Selection procedure:

- Condenser capacity is calculated in kW/°C difference between condensing temperature and water inlet temperature, and we get the condenser loading factor.

$$\text{Condensing loading factor} = \frac{\text{Condenser capacity in kW}}{\text{Cond. temp.} - \text{Water inlet temp.}}$$

The capacities are calculated with fouling 0,000086 and 0,000172 m²/°C/W. The first figure is for seawater and the second figure is for brackish water and fresh water.

- Entering the tables, the condenser capacity can be determined according to this equation:

$$\text{Condenser capacity} = \text{loading factor} \times (\text{condensing temperature} - \text{water inlet temperature}).$$

- Water temperature outlet =

$$\text{water temperature inlet} + \frac{\text{Condenser capacity} \times 860}{\text{l/min.} \times 60}$$

The loading factor is for each condenser calculated for 4 different water amounts and K-values. Pressure loss in m. W.G. is given in the table for the water amount in question. Interpolation between loading factor and water amount as well as scale factor is allowed.

Type SKN	Cooling surface	Press. loss		Cond. loading factor	Type SKN	Cooling surface	Press. loss		Cond. loading factor
2 pass	m ²	m WG	l/min	KW °C	2 pass	m ²	m WG	l/min	KW °C
				0,000086					0,000086
				0,000172					0,000172
8.5/8" F45		0,12	113	3,75	16" F175		0,14	439	17,77
		0,47	226	5,71			0,53	878	27,77
L 1500	3,92	1,06	342	7,01	L 2000	20,48	1,18	1329	34,60
		2,69	549	8,53			3,01	2134	42,77
8.5/8" F45		0,14	113	4,57	16" F175		0,15	439	20,32
		0,53	226	7,14			0,59	878	32,55
L 2000	5,27	1,19	342	8,90	L 2500	25,70	1,31	1329	41,13
		3,03	549	10,99			3,34	2134	51,55
8.5/8" F45		0,15	113	5,22	16" F175		0,17	439	22,36
		0,59	226	8,37			0,65	878	36,64
L 2500	6,61	1,32	342	10,58	L 3000	30,92	1,44	1329	46,92
		3,37	549	13,25			3,69	2134	59,60
8.5/8" F45		0,17	113	5,75	16" F175		0,19	439	23,99
		0,65	226	9,42			0,71	878	40,15
L 3000	7,95	1,45	342	12,06	L 3500	36,15	1,58	1329	52,06
		3,7	549	15,32			4,03	2134	66,98
10.3/4" F72		0,2	181	6,00	16" F175		0,2	439	25,30
		0,79	361	9,13			0,77	878	43,16
L 1500	6,28	1,8	547	11,21	L 4000	41,37	1,71	1329	56,62
		3,02	712	12,57			4,36	2134	73,75
10.3/4" F72		0,22	181	7,31	18" F227		0,16	564	28,75
		0,85	361	11,43			0,59	1129	47,11
L 2000	8,42	1,93	547	14,24	L 3000	39,76	1,32	1709	60,32
		3,24	712	16,10			4,53	3214	82,07
10.3/4" F72		0,24	181	8,36	18" F227		0,17	564	30,85
		0,92	361	13,39			0,65	1129	51,62
L 2500	10,57	2,05	547	16,92	L 3500	46,48	1,45	1709	66,93
		3,46	712	19,29			4,99	3214	92,59
10.3/4" F72		0,25	181	9,20	18" F227		0,19	564	32,53
		0,98	361	15,08			0,71	1129	55,49
L 3000	12,72	2,2	547	19,30	L 4000	53,19	1,58	1709	72,80
		3,69	712	22,18			5,44	3214	102,34
12.3/4" F105		0,17	263	8,75	22" F342		0,16	878	44,72
		0,66	527	13,32			0,61	1756	73,29
L 1500	9,15	1,5	797	16,35	L 3000	61,85	1,36	2658	93,84
		2,48	1031	18,29			4,27	4731	124,73
12.3/4" F105		0,19	263	10,66	22" F342		0,18	878	47,99
		0,72	527	16,66			0,67	1756	80,30
L 2000	12,29	1,63	797	20,76	L 3500	72,30	1,49	2658	104,12
		2,69	1031	23,41			4,68	4731	140,54
12.3/4" F105		0,2	263	12,19	22" F342		0,2	878	50,61
		0,78	527	19,53			0,73	1756	86,31
L 2500	15,42	1,76	797	24,68	L 4000	82,74	1,63	2658	113,24
		2,91	1031	28,05			5,1	4731	155,13
12.3/4" F105		0,22	263	13,41	24" F424		0,16	0	0,00
		0,84	527	21,99			0,61	878	47,99
L 3000	18,55	1,9	797	28,15	L 3000	0,00	1,36	1756	80,30
		3,13	1031	32,24			4,27	2658	104,12
14" F134		0,16	336	11,17	24" F424		0,18	878	50,61
		0,61	672	17,00			0,67	1756	86,31
L 1500	11,68	1,38	1018	20,87	L 3500	82,74	1,49	2658	113,24
		2,34	1335	23,47			4,68	4731	155,13
14" F134		0,17	336	13,60	24" F424		0,2	0	0,00
		0,67	672	21,27			0,73	0	0,00
L 2000	15,68	1,51	1018	26,50	L 4000	0,00	1,63	0	0,00
		2,56	1335	30,06			5,1	0	0,00
14" F134		0,19	336	15,56					
		0,73	672	24,92					
L 2500	19,68	1,64	1018	31,49					
		2,79	1335	36,03					
14" F134		0,21	336	17,12					
		0,79	672	28,06					
L 3000	23,68	1,77	1018	35,93					
		3,02	1335	41,43					

Notes:

The connections for refrigerant for the gas- and liquid side are pipe connections intended for welding. Flanges for welding or soldering can be delivered at an additional price. For connections for water, all types are delivered with flange connections. Pumping down capacity is based on appr. 85% free volume.

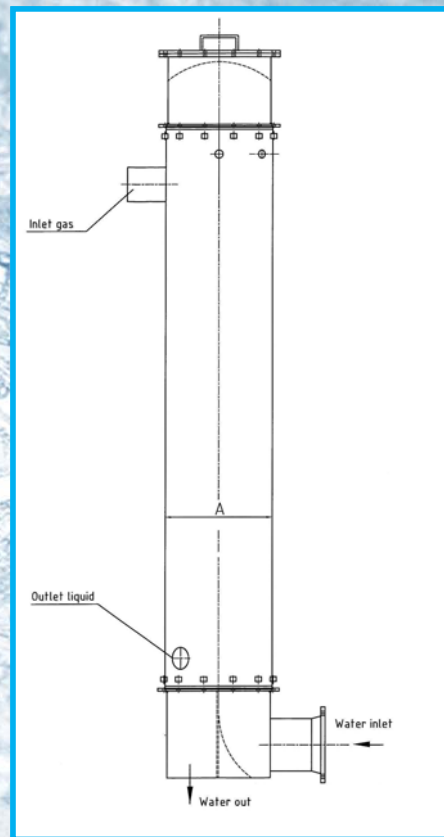
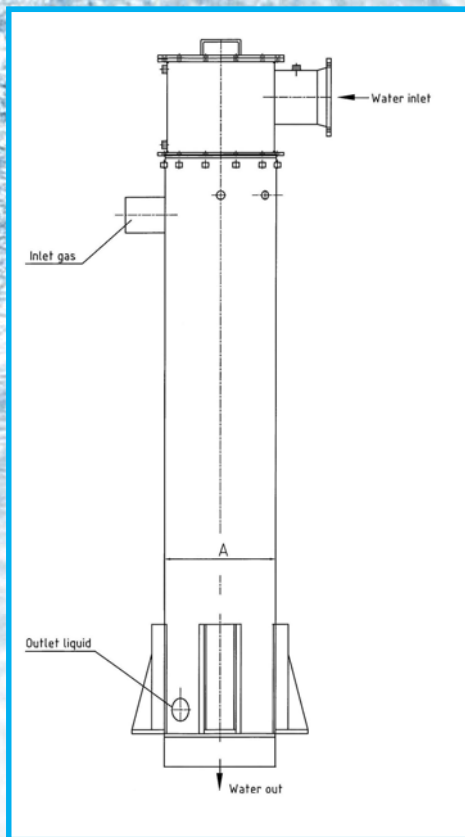
Type SKN	Cooling surface	Press. loss		Cond. loading factor
4 pass	m ²	m WG	l/min	KW °C
				0,000086
				0,000172
8 5/8" F28		0,13	35	1,49
		0,52	70	2,35
L 1100	1,77	1,15	106	2,94
		6,58	255	4,23
8 5/8" F28		0,16	35	1,78
		0,61	70	2,91
L 1500	2,44	1,36	106	3,72
		7,79	255	5,55
8 5/8" F40		0,18	50	2,13
		0,61	100	3,36
L 1100	2,53	1,37	152	4,20
		3,83	255	5,31
8 5/8" F40		0,19	50	2,54
		0,71	100	4,15
L 1500	3,49	1,58	152	5,31
		4,42	255	6,87



TEKNOTHERM

MARINE

TKN VERTICAL CONDENSER



Titanium vertical condenser, shell and tube design for ammonia refrigerant, and cooled by seawater.

Condenser is made with seamless steel tubes in quality P.23GH.

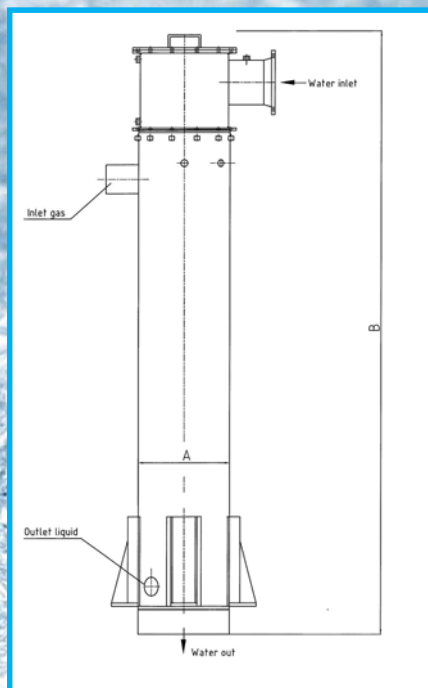
The tube plates are made of stainless steel AISI316L and the innertubes are of titanium grade. 2, ASTM 338.

The end covers will be in hot dipped galvanized steel/plastic.

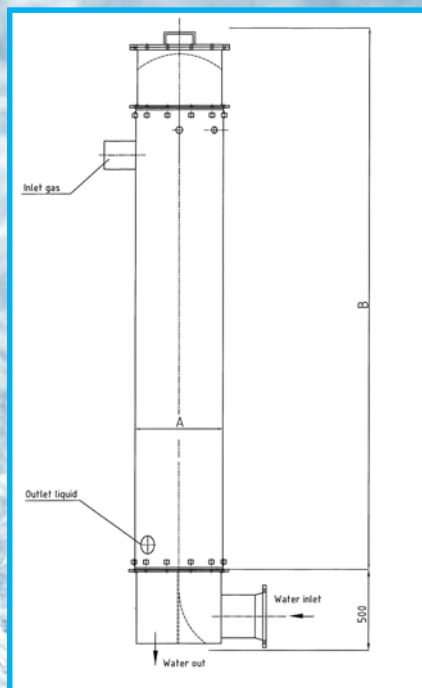
The condenser's external surface to be painted with rust protecting paint.

The condenser to be classified according to PED.

TKN VERTICAL CONDENSER



1 pass



2 pass

Modell	Refr. Cap. kW	$^{\circ}\text{C}$ Δt	A	B	No. of tubes
TKN-22"/4	-	-	ø 560	5200	268/342
TKN-24"/3	-	-	ø 610	4200	330/424
TKN-24"/3,5	-	-	ø 610	4700	330/424
TKN-24"/4	-	-	ø 610	5200	330/424
TKN-27"	-	-	ø 750	5200	364/572

Reference data based on:

Shell : carbon steel, epoxy painted
 Innertubes : titanium
 Tube plate : acid resistant AISI 316L
 End cover : hot dipped galvanized /
 plastic

Note! All data and measures are subject to final design.

We reserve the rights to change specification without notice.

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