BUUS ICE A/S.

Installation manual for ice machines
Type V156, V316, V373, V619, VD746 and VD1206

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Preface

A standard ice machine comprises of various parts, select with a particular application in mind. This instruction manual is not limited to precisely your machine, but describes all the variations available from Mk4 ice machine serial no. 3050.

The table below shows general info for your machine at the time is was supplied by BUUS. Using the table as a guideline, you will be able to find all relevant information in this manual.
Together with the machine is also a specific data chart covering the specific delivery.

Please see the name plate on front of the ice machine as well.

Ice machine type

Ice machine serial no.

Drum serial no.	Right		Left	
Refrigerant	R404A □	R507 □	R717 □	R744 □
Refrigerant system	Liquid level control □		Pump circulation □	
Knife type	Fresh water □		Sea water □	
Connection side (type V only)	Right □		Left □	
Drum approval	PED □	LRS □	DNV □	
	ASME □	CRN □		

The instruction manual is roughly divided into three main sections:

a. Chapters 1-4, which describe the basic function, size and capacity. Guidelines and suggestions for installation are also given.

   In addition to describing the ice machine itself, a series of control components – not included in the standard product – are also described. All this information contributes to perfecting the interplay between the ice machine at the rest of the refrigeration plant. This section is particularly relevant before you take delivery of the ice machine.

b. Chapters 5-8 describe installation, operation and maintenance. This section is, of course, necessary when you take delivery of the ice machine, but should also be used as a day to day reference.

c. Chapter 9 comprises technical drawings and diverse sketches indicating spare part sets.

It is absolutely necessary that all personnel involved with operating the ice machine have read and understood this instruction manual. Apart from ensuring optimal and effective operation, Buus cannot be held liable for accidents or damage occurring during the guarantee period if incorrect machine operation is the cause.

The contents of this instruction manual must not be copied or communicated to a third party without the express permission.

Warning!
Please note that cleaning/flushing compressors, condensers, tanks or any other part of the refrigerant plant that may contain refrigerant with steam or hot water is exceedingly **dangerous** and can be explosive.

Furthermore, tanks and cooling coils that may contain liquid refrigerant must **not** be **completely** closed until the liquid level has been checked – such vessels must **never** be completely full.

The ice machine drums may be completely filled with refrigerant. If the temperature rises, the pressure generated may burst the drum. It is, therefore, essential that these drums are connected to a safety valve system!

The drum surface is coated with a thin layer of metal to prevent corrosion. Although this coating can tolerate scrapes by the ice it **cannot** stand sporadic mechanical stress from hard objects. Consequently, check that the knife does **not** touch the surface of the drum at ambient temperature. Avoid knocking the surface of the drum.

The drum may also be delivered without coating, with carbon steel drum(s). If so it is important to prevent corrosion after every use. Wipe of the drum and coat it with an anticorrosive spray.

If combustion engines are to be installed in the same room as refrigeration plant or pipes containing refrigerant, it is imperative that combustion air for the motor is taken from a point where refrigeration gas is never likely to be present – even if the gas accidentally escapes from the system.

If this warning is ignored, the lubricating oil from the combustion engine may mix with the refrigerant – resulting in corrosion or perhaps severely damaging the motor.

Note: When the ice machine unit is delivered, the compressor is charged with refrigerator machine oil type ESSO Zerice S68.

Content

First aid for accidents with ammonia, always revert to specific Safety data Sheet.

(Chemical formula: NH_3 – refrigerant no.: R717)

Warning!

No plant can ever be said to be too safe - safety is a way of life.

General

Ammonia is not a cumulative poison. It has a distinctive, pungent odour that even at very low, harmless concentrations is detectable by most persons.

Since ammonia is self-alarming, it serves as its own warning agent so that no person remains voluntarily in hazardous concentrations. Since ammonia is lighter than air, adequate ventilation is the best means of preventing an accumulation.

Experience has shown that ammonia is extremely hard to ignite and under normal conditions a very stable compound. At extremely high, though limited concentrations, ammonia can form ignitable mixtures with air and oxygen and should be treated with respect.

Basic rules for first aid

Always call a doctor immediately.

Be prepared: Keep an irrigation bottle available containing a sterile isotonic (0.9%) NaCl-solution (salt water). A shower or a water tank should be available near all bulk installations with ammonia.

When applying first aid, the persons assisting must be duly protected to avoid further injuries.

First aid measures

Inhalation: Immediately, move affected personnel into fresh air and loosen clothing restricting breathing.

Call a doctor/ambulance with oxygen equipment.

Keep the patient still and warmly wrapped in blankets.

If mouth and throat are burnt (freeze or acid burn) and the patient is conscious, let him drink water in small mouthfuls.

If the patient is conscious and mouth and throat are **not** burnt, feed him sweetened tea or coffee (**never** feed an unconscious person).

Oxygen may be given to the patient, but **only** when authorised by a doctor. If the patient stops breathing, apply artificial respiration.

Eyes: In case of injuries from liquid splashes or concentrated vapour, immediately rinse with water (preferably using an eye rinser) and consult a doctor. Continue rinsing until otherwise stated by a doctor.

If the affected person wears contact lenses these must be removed before the rinsing.

Skin: In case of burns from liquid splashes or concentrated vapour, immediately wash with large quantities of water until the pain stops.

Consult a doctor about actual burns.

After washing, apply wet compresses - wetted with a sterile isotonic (0.9%) NaCl-solution (salt water) - to affected areas until medical advice is available.

First Aid for Accidents with HFC/HCFC, always revert to specific Safety data Sheet.

Warning!

No plant can ever be said to be too safe - safety is a way of life.

General

HFC/HCFC form colourless and invisible gasses which are heavier than air and smell faintly of chloroform at high concentrations.

Characteristics:

- non-toxic
- non-inflammable
- non-explosive
- non-corrosive

When heated to above approx. 300°C, they break down into toxic, acid gas components, which are strongly irritating and aggressive to nose, eyes and skin and generally corrosive.

Besides the obvious risk of unnoticeable, heavy gases displacing the atmospheric oxygen, inhalation of larger concentrations may have an accumulating, anaesthetic effect which may not be immediately apparent. 24 hours medical observation is therefore recommended.

Basic Rules for First Aid

When affected persons are moved from low-lying or poorly ventilated rooms where high gas concentrations are suspected, the rescuer must wear a lifeline and be under constant observation from an assistant outside the room.

Do not use adrenaline or similar heart stimuli.

Inhalation: Immediately move affected persons into fresh air. Keep them still and warm and loosen clothing restricting breathing.

If the patient is unconscious, call a doctor/ambulance with oxygen equipment immediately.

Apply artificial respiration until a doctor authorizes other treatment.

Eyes: Immediately rinse with water (preferably using an eye rinser) and consult a doctor. Continue rinsing until otherwise stated by a doctor.

If the affected person wears contact lenses these must be removed before the rinsing.

Skin: In case of frost-bite, immediately rinse with lukewarm water (max. 37°C) and remove all clothes impeding blood circulation.

Consult a doctor.

Avoid direct contact with contaminated oil/refrigerant mixtures from electrically burnt-out hermetic compressors.

First Aid for Accidents with CO2, always revert to specific Safety data Sheet.

(Chemical formula: CO2 – refrigerant no.: R744)

Warning!

No plant can ever be said to be too safe - safety is a way of life.

General

CO2 form colourless and invisible gasses which are heavier than air and in high concentrations may cause asphyxiationat.

Characteristics:

- non-toxic
- non-inflammable
- non-explosive
- non-corrosive

Besides the obvious risk of unnoticeable, heavy gases displacing the atmospheric oxygen, and alarm must be present since you cannot smell the CO2.

Basic Rules for First Aid

When affected persons are moved from low-lying or poorly ventilated rooms where high gas concentrations are suspected, the rescuer must wear a lifeline and be under constant observation from an assistant outside the room.

Do not use adrenaline or similar heart stimuli.

Inhalation: Low concentrations of CO2 cause increased respiration and headache.
In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation.
Remove victim to uncontaminated area wearing self-contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped..

Apply artificial respiration until a doctor authorizes other treatment.

Eyes: Immediately rinse with water for minimum 15 min. (preferably using an eye rinser) and consult a doctor. Continue rinsing until otherwise stated by a doctor.

If the affected person wears contact lenses these must be removed before the rinsing.

Skin: In case of frost-bite, immediately rinse with lukewarm water (max. 37°C) and remove all clothes impeding blood circulation.

Consult a doctor.

Ingestion: Ingestion is not considered a potential route of exposure.

Protecting the Operator as well as the Environment

Warning!

No plant can ever be said to be too safe - safety is a way of life.

Increasing industrialisation threatens our environment. It is therefore absolutely imperative to protect nature against pollution.

To this end, many countries have passed legislation in an effort to reduce pollution and preserve the environment. This legislation applies to all fields of industry, including refrigeration, and must be complied with.

Pay extra attention to the following substances:

- refrigerants
- cooling media (brine, etc.)
- lubricating oils

Refrigerants usually have a natural boiling point considerably below 0°C. This means that liquid refrigerants can be extremely harmful if they come into contact with skin or eyes.

High concentrations of refrigerant vapours can be suffocating when they displace air.

If high concentrations of refrigerant vapours are inhaled, they will attack the human nervous system.

When halogenated gasses come into contact with open flame or hot surfaces (over approx. 300°C), they will decompose to produce poisonous chemicals. These have a very pungent odour and will thus warn personnel of their presence.

At high concentrations R717 causes respiratory problems. When the amount of ammonia vapour in air is between 15 and 28 vol. % the combination is explosive and can be ignited by an electric spark or open flame.

Oil vapour in the ammonia vapour increases this risk significantly as the point of ignition falls below that of the mixture ratio stated.

Usually the strong smell of ammonia will warn personnel before the concentration becomes dangerous.

The following table shows the values for the max. permissible refrigerant content in air measured in volume %. Certain countries may, however, have official limits different from the ones stated.

Max. permissible refrigerant content		Halogenated refrigerants						Ammonia	CO2
		HFC					HCFC		
		R134A	R404A	R407A	R410A	R507	R22	R717	R744
TWA Time weighted average during a week	Unit Vol. %	0,1	0,1	0,1	0,1	0,1	0,1	0,005	0,5
Warning smell	Vol. %		0,2					0,002	

Furthermore, it can be said about refrigerants:

HFC/HCFC

- If released into the atmosphere, halogenated refrigerants of the types CFC and HCFC (e.g. R22) will contribute to the depletion of the ozone layer in the stratosphere. The ozone layer protects the earth from the ultraviolet rays of the sun. Refrigerants of the types CFC, HFC and HCFC are greenhouse gases which contribute to an intensification of the greenhouse effect. They must, therefore, **never** be released into the atmosphere. Use a separate compressor to draw the refrigerant into the plant condenser/receiver or into separate refrigerant cylinders.

Ammonia

- Ammonia is easily absorbed by water: At 15°C 1 litre of water can absorb approx. 0.5 kg liquid ammonia (or approx. 700 litres ammonia vapour).

- Even small amounts of ammonia in water (2-5 mg per litre) are enough to wreak havoc with marine life if allowed to pollute waterways and lakes.

- As ammonia is alkaline, it will damage plant life if released into the atmosphere in large quantities.

Hydro Carbons (HC)

- HC gasses are a group of B1 refrigerants characterized as very flammable.

- Hydro carbons are odourless and non-toxic gasses. Specific mixtures of air and gas create danger of explosion. As the gasses are heavier than air, they will be concentrated at the lowest possible level in case of leaks.

Carbon Dioxide (CO_2)

- Carbon dioxide (CO_2) is a greenhouse gas with a GWP (Global Warming Potential) factor of 1. It is found in the atmosphere in a concentration of 0.036 vol. % (360 parts per million, ppm). As CO_2 is extracted from atmospheric air, it can safely be released into the atmosphere and does not contribute to enhancing the greenhouse effect.
- The boiling point for CO_2 is -78.5°C at 1.013 bar.
- CO_2 is an odourless, non-toxic non-inflammable gas. At concentrations higher than 5000 ppm the gas can be dangerous for humans. The gas is heavier than air and will thus be concentrated on the lowest level of the room in case of a leak. In closed rooms the gas can displace oxygen and cause suffocation.

Refrigerant evacuated from a refrigeration plant must be charged into refrigerant cylinders intended for this specific refrigerant.

If the refrigerant is not to be reused, **return** it to the supplier or to an authorized incineration plant.

Halogenated refrigerants must **never** be mixed. Nor must R717 ever be mixed with halogenated refrigerants.

Purging a refrigeration plant

- If it is necessary to purge air from a refrigeration plant, make sure to observe the following:
- Refrigerants must not be released into the atmosphere (except CO_2).
- When purging an R717 plant, use an approved air purge. The purged air must pass through an open container of water for any remaining R717 to be sent to an authorized incineration plant.
- Halogenated refrigerants **cannot** be absorbed by water. An approved air purge must be fitted to the plant. This must be checked regularly by use of a leak detector.

Note: The occurrence of air is usually an indication of poor maintenance or lack of thoroughness at installation.

Cooling media

Salt solutions (brines) of calcium chloride ($CaCl_2$) or sodium chloride (NaCl) ar often used.

In recent year's alcohol, glycol and halogenated compounds have been used in the production of brine.

In general, all brines must be considered harmful to nature and they must be used with caution. Be very careful when charging or purging a refrigeration plant.

Never empty brines down a sewer or into the environment.

The brine must be collected in suitable containers clearly marked with the contents and sent to an approved incineration plant.

Lubricating oils

Warning!

When charging oil, follow the safety instructions given by the oil supplier (MSDS: Material Safety Data Sheet). Always avoid direct contact with the oil as this may cause skin allergies. Always use protective equipment - goggles and gloves - when charging oil.

Refrigeration compressors are lubricated by one of the following oil types depending on the refrigerant plant type, and operating conditions.

- Mineral oil (M oil)
- Alkyl benzene-based synthetic oil (A oil)
- Polyalphaolefine-based synthetic oil (PAO oil)
- Mixed A and PAO oil (AP-oil)
- Polyalkylen Glycol-based synthetic oil (PAG oil)
- Ester oil (E oil)

When changing oil on the compressor or draining oil from the vessel of the refrigeration plant, always collect the used oil in containers marked “waste oil” and send them to an approved incineration plant. It is **not** recommended to re-use oil.

Refrigerants

Great caution must be exercised when dealing with refrigerants. The supplier of the refrigeration plant has a duty to inform user and operator about the dangers of the used refrigerant. Safety data sheets etc. must be available to the operator.

Cooling water systems

Warning!

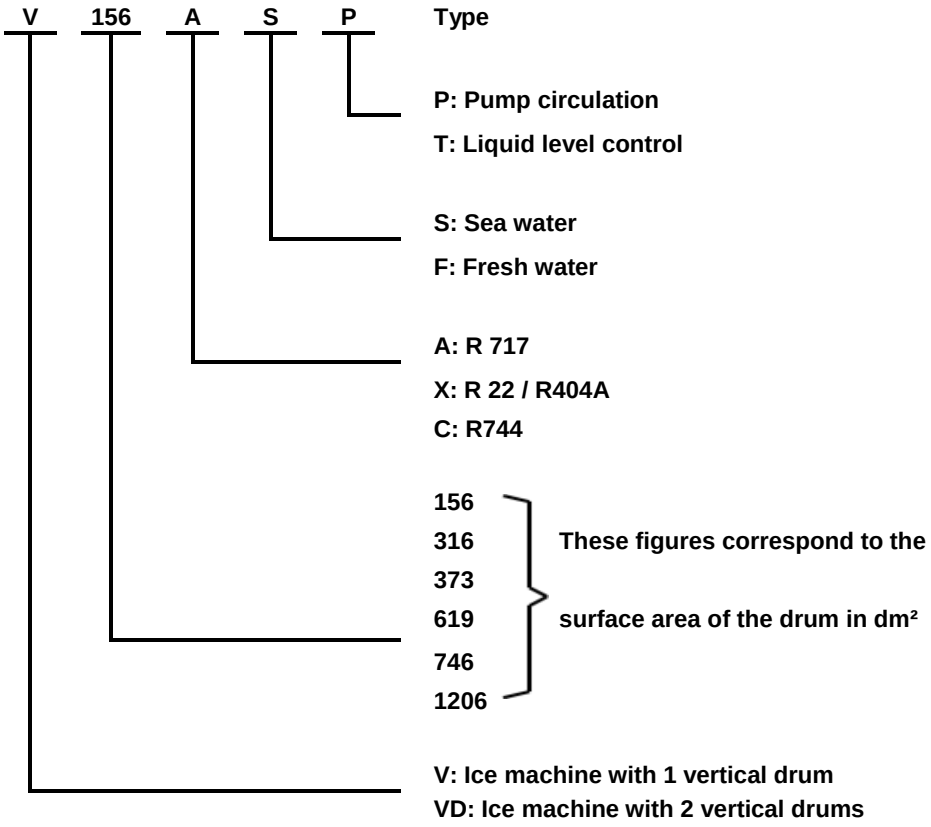
The recirculation water system may contain chemicals or biological contaminants, including legionella, which can be harmful if inhaled or ingested. Water systems should only be operated with an effective biological treatment programme.

Note:

These instructions only provide general information. The owner of the refrigeration plant is responsible for ensuring that all codes, regulations and industry standards are complied with.

1. Description

1.1 Type code, example



1.2. Construction

The ice machine types V and VD are built up of the following main components (please refer to the principle sketch Fig. 1.4

The frame, closed at the sides and rear, is made of all-welded sheet steel which is hot-dip galvanized. The ice machine can be moved by crane. The lower part comprises two trays (m) and (n) placed one above the other, each with its own drain.

The drum (e) is made of all-welded steel, with an aluminium coating. On the cylindrical part of the drum, this coating has a completely smooth finish. The drum is fitted vertically in the frame between the top of the frame and the upper tray with ball bearings.

The knife (f) is made of stainless steel and held in place by a solid, hot-dip galvanized steel bar which is bolted to the frame at each end. The knife can be set in exactly the right position, close to the surface of the drum. If the ice is produced from sea-water, the knife has a vertical blade. A specially shaped knife

device with stainless knives, shown very simplified in the principle sketch Fig. 1, is used for making ice from freshwater.

The water system is built into the frame and com prises a centrifugal pump (l), with an integrated electric motor (k), a filter (d), a throttling valve (c), distribution pipe with nozzles (g), a water reservoir (h) in hot-dip galvanised sheet steel, a float or throttle valve (i) and the internal pipes and hose connections. Threaded sockets for connecting the water and drain are also fitted.

The refrigerant system is built into the frame and drum and comprises a stuffing box (in the base of the drum) with inlet (q) and discharge (r) for the refrigerant and either a special refrigerant level regulating device, or a throttling valve in the inlet line, which regulates the refrigerant. The inside of the drum is specially shaped to optimize the cooling potential. Inlet and outlet pipes for the refrigerant are supplied with welding flanges.

The driving station (a) for the drum is a packaged unit comprising an electric motor (b), a manually regulated belt variator and a shaft mounted double worm gear. The driving terminal is mounted on the top shaft of the drum above the top of the frame and can easily be used, serviced or removed.

Electric motors in the water system (k) and the driving station (b) are jacket cooled, three phase A.C. motors.

A standard set of **spare parts**, consisting of a set of gaskets and O-rings for each shaft seal, is supplied together with the ice machine.

The VD type ice machine is basically two type V ice machines in a common frame, each able to operate independently of the other. Seen from above, the left hand drum rotates in a clockwise direction and the right hand drum, as for the V type ice machine, rotates in an anti-clockwise direction. The ice which is scraped off the two drums falls between the knives, i.e. in the front of the machine.

The inlet and outlet connections for the refrigerant are usually on the right-hand side of the V type ice machine. However, if necessary, this ice machine can be supplied with connections on the left-hand side.

All materials and components in both types of ice machine are protected against corrosion or made of non-corrosive materials.

1.3. Function

(Refer to the principle sketch Fig. 1).

General

The ice machine, types V and VD, produces flake ice of a regular thickness by freezing fresh water or sea-water on the cylindrical surface of a rotating drum. The interior surface of the drum is constantly covered (flooded) with liquid refrigerant which cools the sides of the drum by evaporation. Water, from the distribution pipe (g), is sprinkled onto the outer, cylindrical surface of the drum. When the water comes into contact with the cold surface it freezes, excess water runs way into the upper base tray (n) in the frame. To ensure that the ice is dry and sub-cooled, water is not sprinkled on the area immediately before the knife. The layer of ice which forms on the drum is scraped off by the knife (f) and falls down in front of the middle of the ice machine (j).

Note: The knife must not come into contact with the drum surface.

The ice system

The required ice thickness (between approx. 1,5 - 4 mm) can be adjusted by altering the speed with which the drum rotates (the slower the drum rotates, the thicker the ice will be).

If freshwater is used, a small amount of salt (less than 0.05%) can be added by means of the salt dosing pump (included in the supply) to prevent the ice from sticking to the surface of the drum. (Please refer to *chapter 4.9, Salt dosing system*.)

The refrigeration requirement for various quantities of ice can be determined by using the graphs in *section 3, Capacity*.

Refrigerant system

The liquid refrigerant is fed into the drum through a pipe (q) and stuffing box (p). The saturated refrigerant vapour leaves the drum through the stuffing box at (r). The drum is kept flooded by regulation of the liquid level, as follows:

- by a manual valve fitted in the liquid line, when the ice machine is connected to a pump circulation system

or

- by a special built-in thermostatic liquid level regulator which controls a solenoid valve inthe liquid line.

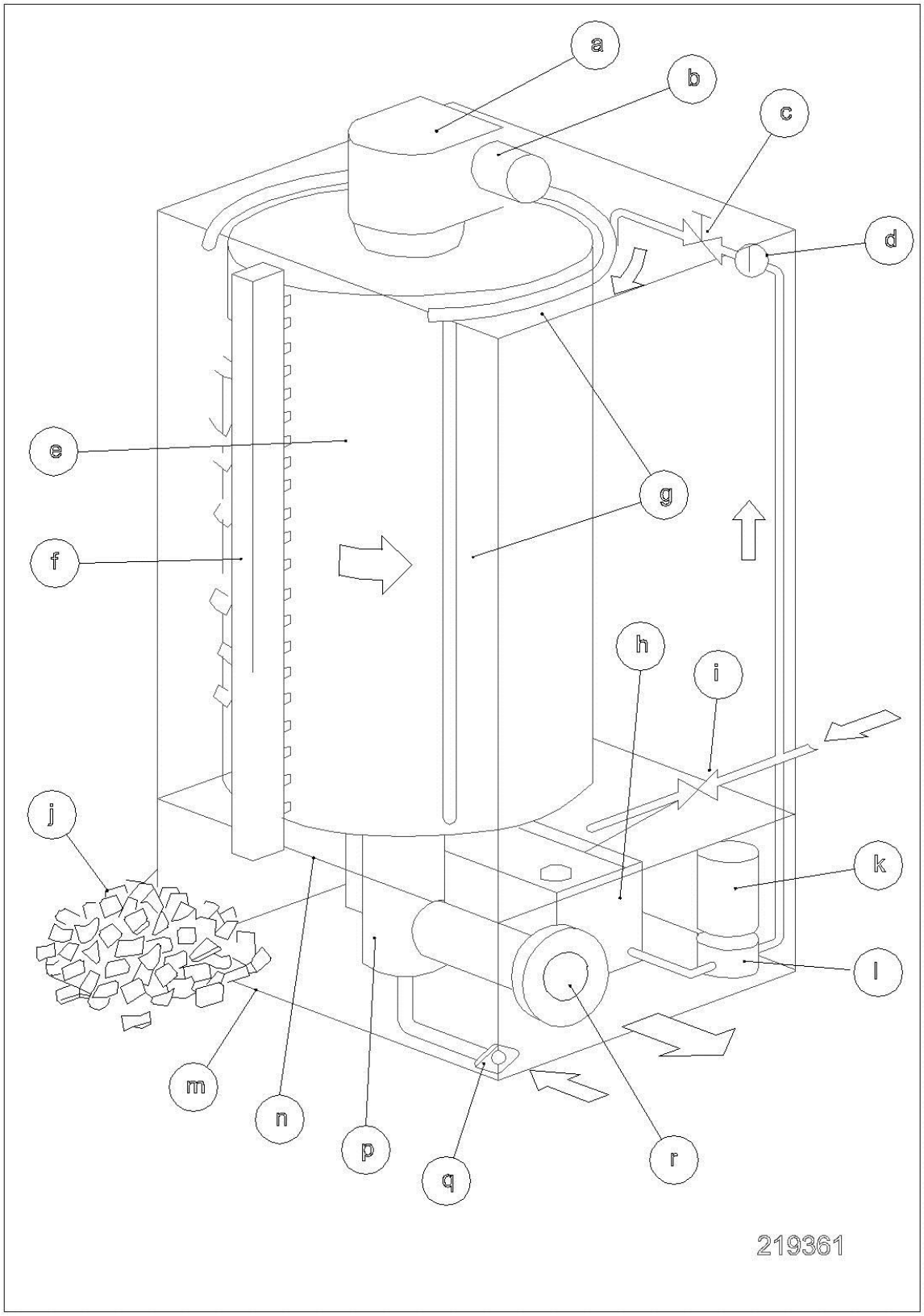
Water system

Excess water from the surface of the drum runs from the upper tray (n) to the water reservoir (h) and is then recirculated by the pump (l) through a filter (d) and throttle valve (c). The water level in the reservoir is maintained by a valve (i) which regulates the supply of make-up water.

If freshwater is used, this valve is a float valve. A manual throttle valve is used for sea-water.

The make-up water is sprayed underneath the drum to prevent ice forming then runs into the base tray (n) and collects in the reservoir.

1.4. Principle sketch.



2. Technical data

2.1. Main data

				Type of ice machine				
			V156	V316	V373	V619	VD746	VD1206
Capacity range 10°C water -17°C / -36°C R717,HFC/HCFC/R744		(Mton 24hrs)	4-11	8-23	10-27	15-44	19-55	30-88
Weight								
Net		(kg)	1100	1360	1680	1900	3350	4400
Refrigerant charge	R717 b)	(kg)	45	90	105	150	2x105	2x150
	R22 b)	(kg)	85	180	210	305	2x210	2x305
	R404A b)	(kg)	95	200	235	340	2x235	2x340
	R744 b)	(kg)	48	97	113	161	2x113	2x161
Shipping volume								
without packing		(m3)	2,7	3,7	4,3	5,7	6,8	9,4
package		(m3)	3,9	5,1	6,1	7,7	8,9	12,1
Cylindrical surface of the drum		(m3)	1,59	3,24	3,83	6,04	2x3,83	2x6,04
(Please refer to dimension sketches)								
A) Refrigerant liquid inlet (oval flange, pressure stage 25)		(mm)		34,5/28 a)			2x34,5/28 a)	
B) Suction line connection (welding flange, pressure stage 40 DIN2635 shape F)		(mm)		114,3/107,1 a)			2x114,3/107,1 a)	
C) For make-up water supply (external pipe thread ISO 7/1)				R1			R1	
Drain socket for the bottom tray (Internal pipe thread ISO 7/1)				2 x Rp ½			2 x Rp ½	
Drum speed 50 HZ Rpm 60HZ Rpm				approx. 0,6 – 3,3 approx. 0,7 – 4				
Electrical supply:				**50Hz▲**	**50Hz Y**	**60HZ▲**	**60Hz Y**	
Supply voltage (motors)		(V)		220-240	380-415	220-254	380-440	
Pilot voltage (others)		(V)		220-255	220-255	220-255	220-255	
Motor protection to I.E.C.				IP54	IP54	IP54	IP54	

a) outer diameter of piping

b) For pump circulation systems the refrigerant charge is to be added 70%

			Type of ice machine					
			V156	V316	V373	V619	VD746	VD1206
Electrical supply:								
Driving station for the drum:								
Motor power		(kW)	0,55	0,55	0,55	0,75	2x0,55	2x0,75
Speed (50/60HZ)			**50Hz ▲**		**50Hz Y**		**60Hz ▲**	**60Hz Y**
		(rpm)	1400		1400		1690	1690
		(V)	220-240		380-415		220-255	380-440
	(0,55 kw)	(A)	2,4-2,7		1,3-1,6		2,2-2,5	1,2-1,5
	(0,75 kw)	(A)	3,7-3,9		2,15-2,3		3,5-3,3	2,02-1,9
Water pump:			Motor: Insulation class B					
Motor power		(kW)	0,37	0,37		0,37	2x0,37	2x0,37
			50HZ▲		**50Hz Y**		**60HZ▲**	**60HZ Y**
Speed (50/60HZ)		(rpm)	2870		2870		3440	3440
Rated voltage		(V)	220-240		380-415		220-254	380-440
Rated current		(A)	2,05		1,2		1,65-1,60	0,95-0,92
Salt dosing pump:			Pilot voltage (50/60HZ): 200-270 V Power: max. 90 VA					
Transformer:	Primary Secondary			Pilot voltage (50/60HZ): 200 – 255 V 24V AC/DC +10%/-15% 10 W				
Heating element				24V AC/DC +10%/-15% 10W				

Pressure

- Refrigerant side:
  max. working pressure (bar)

PED	ASME	LRS	DNV
25	16,2	18,2	25

- water supply: min. 1 (bar)
- salt dosing pump:
  max. suction head 30 (mWG)
  head 1.5 (mWG)

Temperature

- refrigerant side:
  max. 40/min. -40 (°C)
- make-up water supply:
  max. +30/min. +10 (°C)
- ice machine surroundings:
  max. +40/min. +5 (°C)

2.2. Approval

Standard drums are designed to standards stipulated by the following authorities and classification societies:

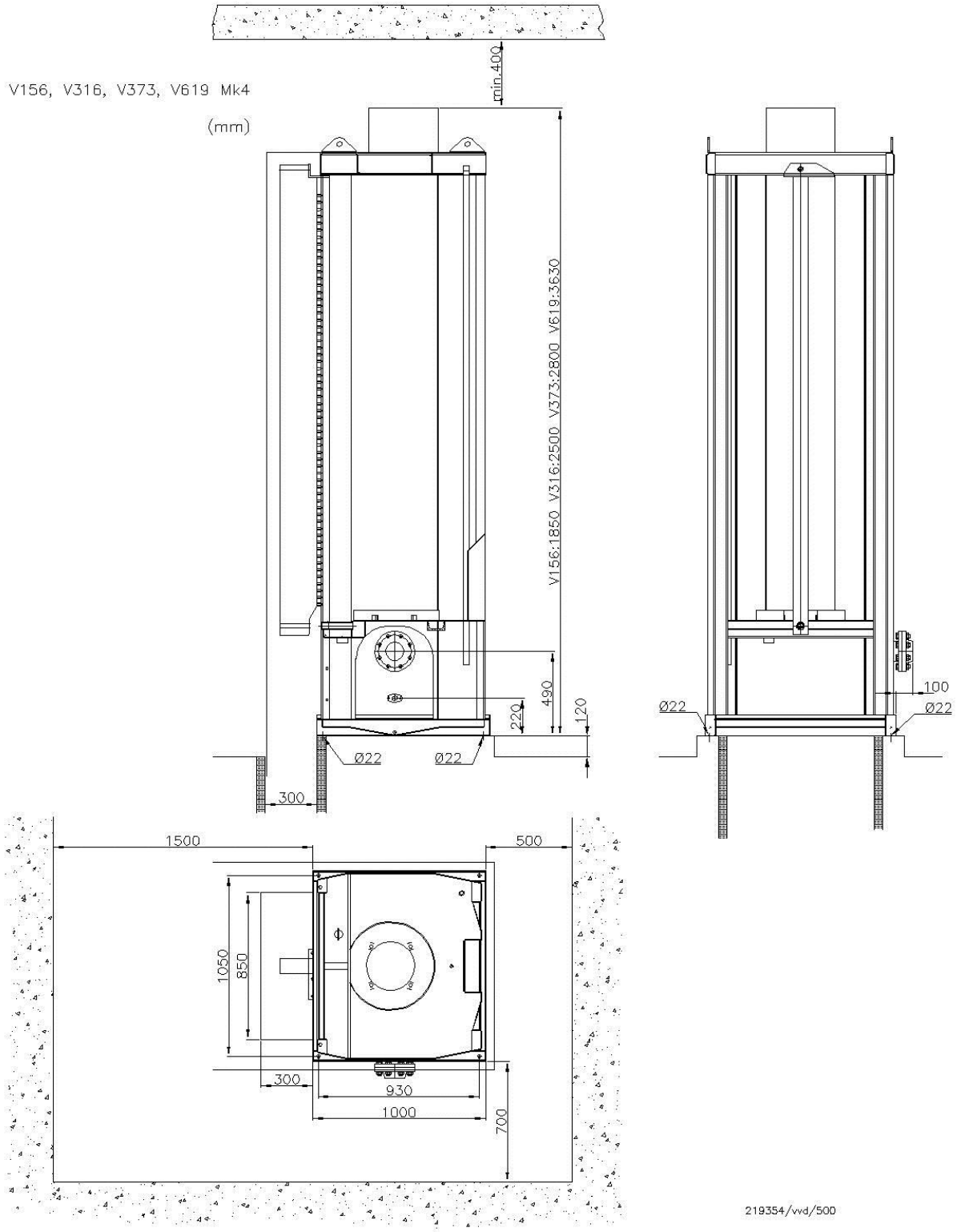
- ASME: American Society of Mechanical Engineers, USA
- PED: Force or other 3 rd. party Denmark
- LRS: Lloyds Register of Shipping, England

NDE testing, inspection and certificates can be supplied on request as an optional extra.

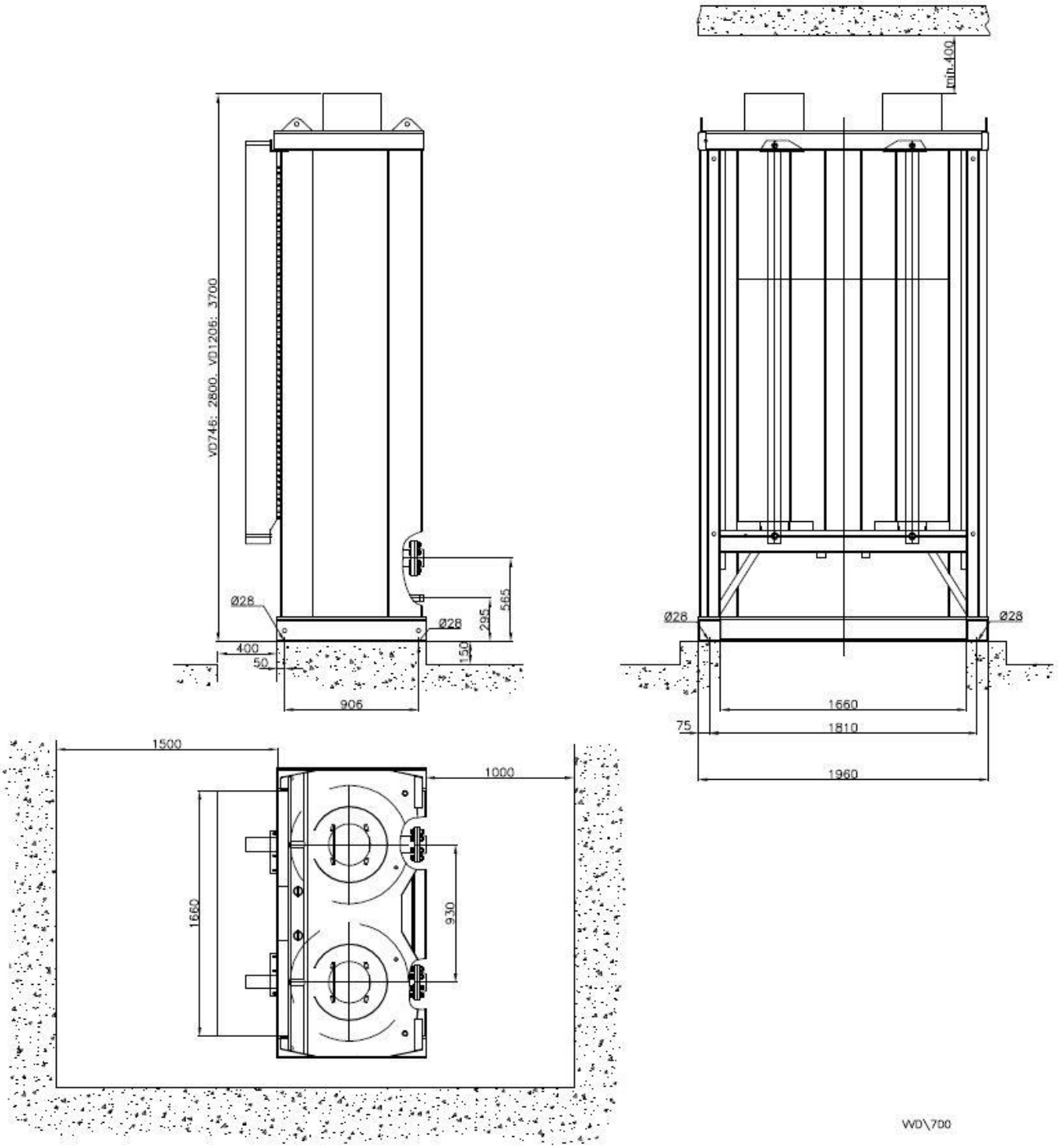
Machines with other approvals are available on request.

2.3. Dimension sketches

Note: All measurements are stated in mm.



VD746, VD1206 MK.4



3. Capacity

3.1. Electing machine size

The specific ice production and the refrigerating capacity required depend on:

- type of refrigerant, HFC/HCFC, R717, or R744
- evaporating temperature in drum (TE)
- make-up water temperature
- desired ice thickness

This selection can be made using Matchmaster COMP1 or capacity graphs. These capacity graphs are based on:

- refrigeration systems with an efficient oil separator (please refer to the comments in *section 4.4, Refrigerant system).*
- fresh water or sea water
- pump circulation or liquid level control
- cooling of the ice to approx. 0.5 x TE (°C).

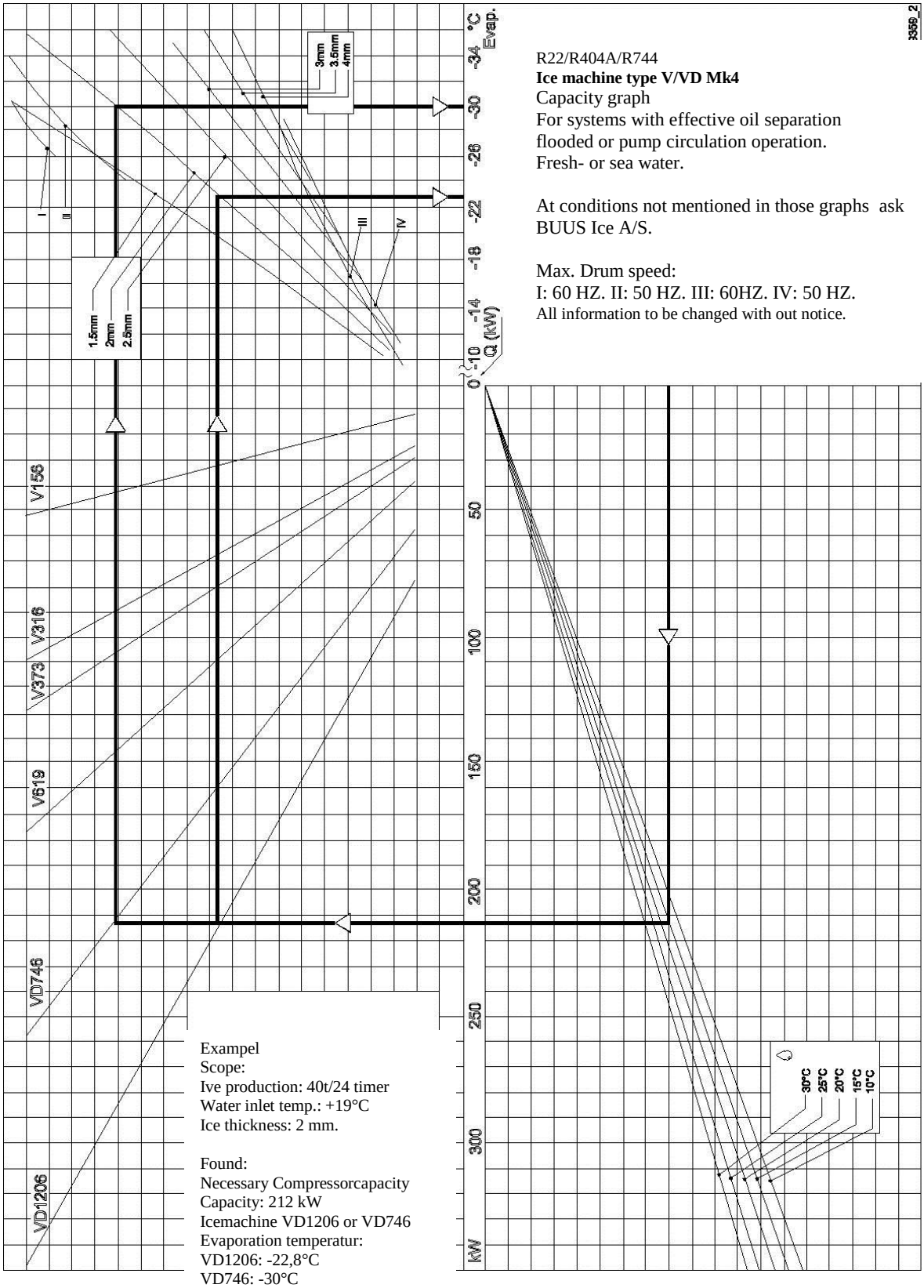
Note that the desired thickness is achieved by adjusting the rotation speed of the drum and that the thickness of the ice must be within the specified limits for minimum and maximum drum speed, depending on the frequency. The drum speed can be calculated as follows:

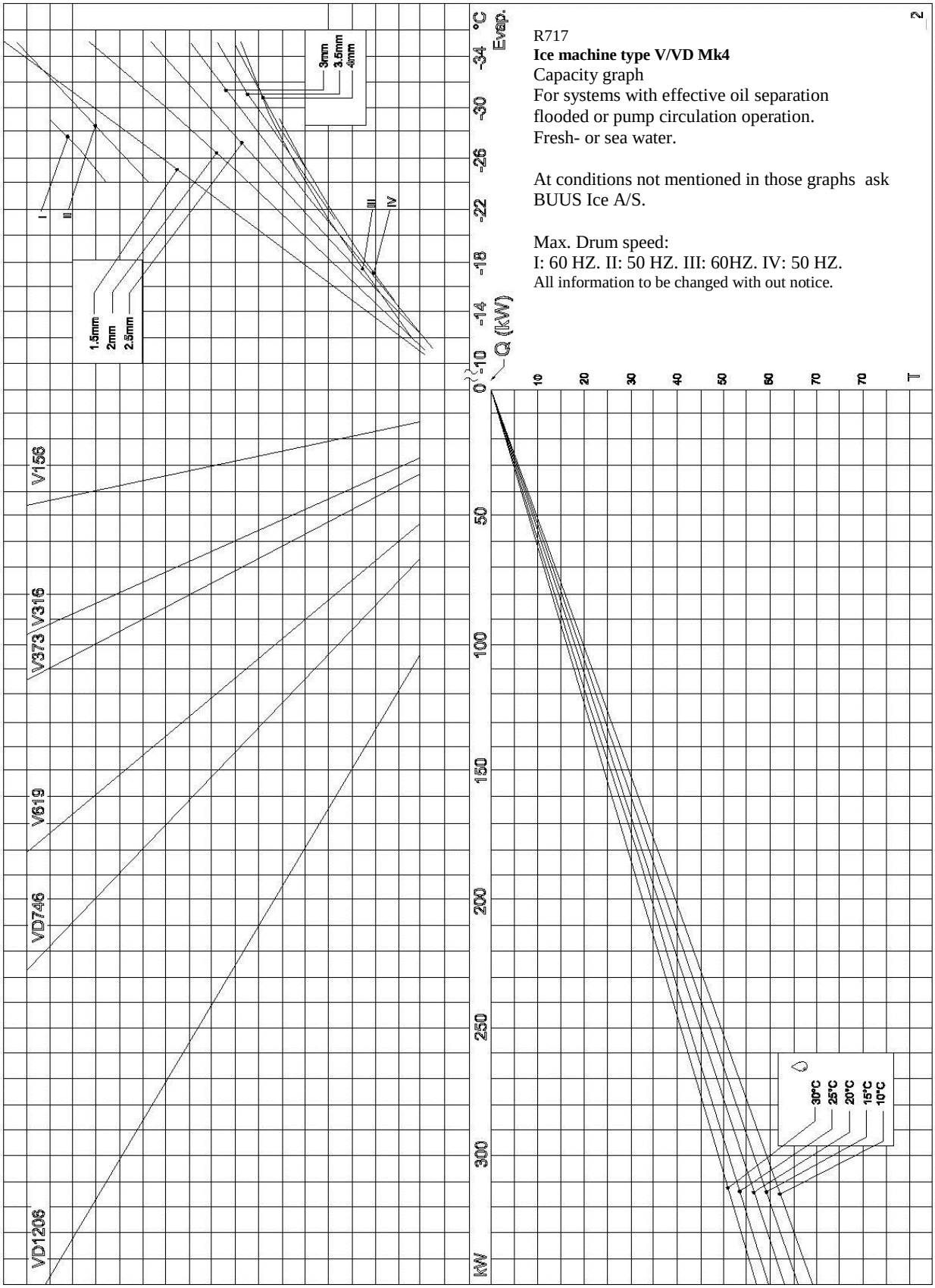
$$\text{speed (rpm)} = \frac{\text{ice production (tonnes/24 hrs)}}{1.3 \times \text{drum surface (m}^2\text{)} \times \text{ice thickness (mm)}}$$

The example in the capacity graph shows how these graphs are applied.

Note: For freshwater and ice thickness in the range of 1.5 -1.8 mm please contact us specifying the actual conditions.

3.2 Capacity graphs.




R717
Ice machine type V/VD Mk4
Capacity graph
For systems with effective oil separation
flooded or pump circulation operation.
Fresh- or sea water.
At conditions not mentioned in those graphs ask BUUS Ice A/S.
Max. Drum speed:
I: 60 HZ. II: 50 HZ. III: 60HZ. IV: 50 HZ.
All information to be changed with out notice.
Evap. °C
-34
-30
-26
-22
-18
-14
-10
0
Q (kW)
10
20
30
40
50
60
70
80
T
50
100
150
200
250
300
kW
V156
V373
V316
V619
VD746
VD1206
1.5mm
2mm
2.5mm
3mm
3.5mm
4mm
I
II
III
IV
30°C
25°C
20°C
15°C
10°C

4. Installation instructions

4.1. General

The position numbers in this main section, e.g. (C) and (2.8), refer to *section 4.6 Installation Sketch*.

As regards positions A to D inclusive (inlet and outlet dimensions for refrigerant and water), please refer also to *section 2.3 Dimension Sketches* and *section 2.1 Main Data*.

The installation drawing for the V type ice machine shows refrigerant connections positions A and B on the right-hand side. However, these can be placed on the left-hand side, if requested (using Order specification form).

4.2. Included in the Delivery

Water System

(C) Branch [a] for make-up water supply.

(2.8) Throttle valve [a] which controls water quantity admitted to the drum surface.

(2.7) Filter [a] for cleaning recirculated water. (2.11) Water pump [a] for recirculating water.

(D) Drainage branch [a] for bottom tray (one on either side)

(2.6) Drainage branch [a] for sea-water overflow (ext. thread R 1 1/2 with a cap).

(2.14) Drainage branch [a] for draining water reservoir (3/4" pipe sealed with a rubber plug)

Freshwater

(2.10) Float valve [a] for controlling the make-up water supply.

(8.0) Salt dosing pump incl. suction filter, suction and discharge hoses and injection valve; see also *section 4.9 Salt Dosing System*.

Sea-water

(2.13) During transit, the throttle valve for control ling the make-up water supply (int./ext. thread R1) is located in the water reservoir, and is to be fitted to the water intake branch (C) or the pipe.

Refrigerant System

(A) Welding counter-flange [a] for refrigerant inlet.
(B) Welding counter-flange [a] for refrigerant outlet.
(4.40) Valve with plug [a] for oil off-take from freezing drum. A loose welding branch is attached for connecting a pipe dia.10/7 [b].

Pump Circulation

(3.14) Throttle valve for controlling supply of liquid refrigerant. Connection dimensions vary according to type of ice machine and refrigerant.

Position the throttle valve at max. 2m from the flange connection (A).

Type	V156,316,373	V619	VD746	VD1206	Connection	Dimension
Refrigerant	HFC/HCFC R744	HFC/HCFC R744		R717	Welding branch	Dia. 21,3/16,7
			HFC/HCFC R744	HFC/HCFC R744	Welding branch	Dia. 26,9/22,3
	R717	R717	R717		Oval welding flange, Pressure stage 25 DIN 3159	Dia. 17/14

Liquid level Control

(3.1) Level controller [a].

(3.8) Nozzle integral with flange joint (A). Size and dimensioning are described in *section 4.5 Liquid Level Control*.

(3.2) Transformer for operating heat-sensing element.

Miscellaneous

(6.0) Axle-mounted drive station unit [a] for drum, consisting of double worm reduction gear, VFD drive and electric motor requiring mains connection only; see *section 4.8 Wiring Diagram*.

(6.11) Pot meter for controlling drum speed. (4.38)Oil reservoir [a] for compressor oil for lubricating bottom bearing.

(4.39) Lubricator nipple [a] for grease with antifreeze for lubrication of tightening rings in bottom bearing.

(4.41) Bleeder screw [a] for checking oil flow from oil reservoir to bottom bearing.

(9.0) Standard spare-parts set consisting of 1 complete set of gaskets for each stuffing box.

a) Already mounted. Includes the necessary internal connections in the ice machine.
b) External/internal pipe connection diameter.

4.3. Not included in the delivery water system

(3) Pipe for make-up water supply

(4) Drainage pipe from bottom tray and floor drain.

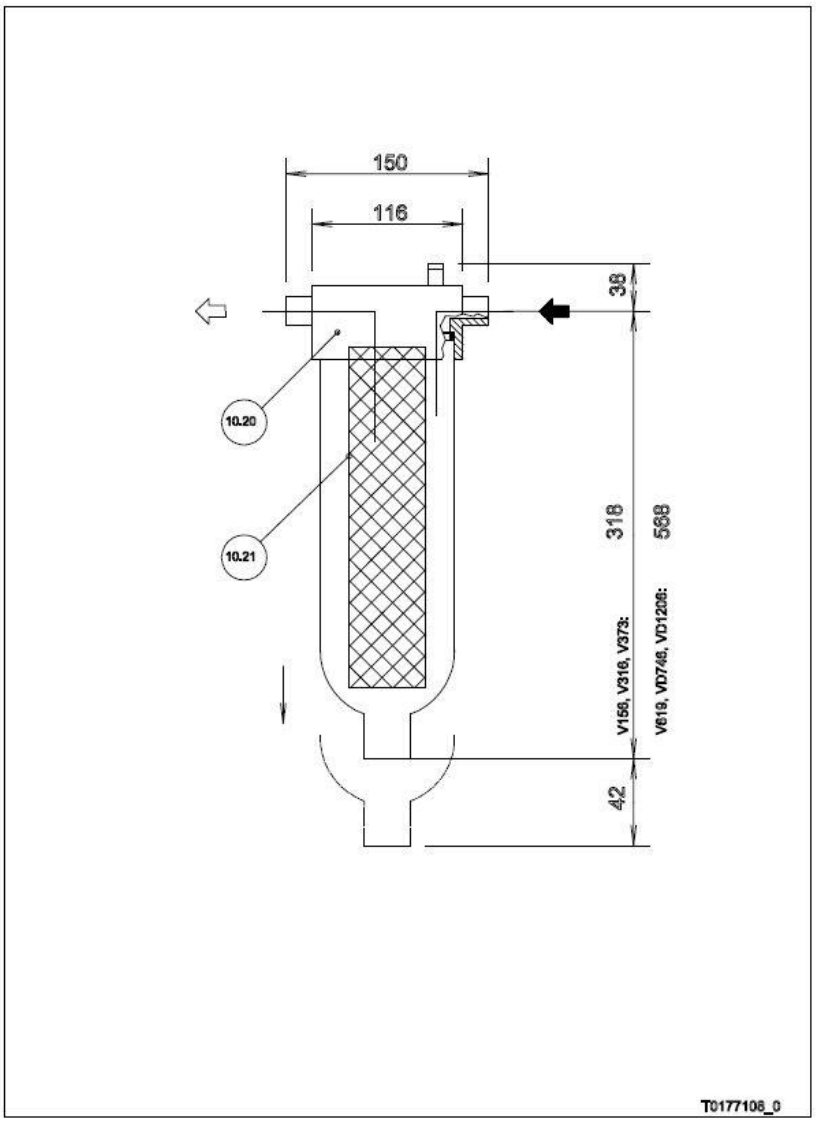
Freshwater

(10.20) Water filter with housing and filter cartridge fitted in pipe for firewater supply (can be supplied as accessory). The connection has an outer thread ISO 7/1-Rp ¾. With VD ice machines, the two filters should be connected in parallel.

(10.21) Filter cartridge for water pre-Filter(10.20)

Sea-water

(5) Drainage pipe (for connection to branch (2.6)) with visible overflow for adjustment.


150
116
38
10.20
10.21
318
568
V156, V316, V373:
V618, VD748, VD1206:
42
T0177106_0

Refrigerant System

(6) Lequid refrigerant pipe with stop valve.
(7) Suction pipe with stop valve and safety valve.
(8) Service valve for connecting evacuating equipment.
(9) Refrigerant pressure gauge.

Liquid Level Control

(3.11) Solenoid valve for mounting in liquid line ac cording to supplier's instructions, but not more than 2m from flange connection (A).

(3.12) Filter, if req., for fitting upstream of solenoid valve and otherwise according to supplier's instructions.

Miscellaneous

(10) Screens on the front of the machine to screen off and guide flake ice, e.g. down into a chute or onto a conveyor belt; see *section 4.4 Installation Requirements and Suggestions*.

(11) Equipment for salt dosing pump, e.g. mixing tank, float valve, etc.; see *section 4.9 Salt Dosing System*.

(10.0) Special tools for dismantling and assembling the stuffing box and the drum bearings (can be supplied as accessories).

4.4. Installation Requirements and Suggestions

The Salt dosing system and the wiring and piping diagrams are described in their respective sections.

Positioning

- It is advisable to provide the space needed for inspection and maintenance (*see section 2.3 Dimension Sketches*).
- An ice machine must be placed in a room free from frost. Ambient temperature should be higher than 5°C.

(12) An ice machine should be placed on a foundation with a height of approx. 150 mm to ensure a good outlet from the bottom tray to the floor drain (pos. D and 4).

If an ice machine is placed on top of an ice silo, measures must be taken to prevent the floor drain freezing.

The piping (pos. 3, 6 and 7) shown on *Installation sketches* in section 4.6 serves exclusively as an illustration and must always be dimensioned and executed to current rules for piping in industrial refrigeration plants.

All piping, especially the suction line (7), must be supported so that the ice machine cannot be exposed to stress from the weight and/or the tension of the piping.

Screens (10) (see also installation sketch in *section 4.6 Screen Design*)

(13) If an ice machine is placed on top of a refrigerated ice silo, the screen must be closed and have the same height as the machine. In all other cases an open hopper approx. half the height of the ice machine will generally be preferable.

(14) If a screen is made in sections, the joint between each section must be designed in such a way as to avoid the accumulation of ice.

(15) The screen should be fitted with an inspection hatch.

(16) The ice chute must be insulated on all sides and the insulation covered with a waterproof plate ending below the ceiling in the silo room underneath.

(17) If water condenses on the screen, the screen must be insulated.

Refrigerant System

(7) Small amounts of liquid refrigerant may mix with the suction gas in the suction pipe from the ice machine. If the compressor draws directly from the ice machine, precautions **must** be taken to prevent the liquid refrigerant from being drawn into the compressor. This can be done by fitting a liquid separator in the suction pipe. If the ice machine is installed on board a ship a liquid separator is necessary. For land-based installations, the arrangement of the refrigerant plant will determine whether or not a liquid separator is necessary.

If more than 4 freezing drums are connected on the same suction line, we would recommend that you fit a liquid separator.

If the suction line from an ice machine does not run downwards, a liquid lock (21) must be fitted in the suction line. To ensure oil return to the compressor when HFC/HCFC refrigerant is used, vertical suction lines must be dimensioned for a minimum gas velocity, typically around 10-13 m/sec.

(8.9) It is advisable to fit a pressure gauge and a service valve.

(18) A suction line, with a diameter smaller than the welding flange (B) on the ice machine, must be connected eccentrically so that the internal flange and pipes are flush at the bottom.

(19) We would recommend a flanged joint on the suction line, max 1m pipe length from the ice machine, to facilitate dismantling and access.

(20) If several freezing drums are working on the same suction line, they should be connected with a pipe elbow as illustrated.

To enable the ice machine to produce ice in the correct quantities, the oil content in the drum must be maintained at a suitably low level. The following table covers some basic requirements and recommendations in respect to the refrigeration plant.

	Pump circulation	Liquid level control
HFC/ HCFC CO2	The refrigerant liquid from the liquid separator should not contain more than 0,25% oil. If the oil content is higher, the concentration of oil in the drum can be kept down by increasing the overflow.	The oil carry-over from the compressor's oil separator must not be greater than 30-50 ppm. If the oil carry-over is slightly higher, the oil concentration can be kept down by reducing the duration of the regulation cycle. An oil feed-back can also be established via the draining valve 4.40
R717	If the liquid separator is effective, the oil content is the refrigerant will be quite low and the oil will only need to be drained off at long intervals.	If the oil carry-over from the compressor's oil separator is 30 ppm, oil should be drained from the drum every 150 hours of operation. If the oil carry-over deviates from 30 ppm, reduce or increase the frequency as appropriate.

4.5. Liquid level control

(3.8) Nozzle Size and Dimensioning:

The expansion nozzle is supplied with a nozzle size dimensioned on the basis of:

- Condensing temperature = 25°C
- Subcooling of refrigerant = 5 K

Refrigerant flow at:

- Evaporating temperature = -25°C
- Ice thickness from 2 to 3.5 mm
- Condensing temperature = 25°C
- No flash gas in the liquid supply line.

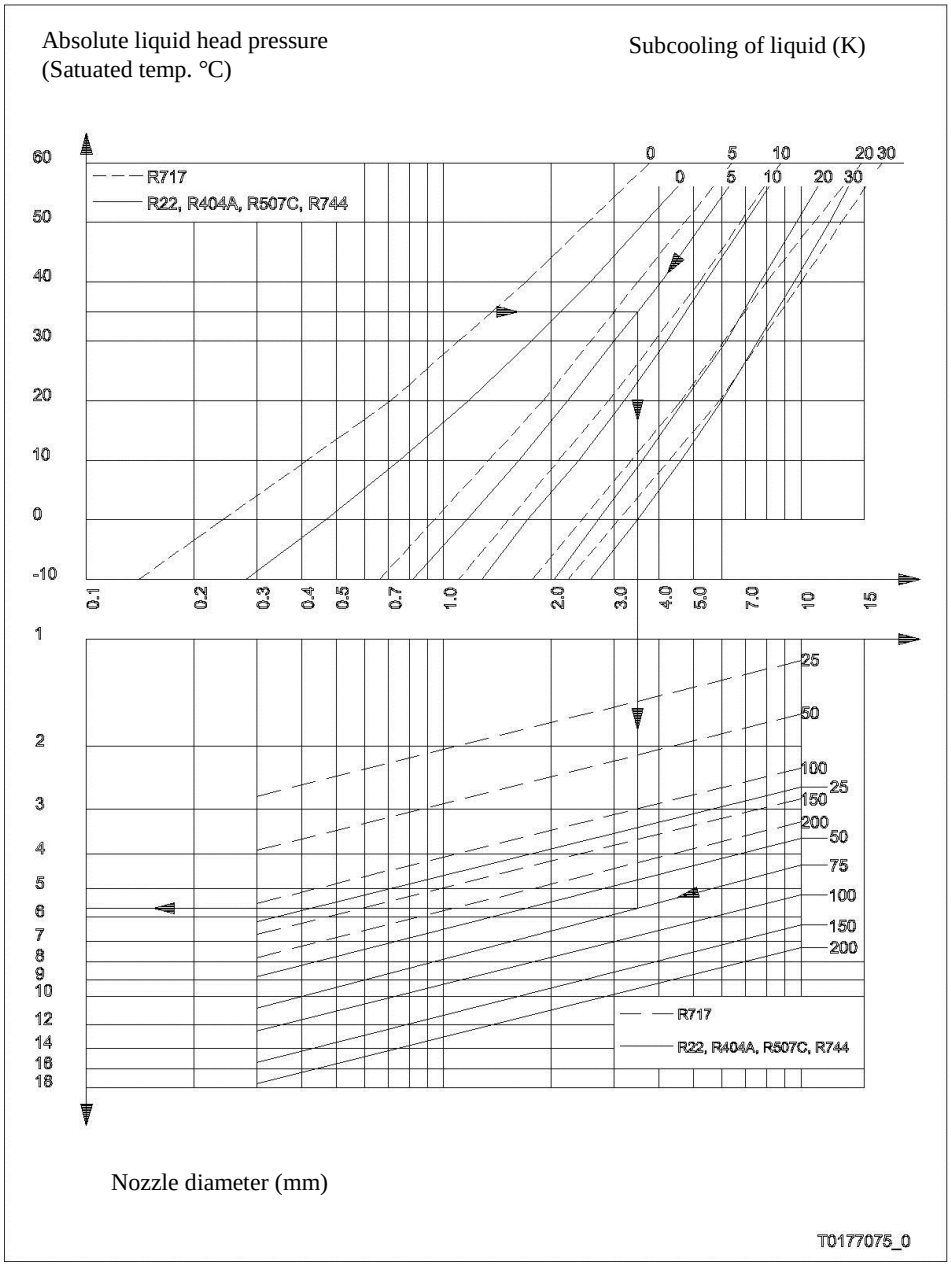
Type	Nozzle no.	Nozzle no.	Nozzle no.	Nozzle no.
	R22	**R404A**	**R717**	**R744**
V156	35	40	20	Special
V316	50	58	25	injection
V373	50	63	30	
V619	70	80	35	
VD746	50	63	30	
VD1206	70	80	35	

Nozzle size = nozzle no. x 0.1 (mm):

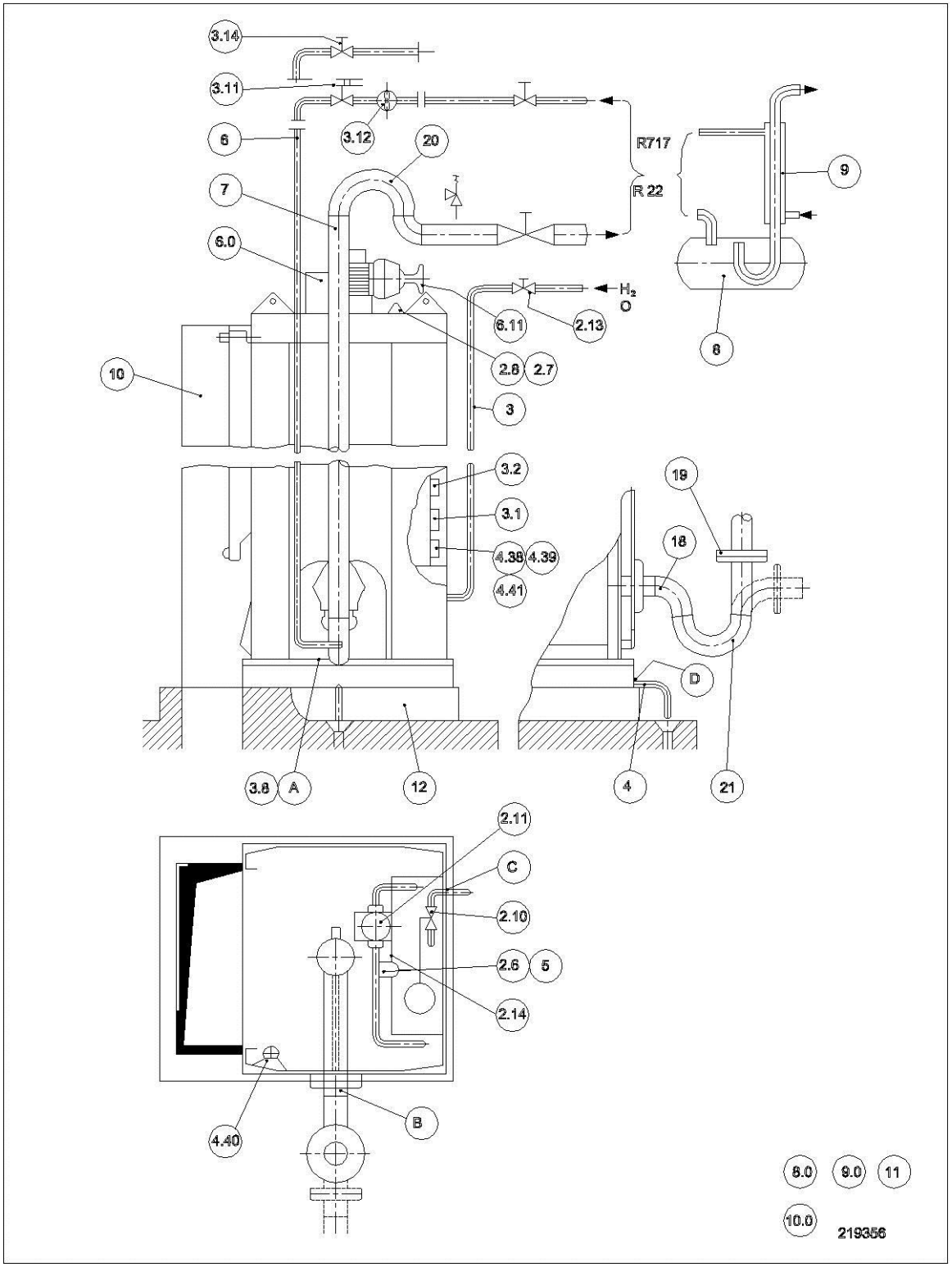
If actual operating conditions differ appreciably from the above, e.g.:

- 10 K lower condensing temperature,
- 5 K lower (or higher) subcooling,
- 25% less (or greater) refrigerating capacity as a result of other evaporating temperature can be determined by following the diagram on the next page. Round the result off to the nearest greater half or whole mm.

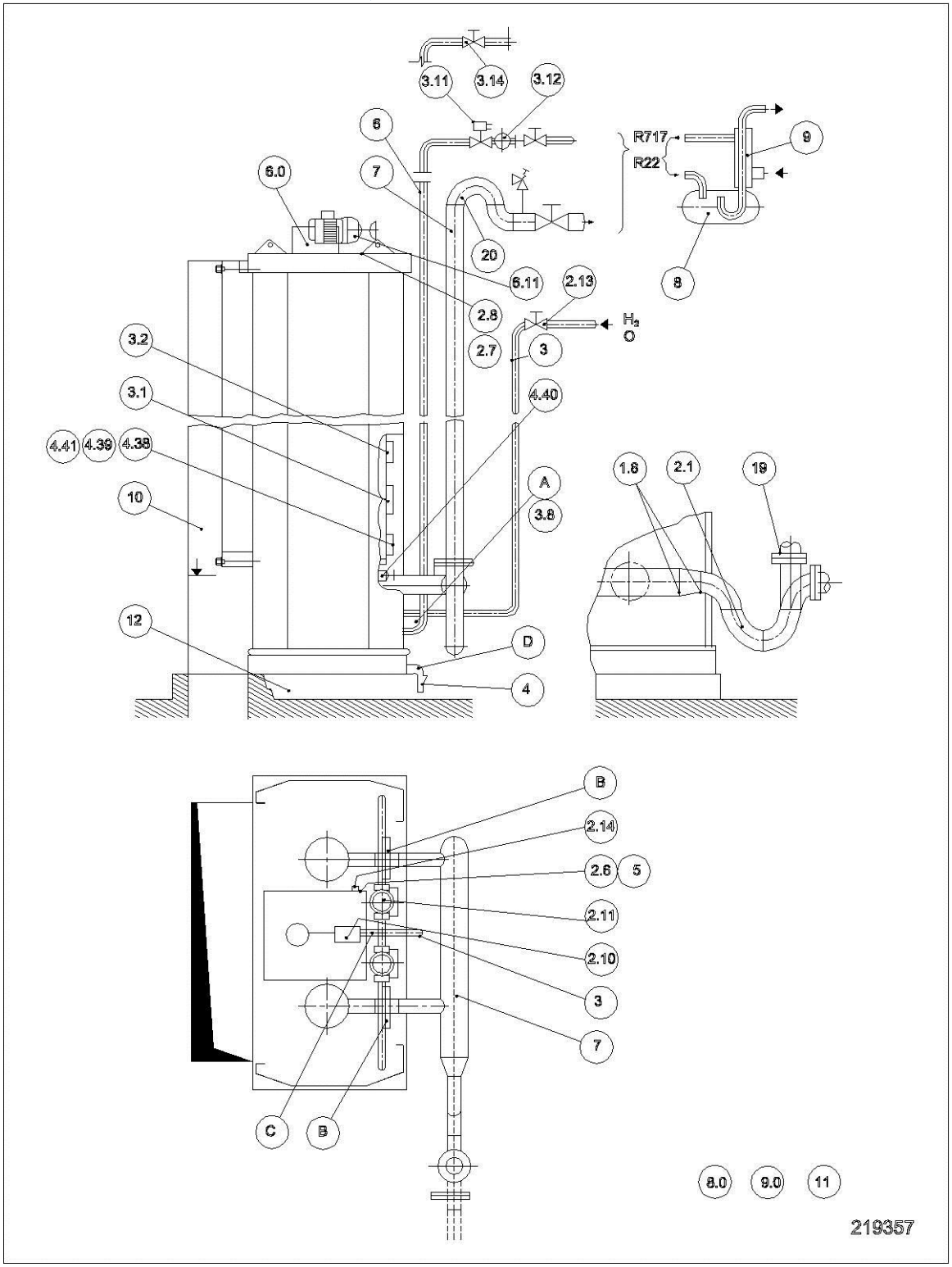
On some models the injection is electronic, please revert to specification under the wiring diaghram.


Absolute liquid head pressure
(Satuated temp. °C)
Subcooling of liquid (K)
R717
R22, R404A, R507C, R744
60
50
40
30
20
10
0
-10
0
5
10
20
30
0.1
0.2
0.3
0.4
0.5
0.7
1.0
2.0
3.0
4.0
5.0
7.0
10
15
1
2
3
4
5
6
7
8
9
10
12
14
16
18
25
50
100
150
200
Nozzle diameter (mm)
T0177075_0

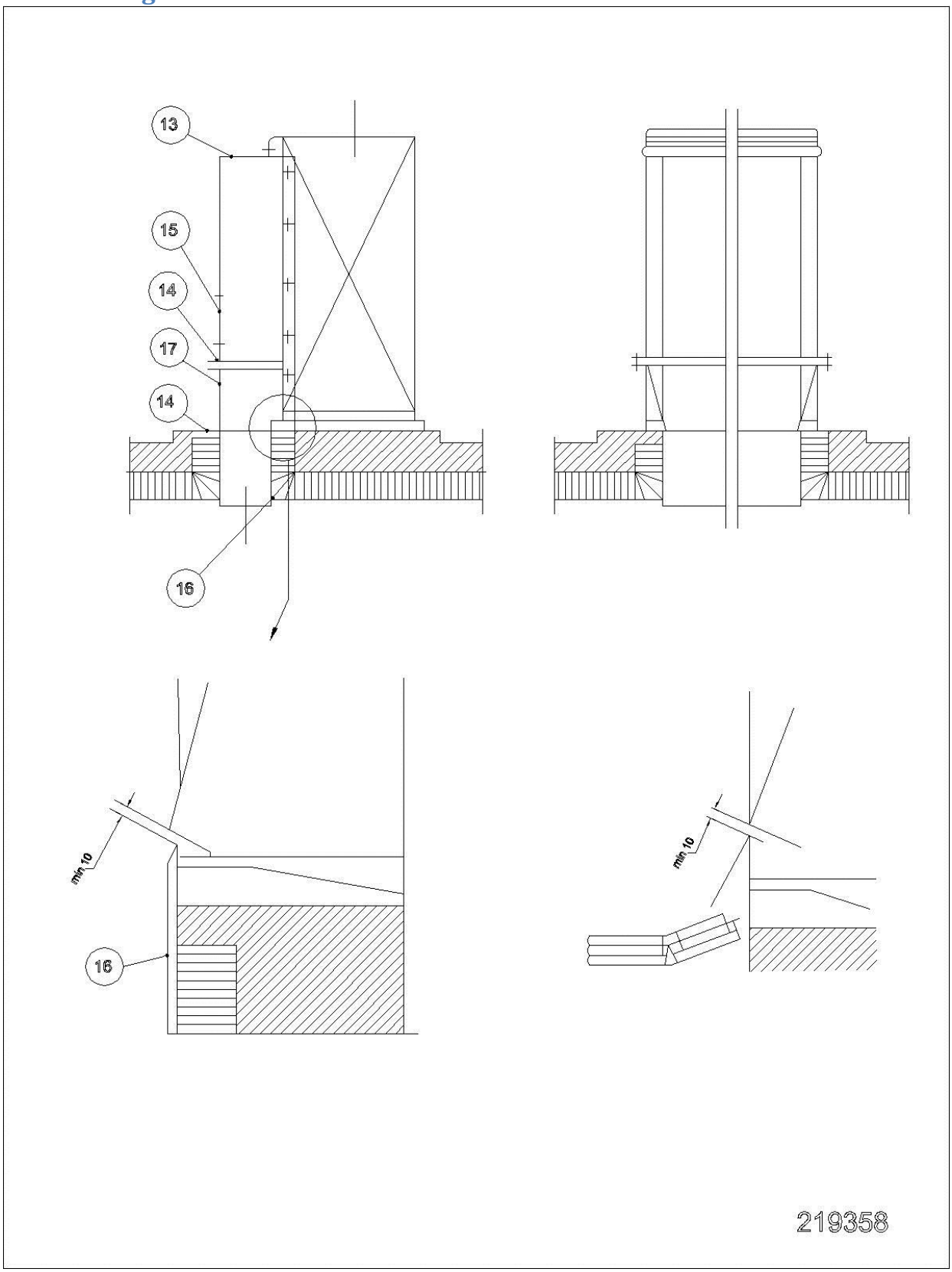
4.6. Installation sketches V156. V316. V373. V619. Mk 4.



Installation sketches VD746, VD1206. Mk 4

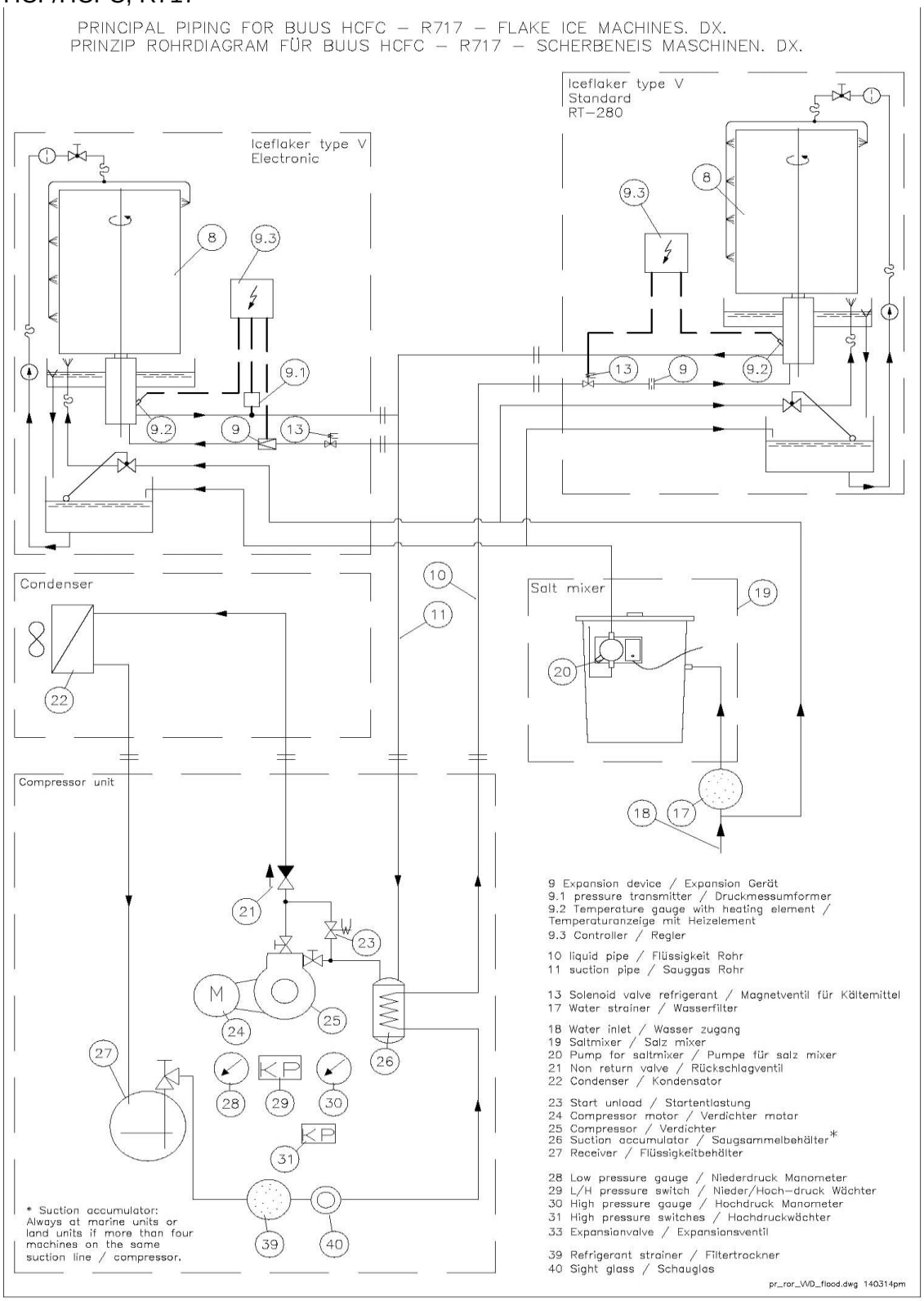


Screen design

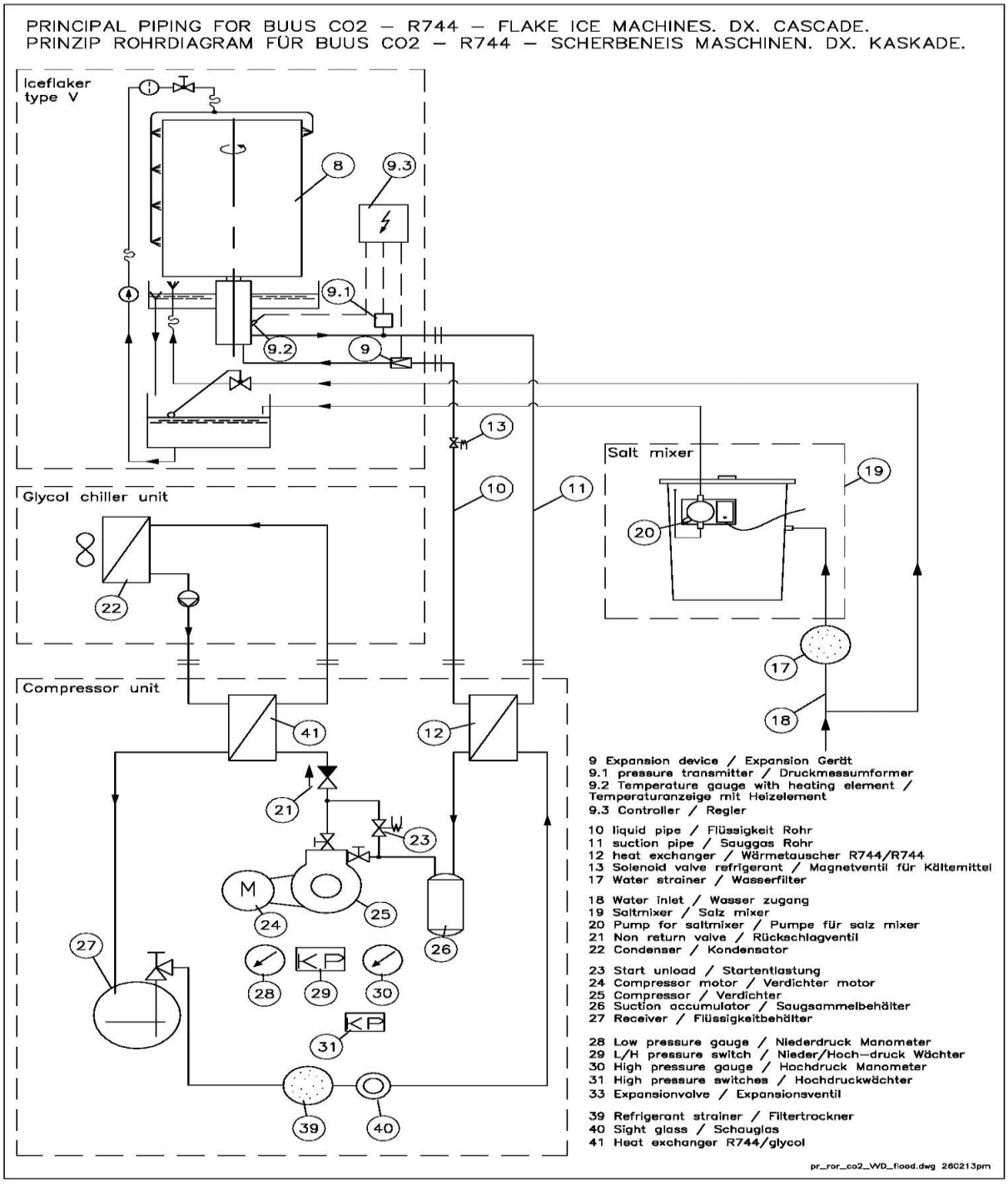


4.7. Piping diagram

HCF/HCFC, R717



R744


PRINCIPAL PIPING FOR BUUS CO2 – R744 – FLAKE ICE MACHINES. DX. CASCADE.
PRINZIP ROHRDIAGRAM FÜR BUUS CO2 – R744 – SCHERBENEIS MASCHINEN. DX. KASKADE.
Iceflaker type V
Glycol chiller unit
Compressor unit
Salt mixer
9 Expansion device / Expansion Gerät
9.1 pressure transmitter / Druckmessumformer
9.2 Temperature gauge with heating element / Temperaturanzeige mit Heizelement
9.3 Controller / Regler
10 liquid pipe / Flüssigkeit Rohr
11 suction pipe / Sauggas Rohr
12 heat exchanger / Wärmetauscher R744/R744
13 Solenoid valve refrigerant / Magnetventil für Kältemittel
17 Water strainer / Wasserfilter
18 Water inlet / Wasser zugang
19 Saltmixer / Salz mixer
20 Pump for saltmixer / Pumpe für salz mixer
21 Non return valve / Rückschlagventil
22 Condenser / Kondensator
23 Start unload / Startentlastung
24 Compressor motor / Verdichter motor
25 Compressor / Verdichter
26 Suction accumulator / Saugsammelbehälter
27 Receiver / Flüssigkeitbehälter
28 Low pressure gauge / Niederdruck Manometer
29 L/H pressure switch / Nieder/Hoch–druck Wächter
30 High pressure gauge / Hochdruck Manometer
31 High pressure switches / Hochdruckwächter
33 Expansionvalve / Expansionsventil
39 Refrigerant strainer / Filtertrockner
40 Sight glass / Schauglas
41 Heat exchanger R744/glycol
pr_ror_co2_WD_flood.dwg 260213pm

Water level control on ice machine type V-VD:

Machines without pre-heater.

The machines have a level control for the feeding water to the nozzle and the water tank.
Please also see principle diagram in section 4.7.
Ball valve pos. 1 on inlet water to nozzle is to be fully opened.

On ice machine type V-VD you need to de-frost the bottom of the drum, otherwise ice is building up over a period. *** **If ice is building up even with ball valve pos. 1 full open the inlet water temperature is too low and a pre-heater is to be mounted*****
This period is depending upon the operation parameters.

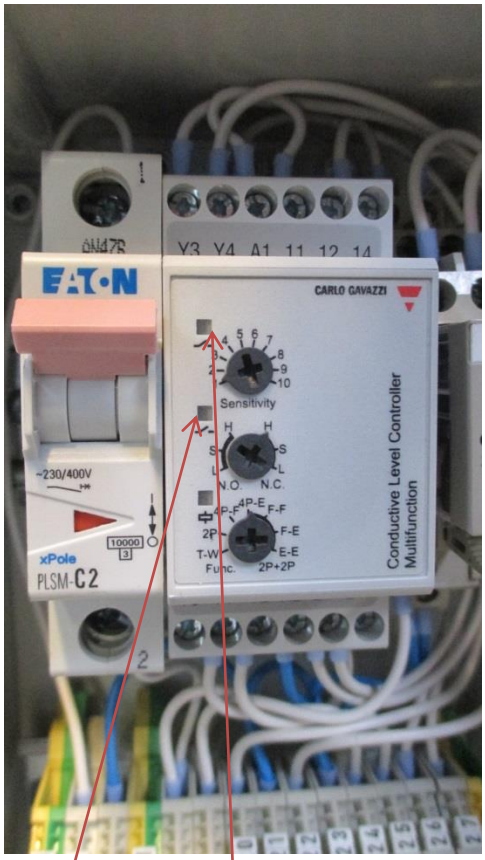
Components for machines type V.

1. Ball valve for controlling water to nozzle
2. Solenoid valve for nozzle water
3. Solenoid for tank filling
4. Connection box for wiring
5. Level sensor in water tank.

It is important that the water to the nozzle is sufficient to keep the machine from freezing up.
Standard setup is to completely open the ball valve pos. 1. All water to the machine is then going through the nozzle.

If the water feeding through the nozzle is less due to too low water pressure the level in the tank will drop, and the control will then add extra water through the solenoid valve pos. 3.

Conductive Level Controller



1. LED for water to nozzle
2. LED for water filling to tank

The LED pos. 1 is in principle ON all time, only if the nozzle filling is enough the LED will be OFF for a short period.

The LED pos. 2 is only ON now and then when the filling of tank takes place through the solenoid valve pos. 3.

Adjustment of the Conductive Level Controller:

Sensitivity: 1
Alarm: NC-H
Mode: 4PE

Machines type VD is simply double drum machines where the filling is through 2 pcs. of nozzles. Adjustment as mentioned above.

Components for machines type VD.

1. Solenoid valve for tank filling
2. Solenoid valve for nozzle filling
3. Ball valve for nozzle filling, right drum
4. Ball valve for nozzle filling, left drum
5. Saltdosing, brine inlet.

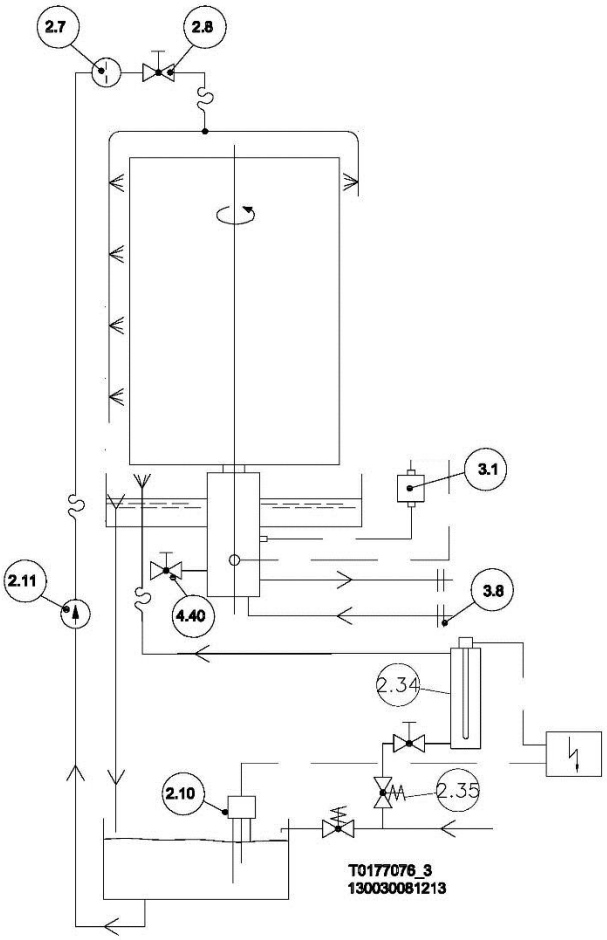
Conductive Level Controller is the same as for type V machines.

Machines with pre-heater installed:

The pre-heater is installed if the water inlet temperature is below +10°c.
Since there is no need for heating up the all incoming water to the machine, and then cool it down during circulation over the freezing drum, the possibility of controlling the nozzle water inlet is made.

On machines with pre-heater you must adjust the flow to the nozzle with the ball valves pos. 1.
The flow is depending upon the incoming water temperature and the suction temperature of the ice machine.
It is important that the bottom of the ice machine is not building up ice.
This can only be determined after a period of operation.
If ice is building up the flow or inlet water temperature must be raised until the operation is stable.

Principle layout for pre-heater on ice machines type V and VD.



Position number	Describtion	Qty. for V	Qty. for VD
2.10	Level sensor in water tank	1	1
2.34	Water heater	1	2
2.35	Solenoid valve for nozzle inlet water	1	2
2.7	Strainer for water	1	2
2.8	Ball valve for inlet water to spray bar	1	2
2.11	Pump for water to spray bar	1	2
3.1	Level control for refrigerant	1	2
3.8	Inlet of refrigerant	1	2

4.8. Wiring diagram

The wiring layout suggested in the diagram applies to the V type ice machine designed for freshwater ice production and featuring liquid level control. In the case of the VD type, the diagram applies to each drum, except that the salt dosing pump must be shared by both drums (the reason being that only one dosing pump is used per ice machine).

For ice machines connected to plants with pump circulation of refrigerant, leave out the transformer and liquid level controller RT 280A or electronic injection incl. controller.

The diagram is based on the following:

- **manual operation:**

  all components can be started and stopped independently of one another.

- **automatic operation:**

- Start:

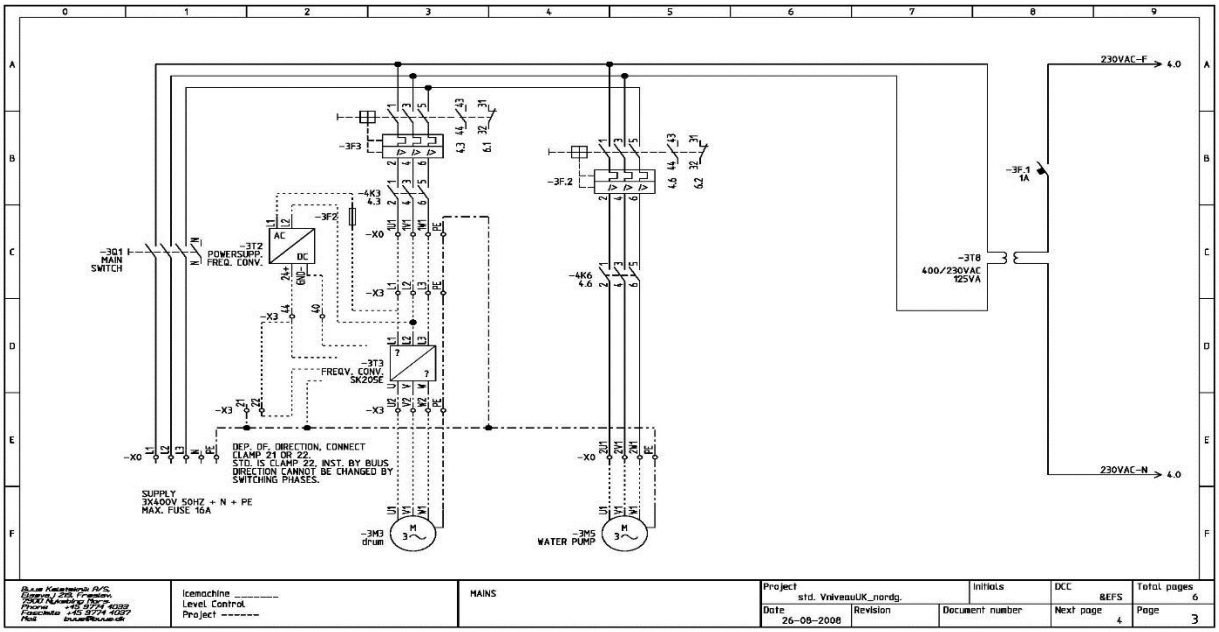
  1) When the compressor is started the salt dosing pump is activated. The liquid supply at the pump circulations plant is also activated.
  2) Water pump and drum rotation are started once the required operating temperature is reached.

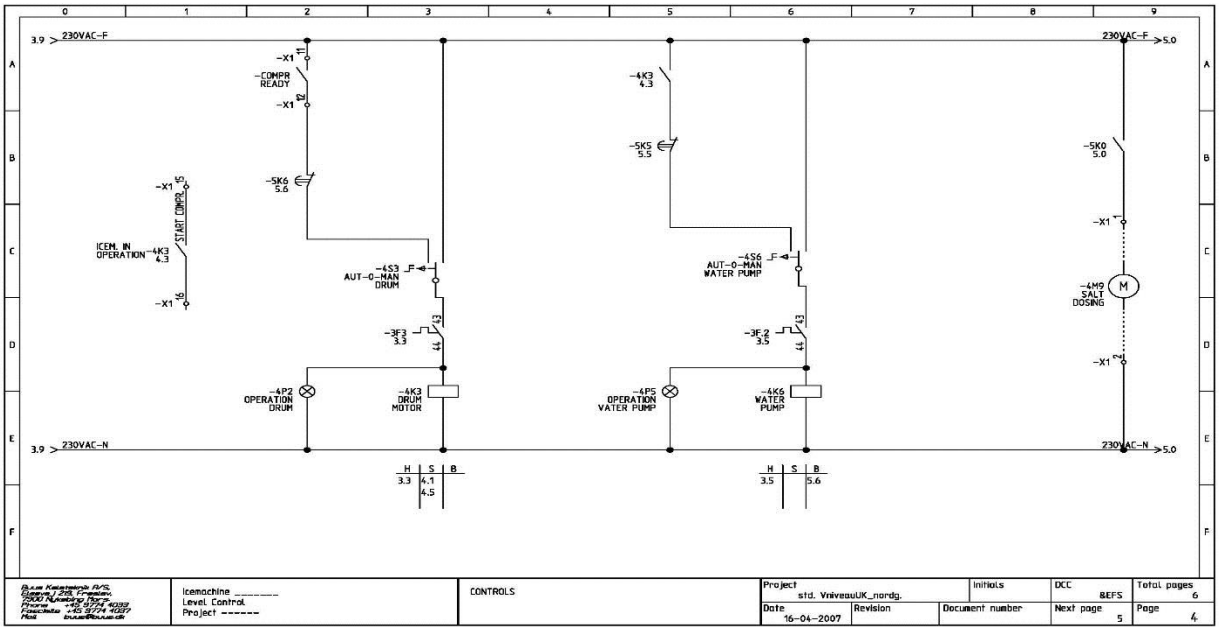
- During operation:
  Stoppage of drum motor causes water pump to stop.

- Stop:

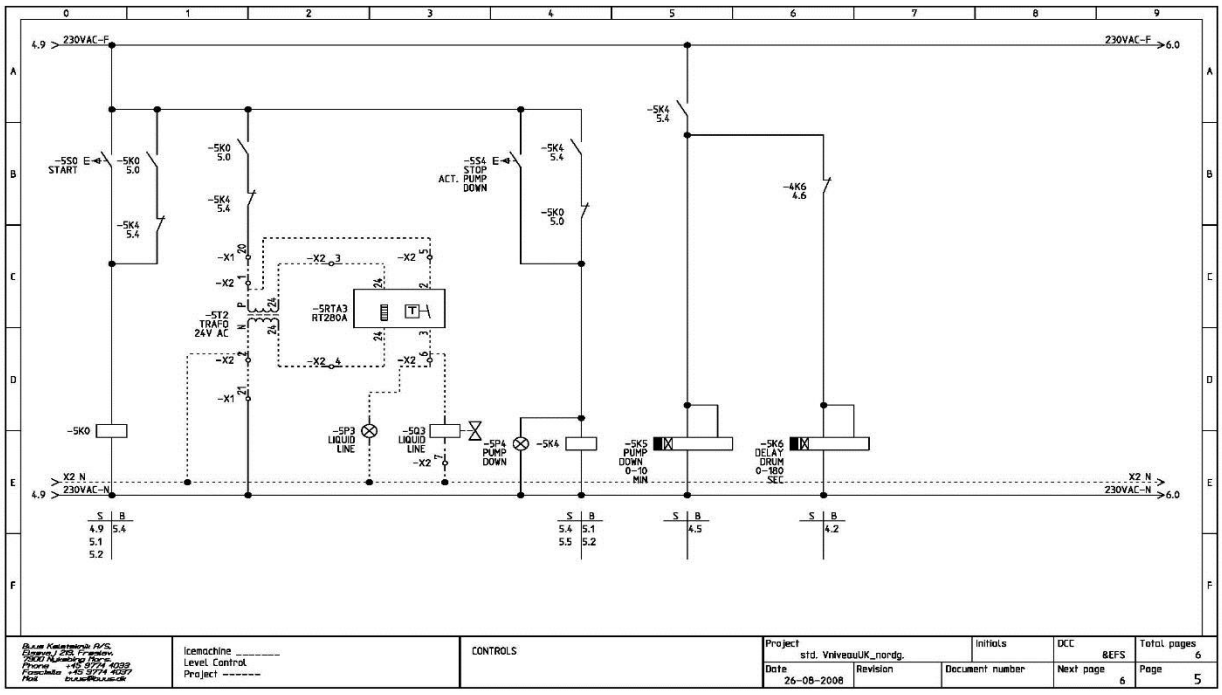
  1) Refrigerant supply is cut off.
  2) After 0-10 minutes, the water pump is cut out and the compressor capacity reduced. The time lapse selected depends on the required “pump down” of the drum.
  3) After 0-3 minutes, the drum motor and the compressor are stopped. The time lapse selected should be sufficient to ensure that the drum is run free of ice.

Standard wiring for flooded machines.

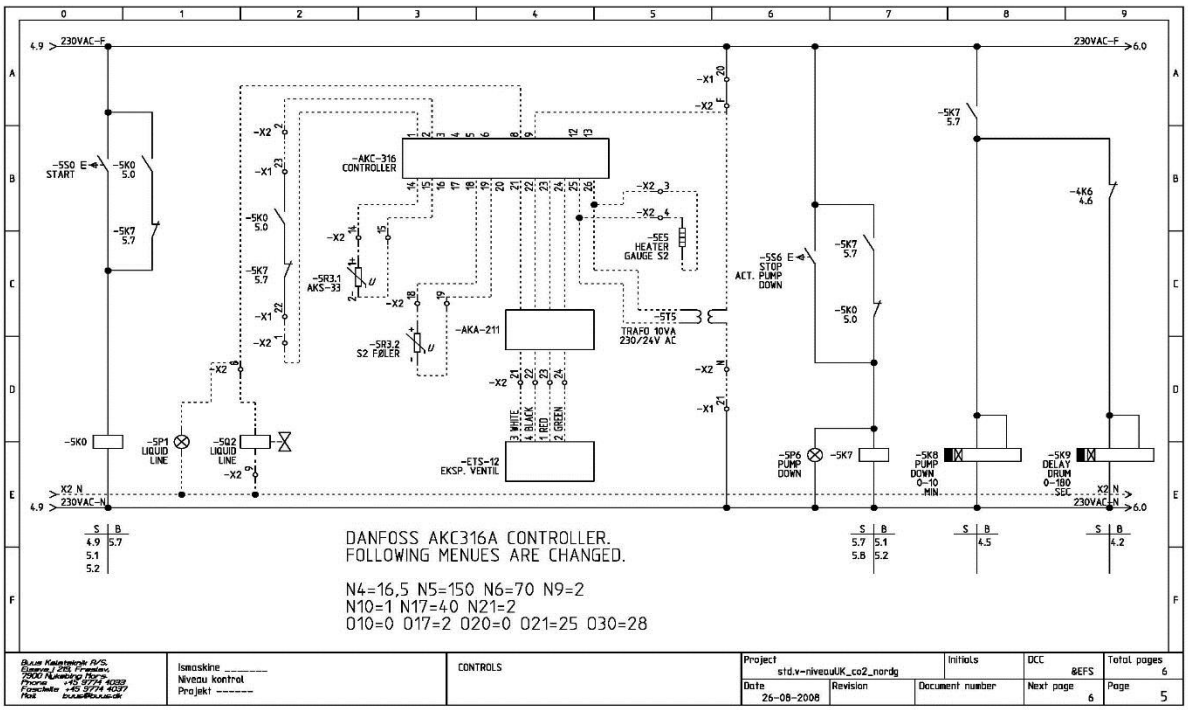




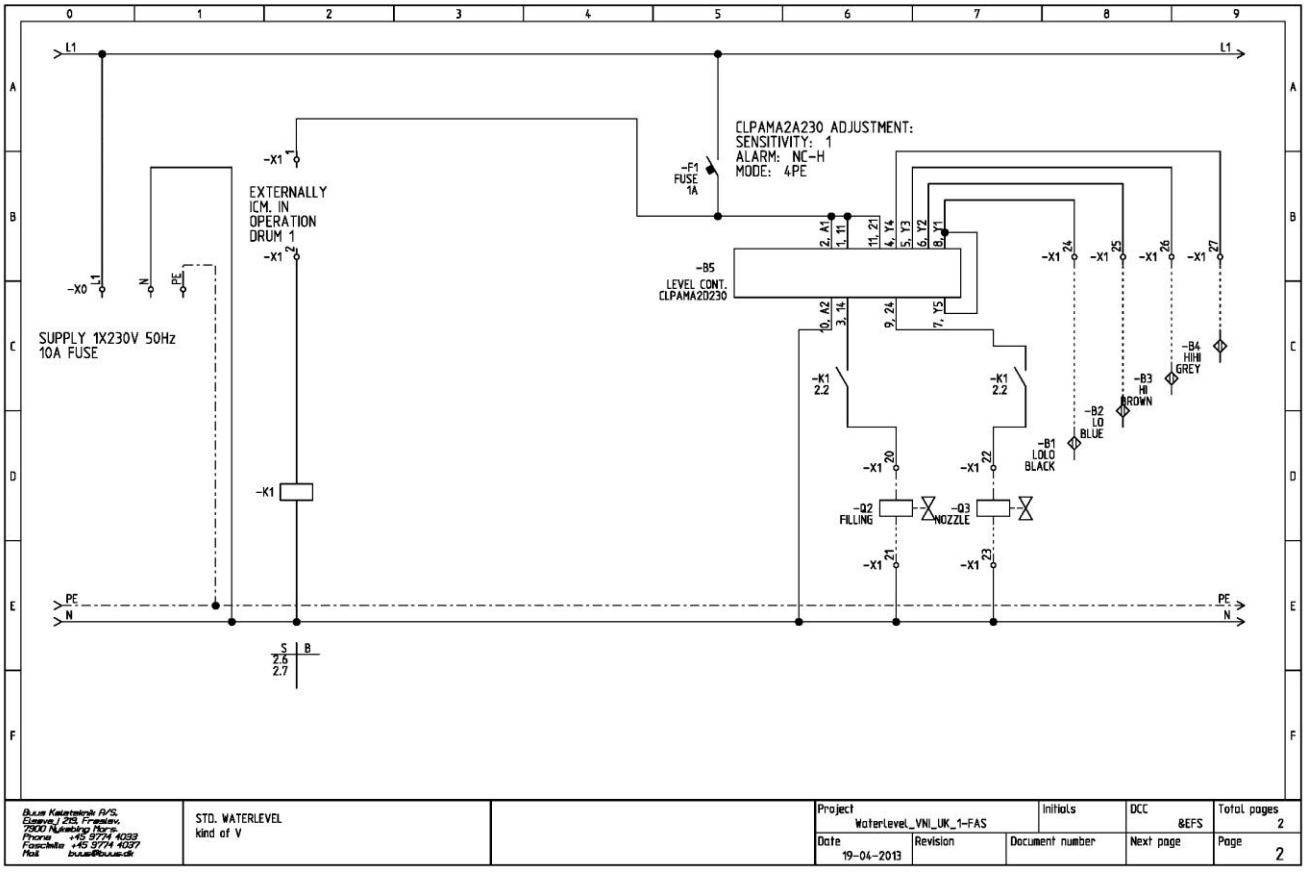
For HFC/HCFC, R717 with RT280:



For HFC/HCFC, R717, R744 with electronic injection:



Water level for ice machines:



4.9. Salt dosing system

Function

- When producing flake ice from freshwater, a small amount of salt (NaCl) is added to the water by means of a dosing pump. As a result:
- the ice breaks off in larger flakes and is easier to prize off the drum.
- calcareous deposits on the drum are reduced
- the mechanical parts of the ice machine are subjected to less stress.

The quantity of salt added ranges from 0-500 grammes per tonne of ice (ppm) or 0-0.05%. This salt content cannot be tasted and has no influence on the applicability of the ice for e.g. cooling of foodstuffs.

Ice Produced from Freshwater

When ice is produced, the consistency of the water will have a significant effect on the nature of the ice. Ice produced from soft water (rainwater) will thus be partly transparent and stick fast to the drum. For this reason, a small amount of salt needs to be added to the freezing water to enable the ice to fall easily off the drum.

Very hard water (with a high calcium content) will cause calcareous deposits on the drum and this again makes the ice stick to the drum. As a result of this much of the ice will be crushed by the knives. In our experience, adding small amounts of salt to the water reduces the above deposits. At the same time the ice is made more consistent, does not stick to the drum and falls off in larger flakes.

In such cases, it will therefore be advantageous to use the salt dosing pump.

Ice Produced from Sea-water

This ice, though tough, is soft and can be scraped off the drum easily. Obviously, there is no need for extra salt dosing.

Installation Principle

(1) The mixing tank should be made of material which is resistant to salt water, e.g. plastic. We recommend that you cover the tank with a lid in order to avoid unwanted impurities.

The size of the mixing tank depends on the type of ice machine in question, the number of ice machines and the desired frequency of salt refills.

The following table can be used as a guide to dimensioning.

Ice machine type	V156	V316	V373	V619	VD746	VD1206
Basic size of mixing tank in litres a)	15	20	25	30	35	60
Supply volumen litres b)	2	4	5	7,5	9	15

a) The basic size is calculated on a daily refilling of salt for one ice machine.

b) The supplementary volume indicates litres per day and must be multiplied with the number of operating days between each filling.

Example

For a V619 ice machine, refilling is desired once a week. How many litres must the mixing tank contain?

30 + (6 x 7.5) = 75 litres

Salt dosing flow for a saturated NaCl solution

(2) The float valve is to be fitted in the mixing tank and connected to the water supply.

Ice production (ton per 24 hrs)	ml/min	
	100 ppm	500 ppm
10	2.2	11
20	4.4	22
30	6.6	33
40	8.8	44
50	11	55

(3) Dosing pump to be mounted in close proximity to and below the water level in the mixing tank, to prevent the valves and the pump drying up during standstill.

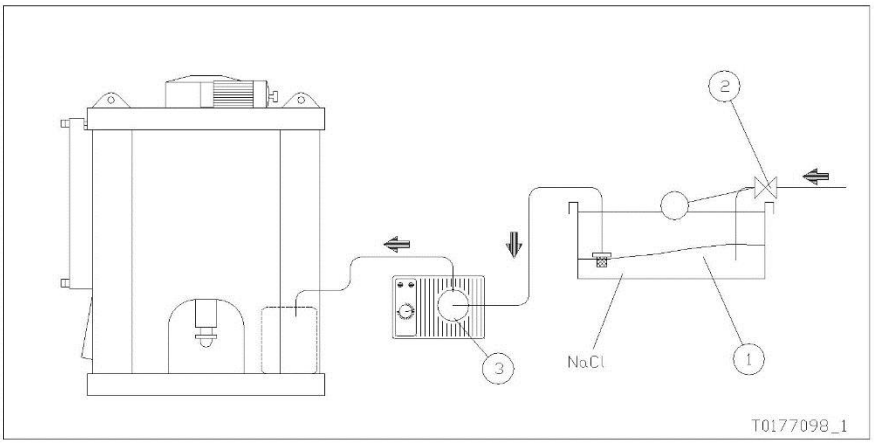
The suction filter of the pump is placed on the bottom of the mixing tank and connected to the suction branch of the pump via the suction hose supplied.

The delivery side of the pump is connected to the water reservoir of the ice machine via the discharge hose and injection valve supplied.

The dosing pump is wired to the power supply; see *section 4.8 Wiring Diagram*.

If an ice machine is placed in a high, less accessible position, the salt dosing pump and mixing tank can be placed as much as 15-20 m below the ice machine.

The saltdosing pump has a sensor mounted in the water tank of the machines.
The sensor check the salinity of the water, and add saltwater to the tank when needed.



Adjustment of the FMSCD salt dosing pump

How to use the "FMSCD" PUMP:

On power up pump shows ·'Waiting". Default time is 10 seconds. This functions helps conductivity
probe to stabilize readings. At the end of this pause, pump's display shows conductivity's value
(mS), electrovalve's status and pump's flow (00%).

Now setpoints and probe must be set. To enter into setup mode keep pressed "E" for about 4 seconds.

Instrument will ask for a password showing "Enter PW" message. If this is the first operation made with the pump (or after a reset) simply press "E" to enter into main menu.
Default password is "0 0 0 0".

From main menu you may choose: "Setup", "Param" or "Serv." Move on "Setup" (using ">") and choose it by pressing "E".

From "Setup" menu you may choose: "SetPn" , "Calib" or "AI Dos". Choose "Calib" for probe's calibration. Press "E" to confirm.

"Calib" menu shows the temperature read by probe ("C). Press ">" to get into "COMP" menu for conductivity probe/temperature compensation. Default value (refers to NaCI solution) is 3.0% / °C.
To change it use "^" or "E" and confirm it pressing ">". Pump's display shows "R00.80ms" as probe's read value and "C 5.00mS" as probe's calibration value. To change it use "^" or "E" and confirm it pressing ">". Pump's display will show "Calibr. NO". Press" ^" to confirm calibration pump's display will show "Calibr. YES". Press "E" to confirm. Pump's display will show "Calib;' Success". In the next menu, you can choose "Calib" or "SetPn". Move on "SetPn" and press "E" to confirm.
Now go back to "Setup" menu and choose "SetPn" to set up pump's setpoint and electrovalve's setpoint. Press "E" to enter. Into "SetPn" menu you may begin setpoint calibration for metering pump.

"SetPn" menu shows "1) 0%" and "1.00mS". Using ">" key you may navigate through these
parameters. Pressing twice ">" key pump's display shows "2) 100%" and ·0.50mS". Percentual values are pump's flow. mS values are pump's activation point. Pump will stop to work when it reachs 1.00mS value. When the flow will reduce to 0.50mS value, pump will increase flow proportionally untill 100%. Pump functioning mode is proportional; reducing the difference between the mS values pump will work in On/Off mode. To choose / change these values use ' A" or "E". To confirm it press ">". Pump's display will show "Exit No SAVE". Press"^" to save. Pump's display will show "Exit SAVE". Press "E" to confirm.

Now go back to main setup menu. Choose "Param" and press "E" to confirm. From this menu is possible to change pump's activation delay. Press" ^ " to set delay time from O to 60 sec. Press" >" key to get into "NEW PW" menu to change the password. Press" ^" to change password and "E" to confirm.

Now go back to main setup menu. Choose "Serv."

Into this menu you may manually open and close pump's electrovalve. Press "E" to manually start and stop the pump. To exit press"^ ".

AL DOS (Maximum Time Dosing Alarm):

This alarm prevents the pump to dose if a set time is reached. To set this alarm enter into "Setup
menu". Use ">" key to choose "AI Dos" and press "E" key. The pump shows: > AL OFF

DOSING:

To activate the alarm use "E" key to set the time (from 1 to 100 minutes or "AL OFF"). To setup the alarm mode use the ">" key. Cursor moves on "DOSING". Use "^" key to change this voice. On "STOP" mode the pump will stop the dosing procedure once the set time is reached. The pump's display will show the alarm condition and requires to press a key to continue. On "DOSING" mode the pump will NOT stop the dosing procedure once the set time is reached.
The pump's display will show the alarm condition ("DOS. Al:') and requires to press a key to continue. To exit press ">" untl the display shows "EXIT NO SAVE". Press "E" key to exit without saving. To save data press" ^" key to save data and press "E" key to exit.

SPECIAL FUNCTIONS - STAND BY:

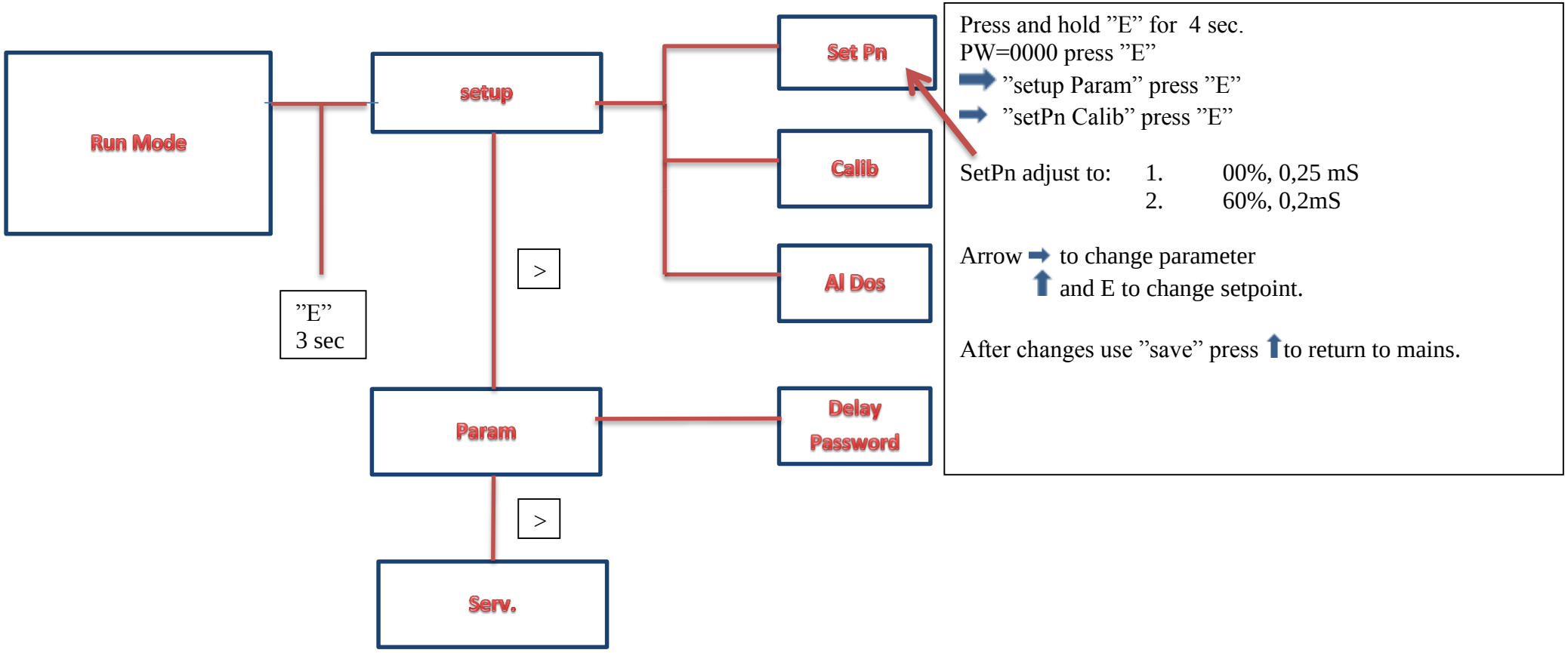
Keeping pressed " ^ " key for about 4 seconds the pump will be disabled. During this time pump's display shows "OFF". To go back to normal operation keep pressed "^" key for about 4 seconds.
During this time pump's display shows "Supply 240 Volt". To go back to normal operation keep pressed " ^ "

Pump`s RESET:

Turn off the pump. Keeping pressed" A" and "E" turn on the pump.

Be careful: all stored data will be restored to their original values.

Navigation menu:



5. Mounting and checks

5.1. Mounting

The foundation for the ice machine should be as level as possible in order to avoid stressing the frame. Refer to *section 4 Installation Instructions* for measurements and directions.

Place the ice machine and connect the electric cables, refrigerant piping and water.

The following should be noted about the electrical connections:

(2.11) It does not matter which way the water pump rotates, but we would recommend that you follow the arrow on the pump motor.

(6.0) The left-hand drum on a VD machine should turn clockwise, and all the others anti-clock- wise. (Refer to the arrow on the top of the ice machine frame.)

(3.2) A voltage of 240-255V is to be connected to the terminals marked 240 on the transformer for the liquid level regulation equipment.

(6.12) The thermal overload for the drum motor is to be adjusted to the motor's rated current. Refer to the nameplate on the motor, or to *section 2.1 Main Data*. A correct setting is necessary because of the motor as well as the drum mechanical drive system.

During installation work, the machine should be covered over to prevent dirt from entering the water system and to avoid damaging the drum surface.

5.2. Checks before first start-up

The ice machine has undergone a functional test before leaving the factory, and it is normally despatched with oil in the gearbox and shaft seal.

Follow the procedure outlined below **before** the first start-up:

- Check that the oil level in the gear (6.3) is in the middle of the sight-glass (6.22). If the level is too low, fill up through the oil plug (6.19).
- Refer to *section 8.1 Lubrication* for suitable oil types.
- Check that the purging opening in the oil filling plug is open.
- Open the bleeder screw (4.41) on the back of the frame and fill the oil reservoir (4.38) with oil until approx. 1 dl has run out of the purge screw. In this way, you ensure that the shaft seal is filled with oil. Fill up the oil reservoir to mid-level. Check that the purge opening in the filling plug is open.
- Check that there is a large clearance be tween the drum and the knife. (Refer to the next section; *Knife Adjustment*.)
- Check the direction of rotation of the drum.
- Purge the water pump by using the purging plug (2.12).
- Check that the drum motor's thermal relay is set correctly.

If there is a liquid level regulator installed (3.1), then adjust this to the refrigerant being used. Check that the nozzle plate (3.8) is installed in the flange assembly (3.10) in the refrigerant pipe.

Knife Adjustment

The drum is never perfectly round, so before adjusting the knife, find the drum position where the clearance between knife and drum is least by letting the drum rotate. The position can be found by mounting a dial meter on the knife beam. Measurements should be taken near the bottom of the drum, in the middle of the drum, and near the top of the drum.

At normal room temperatures, the **minimum** clearance between knife and drum must be at least 0.3 mm.

- The knife is adjusted as follows:
- Loosen the bolts (5.3) that fasten the fixing flange at the top of the knife beam (5.2.).
- Adjust the beam by using the upper and lower nuts (5.1) on the stay bolts (5.7) until the clearance is 0.3 mm.
- Re-check the clearance after the fixing by means of a feeler gauge.

6. Operating instructions

Refer to *section 5.2 Checks before first start-up*.

6.1. Start of ice machine

Open any closing valves in the suction line, and any stop valves in the refrigerant liquid line. If the ice machine is connected to a pump separator plant, then the valves in the suction line must be opened so that the pressure in the drum is equalised as **slowly** as possible so that hammer in the pipe system is

avoided. (The pressure in a partially filled drum at room temperature is much higher than the pressure in a pump separator at normal running temperature.)

If the ice machine is equipped with a control system, as described in *section 4.8 Wiring Diagram*, start the compressor and put the control system in automatic operation.

If the ice machine is not equipped with a control system as described in *section 4.8 Wiring Diagram*, proceed as follows:

- Start the compressor
- Activate the salt dosing pump
- Activate the liquid level regulator or solenoid valve in the liquid line in a pump circulation system.
- Open any stop valves in the water supply
- Start the water pump and drum motor when the required working temperature is reached.

6.2. Adjustment of ice machine

Water system

It is important that the ice is dry about 100 mm before it reaches the knife. When this happens the surface of the ice becomes opaque. The area of the drum which is to be sprayed with water can be regulated by closing the holes in the water supply pipe according to needs.

If the ice does not detach easily from the drum when it starts, the water supply must be stopped until the ice is scraped off. This phenomenon can be avoided by adding a hand-full of salt to the water tank before starting up.

The water supply to the water spreader pipe (2.1) is regulated by the valve (2.8) in the water pipe between the pump and the spreader pipe. When the machine is being run in, this valve is adjusted once and for all so that the water does not spray over the edge of the drum, keeping it approx. 5 mm below the edge.

Note: The filter (2.7) between the water pump and spreader pipe eliminates unnecessary blockages of the nozzles, and must be cleaned frequently during running-in.

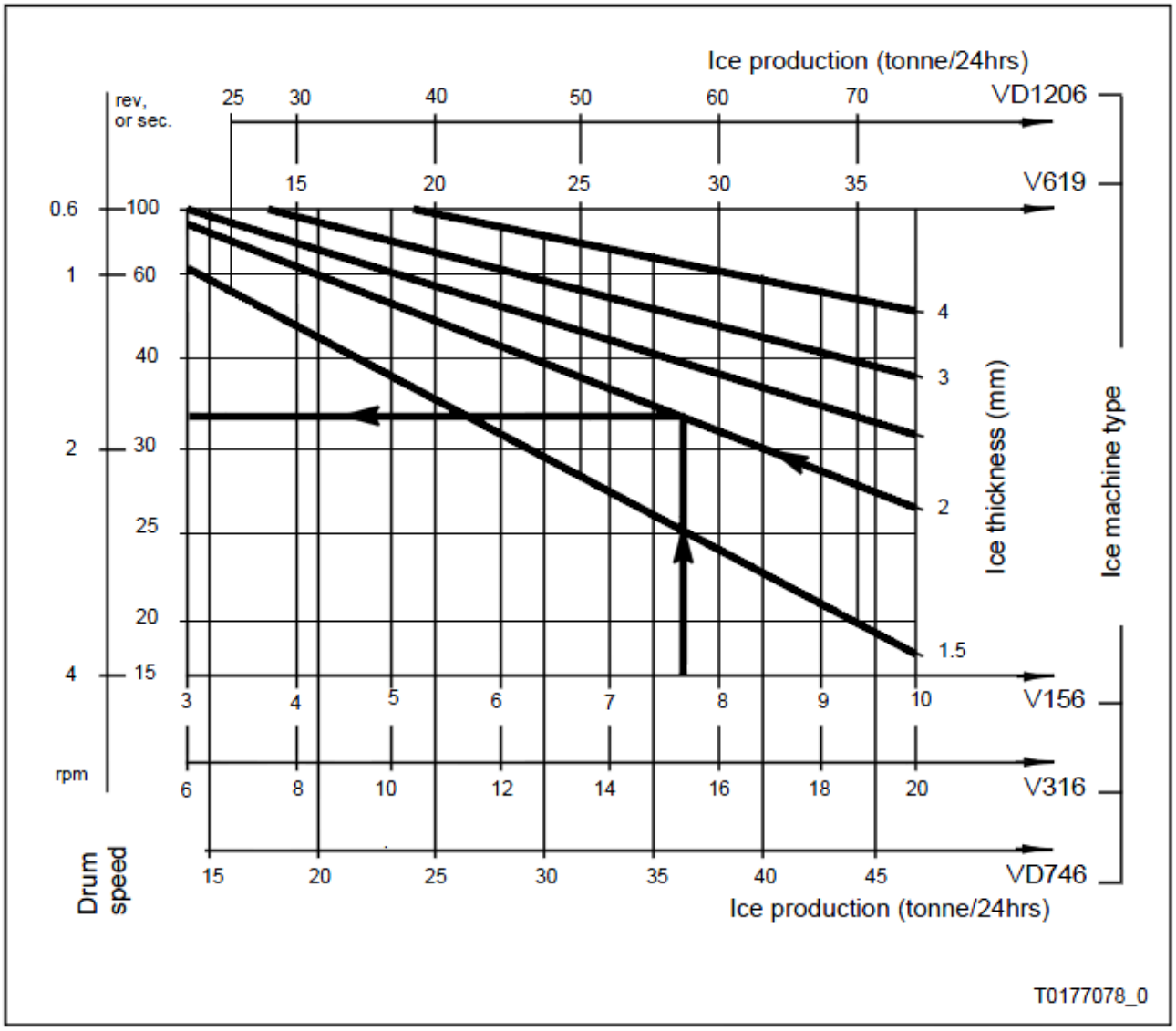
Drum speed is adjusted by using the pot meter on the VFD drive above the drum until the ice has the required thickness. (Low speed means thicker ice.) Refer to diagram on the next page.
Also see section 9.6

Note: Concerning the refrigeration capacity. Refer to *section 3 Capacities*.

Determining the drum speed (guidance only)

The frequency is adjusted with the pot-meter P1 on the box, outside by a screwdriver.

Using terminal 21 or 22 can change the direction of rotation.



Bleeding the system if saltwater is used for ice production.
On ice machines for salt-water supply, the throttle valve (2.13) is regulated so that 0.1-0.2 l/min runs through the drainage branch (2.6) at normal working conditions.

Liquid level control

Refer to *section 9.3 Liquid level control*, as well as Danfoss instruction for level controller RT 280A, which is placed at the end of this manual, and which is meant to help you during the following procedure:

Adjust the red indicator in the level controller (3.1) to the correct refrigerant by means of the setting disc.

Check whether the actual operating conditions are very much different than the dimensioning conditions for a standard nozzle. If this is the case, then the nozzle must be corrected. Refer to *section 4.5 Liquid Level Control*. It is imperative that the liquid supplied to nozzle (3.8) does not contain refrigerant gas.

When the nozzle is correctly sized, and the RT 280A is correctly adjusted, a regulation cycle will be between 3 and 7 minutes. A regulation cycle is the time that elapses from when the solenoid valve opens to when it opens again, and includes the open and closed periods of the valve.

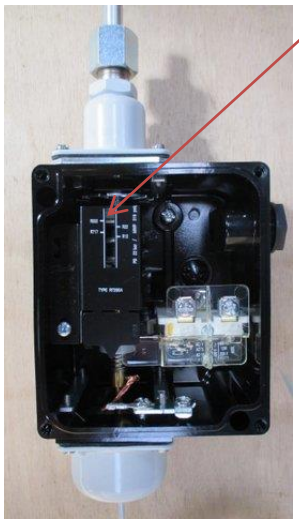
When the RT 280A is correctly adjusted, the closed period will be between 1-3 min. once the nozzle size is corrected, the closed period of 1-3 min. will be 25-40% of the cycle time.

Screwing the red indicator downwards will increase the closed period, and thus the cycle time, and vice versa. Alterations to the indicator position may only be made by 1/2-1 turn of the indicator disc at a time. The system must be allowed to stabilise for 1/2-1 hour after adjustment.

Adjustment of the setting disc for level control RT280A, ice machines as flooded operation:

Pressureat -25°c	
R12	0,25 Bar
R717	0,55 Bar
R22	1,00 Bar
R502	1,40 Bar
R404A/R507	1,50 Bar

Adjustment of disc at RT-280A	
R404A/R507	
R502	
	R22
R717	
	R12



Pump circulation

The supply of refrigerant is controlled by a throttling valve (3.14). On the VD machines, each drum has it's own valve.

It is important that the throttling valve does not open too much because of the other evaporators in the system. Therefore, we would recommend that adjustment is made in the following way:

- When all the evaporators in the system are in operation, close the throttling valve gradually until ice ceases to form on the upper part of the drum. When this point is reached, open the valve 1/2-1 revolution. When an adjustment is made, observe the results of this for about half an hour.

- If the ice machine does not make ice on all of the drum surface - even though the valve is fully open - this is due to insufficient liquid.
- If several ice machines are supplied with liquid from the same pump, the valves must be adjusted so that an alteration to the adjustment is carried out on all the machines.

6.3. Stopping the ice machine

With ice machines that have a control system as described in section 4.8 Wiring Diagram, press the stop button to stop. The pump down procedure is thus initiated.

With ice machines that do not have the control system mentioned above, follow the procedure outlined below:

- Stop supply of refrigerant to the drum.
- Continue with ice production for 0-10 min., depending on the required pump down.
- Reduce compressor capacity.
- Stop the water pump.
- Let the drum rotate until the whole surface is ice-free. Then stop the drum's drive station.
- Stop the compressor.
- Shut off the suction line.
- Close any valves in the water supply.

7. Faultfinding chart

A number of fault conditions, cause(s) and remedies mentioned in the following chart

* Indicates in which type of installation the problem(s) can occur.

			Pump circulation		Liquid level control	
			AFP ASP	XFT XSP	AFT AST	XFT XST
Observed irregularity	Cause	Remedy	R717	HFC/ HCFC R744	R717	HFC/ HCFC R744
Too little ice production	Only a small part of drum surface is sprayed with water	Water spraying from water distribution pipe to be improved	*	*	*	*
	Too high oil concentration in the drum	Increase overflow of liquid by opening the regulation valve.		*		
		Decrease oil concentration in pump circulation system.		*		
		Check level control cycle time and decrease, if possible				*
Ice production reduced. There are patches with thin ice.	Too much oil in the drum	Drain off oil. Refer to section 8.2 – Draining oil from the drum.	*		*	
Ice production stops completely or stops periodically. Suction pressure very low.	No supply of liquid, which can be caused by: - Defective coil on solenoid valve (3.11) - Fractured capillary tube (3.6) on level regulator.	Change defective parts			*	*
Ice production stops completely or stops periodically. Suction pressure low. Heating element at sensor (3.3) feels cold.	No heating to sensor, whereby it takes a long time for liquid supply to open. This can be caused by: - No electrical supply. - Defective transformer - Defective heating element.	Repair heating system			*	*
Ice production stops. Refrigeration supply is open. Suction pressure is low. The compressor may be subjected to liquid hammer.	The refrigerant does not reach the drum. The seal (4.13) and/or (4.29) is/are defective.	Change defective parts			*	*
Ice production reduced. The level regulator lets the solenoid valve in the liquid line stay open all the time.	Insufficient refrigerant. Oil concentration in drum becomes too high.	Ensure sufficient supply of refrigerant. The level regulator must work periodically. Refer to section 4.5 Liquid level control.				*

			Pump circulation		Liquid level control	
			AFP ASP	XFT XSP	AFT AST	XFT XST
Observed irregularity	Cause	Remedy	R717	HFC/ HCFC R744	R717	HFC/ HCFC R744
No ice production on top part of drum	Insufficient supply of refrigerant	Check that there is sufficient refrigerant in the plant	*	*	*	*
		Check and rectify poor distribution of liquid between the ice machine and other evaporators.	*	*		
		Clean clogged refrigerant filter(s).	*	*		
		Check the position of the regulating valve. Refer to section 6.2 Pump circulation.	*	*	*	*
		Check that there is no gas bubbles in the liquid. The liquid must be subcooled.			*	*
		Level regulator adjusted to wrong refrigerant. Adjust level control.			*	*
		Nozzle (3.8) too small. Check nozzle size. Refer to section 4.5 Liquid level control.			*	*
Periodical poor ice production on top part of drum.	Level regulator badly adjusted. The solenoid valve in the liquid line is shut for too long.	Adjust the indicator n the level control upwards.			*	*
Periodic poor ice production on top part of drum. Suction pressure in suction line falls at the same time.	The small hole in housing (4.37) around the sensor (3.3) is clogged by dirt. Level regulator stops supply of refrigerant liquid.	Clean sensor pocket and the sensor (3.3) with heating element.			*	*
Severe overflow of refrigerant liquid. Good ice production on the whole drum surface. Solenoid valve in refrigerant line is open all the time.	Level regulator incorrectly adjusted.	Adjust level regulator. The indicator to be adjusted downwards.			*	*
Frequent overflow of refrigerant liquid. Good ice production on the whole drum. Solenoid valve in refrigerant liquid line is open only for a short period.	Closed period is too short. Level regulator incorrectly adjusted.	Adjust the level regulator. The indicator to be adjusted downwards.			*	*
Periodical severe overflow of refrigerant liquid. Solenoid valve in refrigerant line open only for a short period – much shorter than closed period.	Liquid supply too quick. Hole in the nozzle plate (3.8) too big.	Mount nozzle plate with smaller hole. Refer to section 4.5 Liquid Level Control.			*	*

			Pump circulation		Liquid level control	
			AFP ASP	XFT XSP	AFT AST	XFT XST
Observed irregularity	Cause	Remedy	R717	HFC/ HCFC R744	R717	HFC/ HCFC R744
Compressor is cold and is subject to liquid hammer. Level regulator works irregularly.	Liquid from the overflow pipe does not moisturise the sensor (3.3) due to dirt in the sensor pocket.	Clean sensor pocket as well as holes for supply and removal of liquid to sensor (3.3).			*	*
Uneven ice production in diagonal strips on drum.	Insufficient water supply.	Check float valve (2.10) or throttling valve (2.13). check that there is sufficient water pressure during operation of the ice machine. Purge the water pump. (2.11) Clean the water filter. (2.7) Clean holes in water distribution pipe (2.1) Adjust throttling valve (2.8) for water distribution.	*	*	*	*
The ice ripples and will not detach from the drum.	The ice adheres too strongly to the drum because of deposits on the drum e.g. calcium, ochre.	Clean drum. Refer to section 8.3 Cleaning. a)	*	*	*	*
	The ice adheres too strongly to the drum because the water is too soft.	Use salt dosing equipment. a)	*	*	*	*
		If salt dosing equipment is in use, check that it functions correctly and **refill** the tank with salt. a)	*	*	*	*

Note a):

NEVER remove the ice mechanically – you may damage the drum surface.
NEVER use warm water, steam or flame.

Close refrigerant supply and suction pipe. Let the drum motor and water pump work until the ice has melted. Add water to water tank with hose to avoid circulating water which is too cold.

			Pump circulation		Liquid level control	
			AFP ASP	XFT XSP	AFT AST	XFT XST
Observed irregularity	Cause	Remedy	R717	HFC/ HCFC R744	R717	HFC/ HCFC R744
Drum movement is irregular and jerky.	There is ice around the shaft and stuffing box.	Stop the ice machine and compressor at once. De-ice by spraying cold water under the drum. Do not start the ice machine until all the ice under the drum has melted or else the drive station may be damaged.	*	*	*	*
		Check that there is sufficient water sprayed from the float valve or the throttling valve under the drum. If there is not sufficient water, then this may be caused by insufficient water pressure. The supply pressure should be min. 1 bar.	*	*	*	*
		Check that the make-up water is sufficiently warm. (Minimum 10°C.)	*	*	*	*
	The ice attaches too strongly to the drum because of deposits e.g. calcium, ochre.	Clean drum. Refer to section 8.3 cleaning. a)	*	*	*	*
	The ice attaches too strongly to the drum because the ice is too soft.	Use salt dosing equipment. a)	*	*	*	*
		If salt dosing equipment is in use, check that is functions correctly and **refill** tank with salt. a)	*	*	*	*
The ice goes past the knife without being scraped off.	Too big tolerance between knife and drum in relation to ice thickness	Adjust clearance between knife and drum. Refer to section 5.2 Adjustment of knives. a)	*	*	*	*
Refrigerant bubbles up in the oil reservoir (4.38) at the back of the ice machine.	The sealing rings (4.1) are defective.	Replace the seal. Refer to section 8.5 Dismantling and Assembly.	*	*	*	*
There is a refrigerant smell by the ice machine, or a refrigerant detector gives a signal. There are no bubbles in the oil reservoir (4.38) at the back of the ice machine.	There is a leak at: - a flange joint in the pipe system. - the flat gasket (4.21) around the intermediate price (4.6). - the O-ring (4.20= on the bottom axle journal (4.23) -the O-ring (7.1) on the top axle journal (7.3) - valves – if installed	Find the leak, using a sulphur stick (for ammonia) or a refrigerant detector (HCFC) and repair the leak.	*	*	*	*

Note a):

NEVER remove the ice mechanically – you may damage the drum surface.
NEVER use warm water, steam or flame.

Close refrigerant supply and suction pipe. Let the drum motor and water pump work until the ice has melted. Add water to water tank with hose to avoid circulating water which is too cold.

8. Maintenance

8.1. Lubrication

Drive station

The gear VFD (6.1), the electric motor (6.12), and the first worm reduction gear (6.2) are lifetime lubricated from the manufacturer, so no extra lubrication is necessary.

The second worm reduction gear (6.3) is to be lubricated with a special gear oil, e. g. with one of the following:

B.P.: GRXP-320

CASTROL: ALPHA SP-320

ESSO: Spartan EP-320

KUWAIT PETROLEUM: EP lubricant HD-320

MOBIL: Mobilgear 632

SHELL: Omala Oil 320

TEXACO: Meropa 320

HYDRO: Industrigear oil EP320

The oil level must be checked at least once a month. When the drum is at rest, the oil level should be in the middle of the sight glass.

The first oil change is to be carried out after 2000 working hours, or within six months if the machine has not run for 2000 working hours. Successive oil changes are to be carried out once a year.

The filler plug (6.19) has a ventilation opening, and you must frequently check that this is not clogged.

The top bearing on the gear is lubricated with ball bearing grease through the greasing nipple (6. 20).

Drum bearings

The top ball bearing (7.6) is life-time lubricated from the manufacturer, and needs no further lubrication.

The bottom ball bearing is lubricated by oil from an oil reservoir (4.38) situated at the back of the machine frame. Use the same type of oil as for the refrigerating plant compressor(s).

Oil must be topped up very carefully as oil spills in the water reservoir (2.4) will pollute the ice.

Check the connection between the oil reservoir and bottom ball-bearing at least once a year. This can be done by opening the breather screw (4.41) and filling oil into the oil reservoir until oil runs out of the breather screw.

When changing or replenishing oil, use only new oil as it is very important to avoid any kind of pollution in the oil system.

Even small dust particles or drops of water will cause damage to the shaft journal (4.23) and sealing rings (4.1).

In order to avoid water in the oil, grease the oil seals (4.17 and 4.32) with frost-protected grease via the grease nipple (4.39), which is placed at the back of the ice machine frame.

We recommend a lubricating grease as used in the food industry e. g. Castrol FM1. The seals should be greased after a long period of standstill, and at least once a month.

Water pump

The water pump (2.11) is delivered life-time lubricated from the supplier, so this needs no extra lubrication.

8.2. Draining oil from the drum

The unavoidable carry-over of oil from the refrigerating compressor(s) is concentrated in the ice machine drum. With HFC/HCFC, R744 plant, the oil is returned dissolved in refrigerant liquid through the overflow pipe. With ammonia (R717) plants, the oil concentrates in the drum and gradually reduces heat transfer and thereby ice production.

Draining the drum as follows:

- Close off the supply of liquid refrigerant.
- Continued ice production will then boil off the liquid refrigerant in the drum.
- Gradually reduce the compressor capacity so that the pressure in the drum does **not** come under atmospheric pressure. Keep an eye on the refrigerant pressure gauge (9). When all the refrigerant has evaporated, the pressure will fall rapidly. Stop the compressor immediately.
- Seal off the suction line.
- Wait until the drum temperature is sufficiently high so that the oil can be forced out. You can even wait until the next day.
- Remove the blanking plug on the drain valve (4.40), which is placed in connection with the intermediate piece (4.6). Connect a hose and put the other end in a bucket of water.
- Check that there is over-pressure in the drum (can be seen on [9]), and open the drain valve a little. It is **important** that the oil is drained slowly so that it can flow to the drain point from the whole of the bottom of the drum.
- When ammonia bubbles into the water (and dissolves), close drain valve as the drum appears to have been emptied of oil.

Wait about 1 hour, and drain again. Repeat this process until the drum contains no more oil.

- Replace the blanking plug on the drain valve.
- Send the mixture of oil and water to destruction. **Never** pour it down the drain.

8.3. Cleaning

Deposits can form on the drum surface, and these give rise to a fall in ice production as well as problems with the ice sticking to the drum.

Calceous deposits can be removed by using a weak, organic acid, which must be inhibited so that it doesn't attack aluminium, iron, zinc or copper. Provided the acid is inhibited, the internal water system in the ice machine can be used. The instructions for use and safety provided by the supplier of the acid **must** be followed!

If the acid is **only** inhibited with respect to aluminium and iron, minimize the risk of damage to the surfaces treated with zinc (frame etc.) by proceeding as follows:

- Remove the plug in the bottom of the water reservoir.
- Open for the water supply, forcing the float valve open if necessary. Check that the water splashes over the base of the drum and the top tray.

- Start the drum and apply the acid with a cloth or brush.
- Wait a while and then rinse the surface of the drum thoroughly using cold water from a water hose.
- Put the plug back into place in the water reservoir and resume normal water supply.

If the water used contains **ochre**, fit a special filter (10.20) in the pipe supply for fresh water (can be supplied as an accessory) to reduce the likelihood of deposits forming on the surface of the drum.

The nozzles in the water distribution pipe (2.1) must be checked and cleaned at regular intervals as blocked nozzles will lead to reduced ice production and uneven ice layer on the drum. The ends of the circular distribution pipe can be removed, which makes cleaning easier.

The filter (2.7) before the water valve (2.8) must also be cleaned at regular intervals.

8.4. Rust protection

In case the ice machine is to be kept idle for a long period of time under particularly unfavourable conditions (humid and salty environment), it will be expedient to provide the freezing drum and other components with an anti-corrosion protective coating.

The frame is hot dip galvanized and needs no extra protection.

When the ice machine is placed in a chemical plant or in a tropical coastal area, it may be necessary to periodically rinse the frame with freshwater because of abnormal corrosion conditions.

8.5. Dismantling and assembly

The following is a complete description for dismantling and assembling the shaft seals and drum bearings. Such a thorough dismantling is very seldom necessary, but the description may be helpful when stripping parts of the machine for maintenance or minor repairs. However, first follow any of the previous passages, if applicable

Note: The drum can be raised vertically, suspended in a crane, using the M24 threaded holes in the shaft journal (7.3) as suspension points.

We would recommend that you use the special tool set (10.0) - see **fig. 1** in the following section.

Before any pressurised components are dismantled, the refrigerant **must** be removed from the drum (and preferably the oil too), and the pressure **equalized**.

- Use the procedure described in section 8.2 *Oil draining*.
- Evacuate refrigerant vapours from the drum. This can be done by using the compressor, or a portable evacuation compressor that is connected to the service valve (8).
- Open the service valve and equalise the pressure in the drum to atmospheric pressure.
- Prevent the drum drive motor from starting. This is best ensured by removing the main fuses.

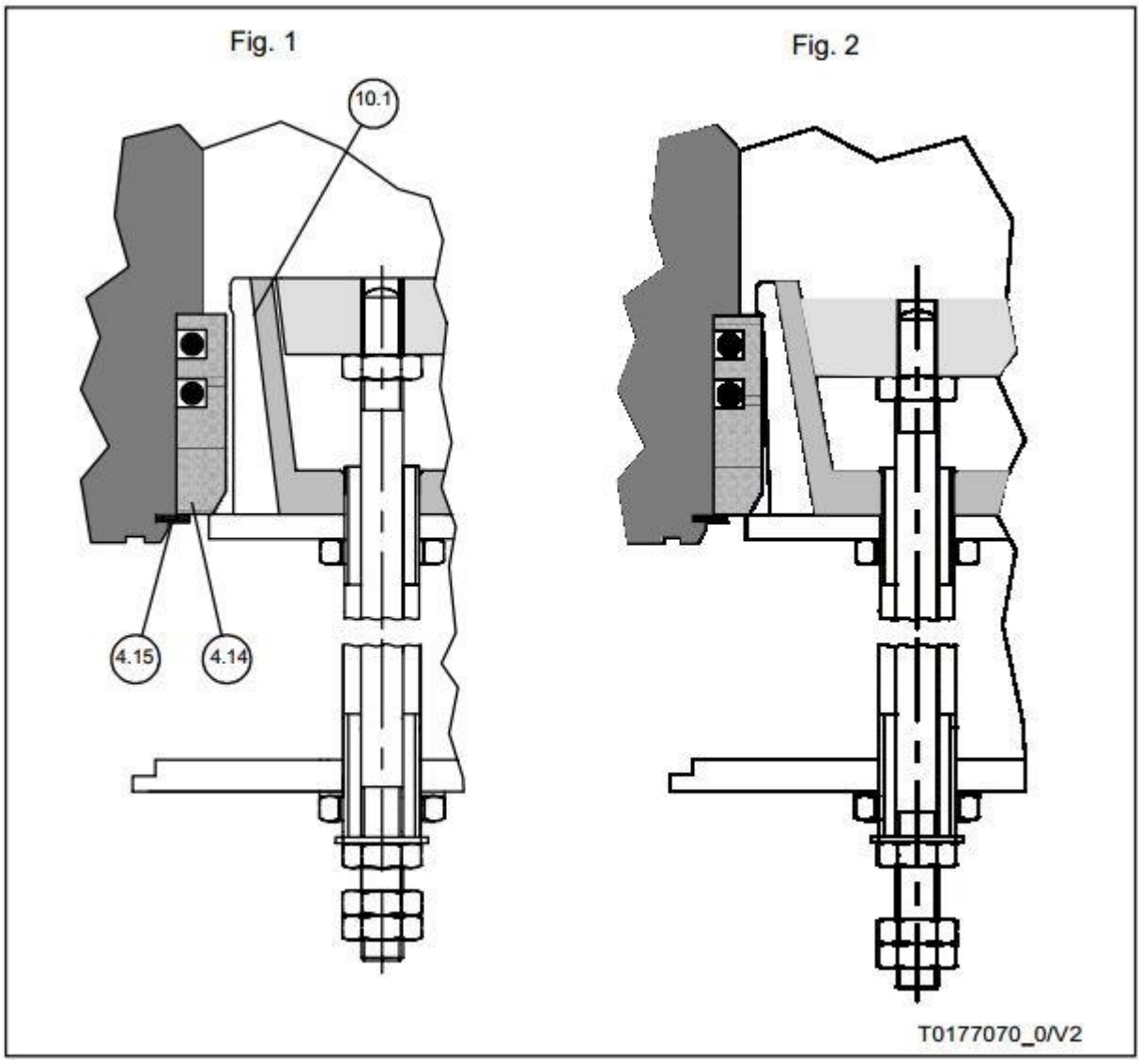
Dismounting the stuffing box and bottom bearing

- Remove the water reservoir (2.4) and the ice chute (1.4) in order to facilitate access to the stuffing box.

- Insert solid supports at 4 points under the peripheral of the drum and place them over the profiles (1.2) that support the upper tray (1.3). Wooden wedges could be used as supports.

- Drain off the oil in the oil reservoir (4.38) by opening the breather screw (4.41). Then dismount the connecting pipe to the oil reservoir and drain off the oil from the bearing.
- Remove the sensor (3.3) in the equalising pipe (3.4) to the level regulator (3.1).
- Dismantle the flanged connection in the liquid line and remove the bottom flange at the liquid supply pipe (4.5), the pipe connection to the oil drain valve (4.40), and the intermediate piece (4.6). Make sure that the nozzle (3.8), which is normally mounted in the liquid pipe flanged connection (3.10) does not get lost. The nozzle is used only in ice machines with level control. The oil pipe (4.7) may drop down, so be careful.
- Make sure by using a jack, for example, that the suction header does not fall down when the nuts (4.8) are removed. Dismantle the flanged connection on the suction pipe branch and revove the nuts. The suction connection piece can now be pushed out of the bearing housing (4.10) by using two M12 screws in the threaded holes provided for this purpose. The suction connection piece can be removed by lowering the jack. Remove the liquid pipe (4.12) and the oil pipe (4.7).
- Remove the locking ring (4.15). Insert punch (10.1) into the bushing, as shown in drawing no T0177070. The segments are drawn over the bushing by pulling the centre cone down by turning the nuts. The bushing (4.14) can now be drawn down.

Using the punch (10.1)



- Remove the bottom knife staybolt (5.7) from the bearing housing (4.10).
- Unload the ball bearing (4.2) pressure on the locking ring (4.16) and remove the locking ring.
- The bearing housing is fixed with reference to the frame by two conical pins. If necessary, these can be drawn out by using two M8 nuts.
- The bearing housing (4.10), complete with bearing, can be drawn down. It may be necessary to press the bearing housing out by placing two M12 screws in the threaded holes provided for this purpose.

Note: There may be liner plates between the bearing housing and frame (4.9). The placing of these and their thickness has been adjusted by Us during assembly, and they must be put back in exactly the same place during re-assembly.

- The ball bearing (4.2) and the seals (4.17),(4.32) and (4.1) can now be removed.
- Note that the teflon lip seals (4.1) and the surfaces they run on must be treated with caution as even the smallest scratch can cause leakages.
- The shaft journal (4.23) can be pushed off by using 4 of the screws mounted in the extra threaded holes if the shaft or drum are to be replaced.

Dismounting the drive station and upper bearing system

- Remove the knife beam (5.2) and the upper staybolt (5.7).
- Remove the stud (7.15) with split pin and turn the gear so that it comes free of the console (7.8).
- Remove the screw (7.17) and place thrust pad (10.2a) on the shaft end. Place puller plate (10.2b) over the shaft in the cover holes on the gear (6.3). The drive station can now be pressed out by using the screw (10.2c).
- Remove the key and distance bushing (7.14).
- The bearing housing (7.5) is fixed in relation to the frame by 2 conical pins (7.12). If necessary, these can be pushed out from beneath using a crowbar. Protect the drum surface!
- Remove screws (7.18) and (7.16). The upper sealing plate (7.11), the bearing house (7.5), and the ball-bearing (7.6), can all now be removed.
- If the drum is to be replaced, it can be lifted in a crane by screwing a lifting eye with M24 thread in the end of the shaft journal (7.3). The drum can now be lowered on to the forks of a fork-lift truck, for example.
- Remove the screws (7.4) and the shaft journal (7.3). If necessary, the shaft journal can be pressed out by using 4 screws mounted in the extra threaded holes.

Mounting the drum

- Clean and grease the drum's contact face and bearing face for the upper shaft journal.
- If the drum is outside the frame, place it inside - e.g. by using a fork-lift truck.
- Lower the drum so that it stands on the shell at the bottom of the drum on the upper tray (1.3).
- Mount the upper shaft journal (7.3) with a new 0-ring (7.1) using new screws (7.4) and washers (7.9). Secure the screws with Loctite 222e, or similar, and tighten with a torque of 35Nm.

Mounting the drive station and upper bearing system

- Push the V-ring (7.13) and the bottom sealing plate (7.11) a fair way down the shaft.
- Mount the bearing (7.6).

- Mount the bearing housing and fix with the two conical pins (7.12) Grease the surface around the bearing.

Carry out the next 2 procedures when the stuffing box (4.0) is mounted (see relevant section) and when the drum is put into place.

- Mount the upper and lower sealing plates (7.11) on the bearing housing and pull the V-rings (7.13) up so that the distance A on drawing T0177080, section 9.7 is between12.3 and 14.7mm.
- Mount the key on the shaft, and then grease the shaft.
- Screw the screw (10.2c) into the thread in the end of the shaft journal. The drive station can now be pressed over the shaft by using nut (10.2d) and the washer (7.20). Then turn the drive station and mount the split pin (7.15).

Fitting the stuffing box and lower bearing

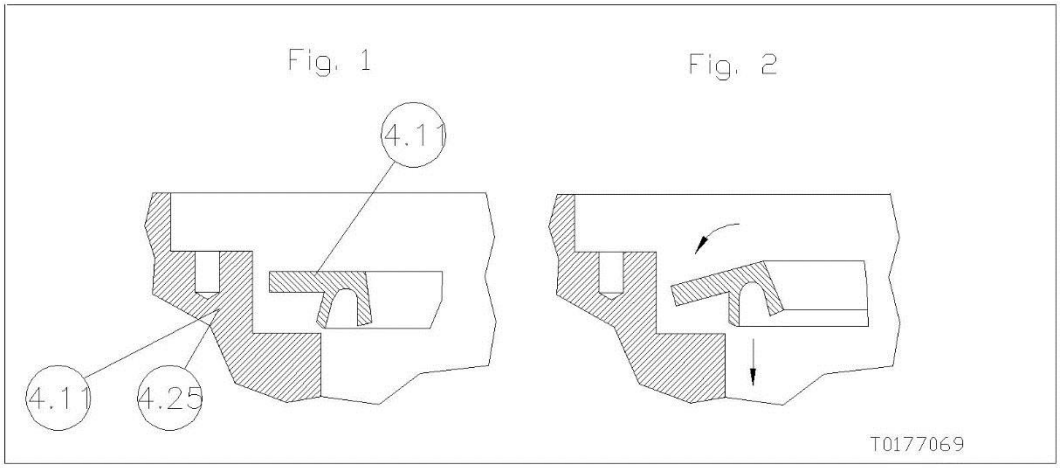
- Clean the bushing (4.14), oil on the outside (but not the inside), fit with new O-rings (4.29), and mount using punch (10.1). Place the locking ring (4.15) in the groove.
- Clean and lightly grease the bottom contact surface and bearing surface of the shaft journal.
- Fit new 0-ring (4.20), screws (4.30) and washers (4.31) on the shaft journal (4.23). Secure the screws Loctite 222e, or similar, and are tighten with a torque of 35Nm. The shaft journal surface, which should be treated with caution, must be cleaned and lubricated with oil.
- The seals (4.17) and (4.32) that keep water out of the drum must then be mounted in the bearing housing. Fill the upper seal (4.32) with silicone. Mount the ball bearing (4.2).
- Oil the 2 conical pins and knock them in from underneath, if they have been removed.
- Place the bearing housing so that the threaded hole for the knife stay is at the front of the machine.
- Lift the bearing housing and retain in place with the conical pins. Fit the locking ring (4.16) in the groove in the shaft journal.
- Insert the liner plates (4.9) in the position they were in before dismantling and lift the drum up so that the bearing housing rests against the frame. If you are not sure of the liner plate position, refer to *section 8.6 Aligning the bearing housing*.

Note: If the alignment is incorrect, the lifetime of the ball-bearing (4.2) and all seals in the shaft seal (4.0) will be greatly reduced.

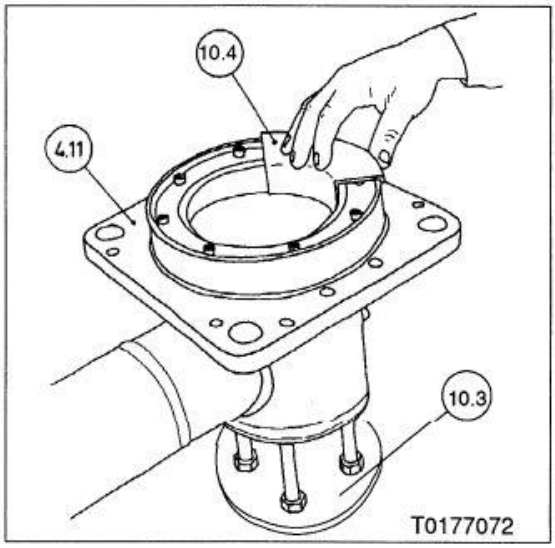
- Oil the two conical pins (4.42) and if they have been removed, knock them in from the bottom.
- Mount the lifting fitting (10.3) under the suction connection piece (4.11) with 2 of the screws (4.35). Mount 0-rings (4.19) and (4.3) and grease them. Fit the sealing ring (4.1). The sealing rings are made of teflon which must not be knocked. The slightest scratch in the sealing edge will cause it to leak.

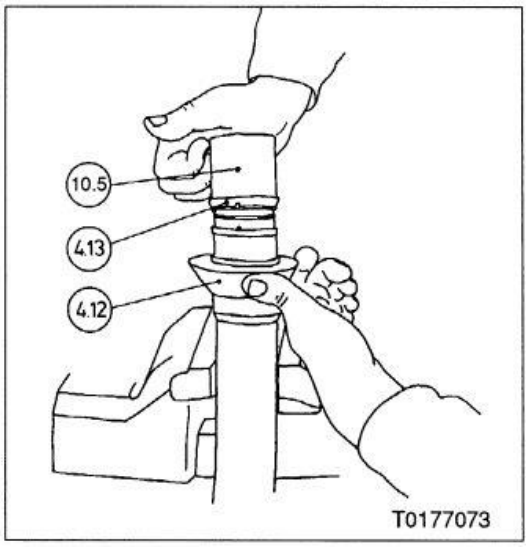
Before fitting the sealing rings between the suction connecting piece and the locking ring (4.25), position them as shown in the drawing below (no. T0177069). Figure 1 shows the outer lips, slightly deformed as they press against the edges of the housing. In figure 2 the seal has been conically twisted by hand. It can now be pushed into place without damaging the outer lip.

Fitting the sealing ring (4.1)



- The lower sealing ring (4.1) is mounted with it´s opening down, as shown. Mont the intermediate ring (4.24) and the upper sealing ring (4.1) with its opening up. The screws (4.27) and washers (4.28) are to be tightened with a torque of 13Nm. Mount the four parts of the seat protector (10.4) in the preassembled suction connection piece (4.11). See drawing no. T0177072.

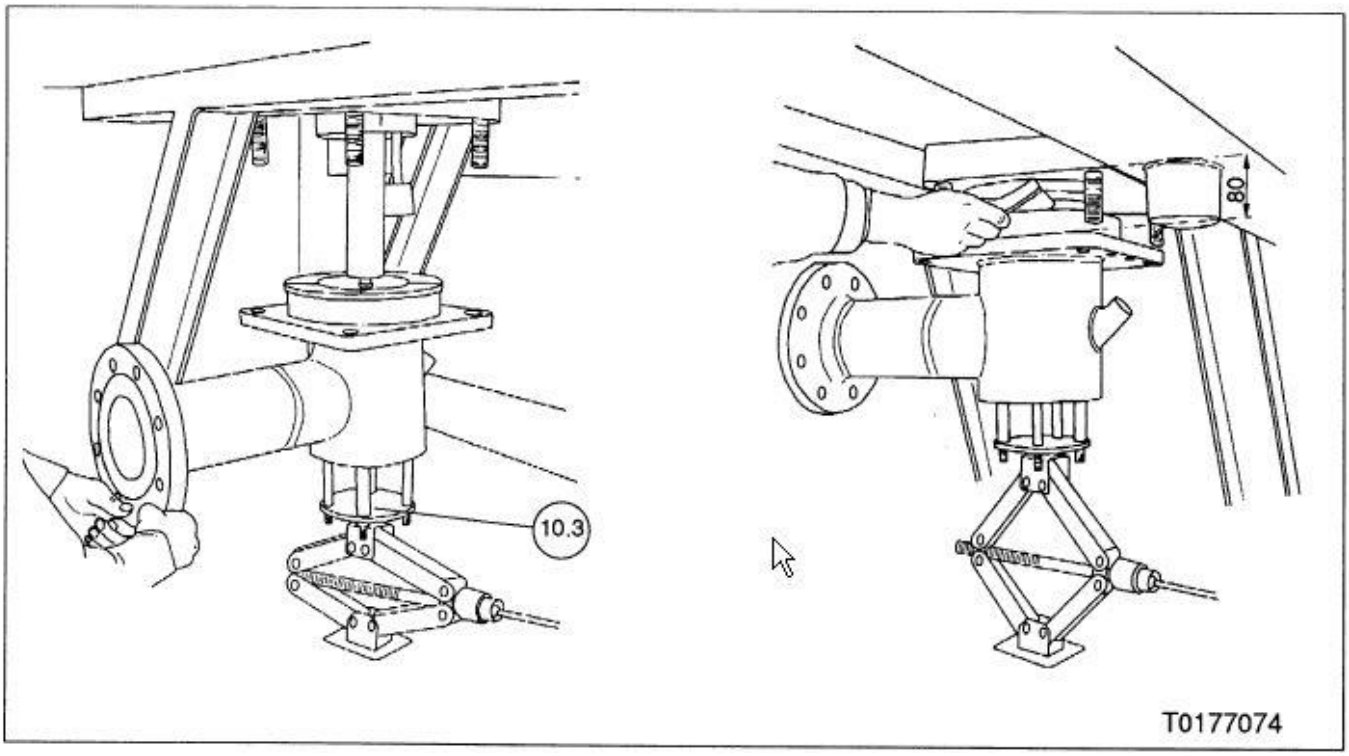




- Put the liquid pipe carefully in a vice, as shown in drawing no. T0177073. Lightly grease the end of the liquid pipe (the cone) and place the sealing ring on the cone with the little notch by the pin that is mounted in the liquid pipe´s sealing track. Press the seal over the cone by applying vertical pressure with the punch (10.5) – see drawing no. T0177073. Wipe the seal so that there is no oil on it.

- A drain is placed on the outside of the liquid pipe. At the bottom it runs out in to a Ushaped console that surrounds the housing for the level regulator sensor.
- Fit the oil pipe (4.7) with new 0-rings (4.18) inside the liquid pipe and carefully lead both pipes up and press in to position. They are now suspended in the drum by means of the seals. Position the liquid pipe carefully so that the drain pipe with plate console faces the opposite way to the piping branch on the suction connecting piece.
- Place the suction connection piece **with** protection ring under the liquid and oil pipe and lift up using a jack, as shown in drawing no. T0177074. Raise the suction connection piece without touching the liquid pipe until the clearance between the bearing housing and the joint face of the suction connection piece is approx. 80 mm. Remove the parts of the protection ring, and then continue raising the suction connection piece and fasten it in place with (4.8). Check while you are doing this that the U-shaped plate console on the drain pipe encircles the sensor housing (4.37) - this can be seen through the nozzle on the suction connecting piece.

Mounting the suction connection piece (4.11)



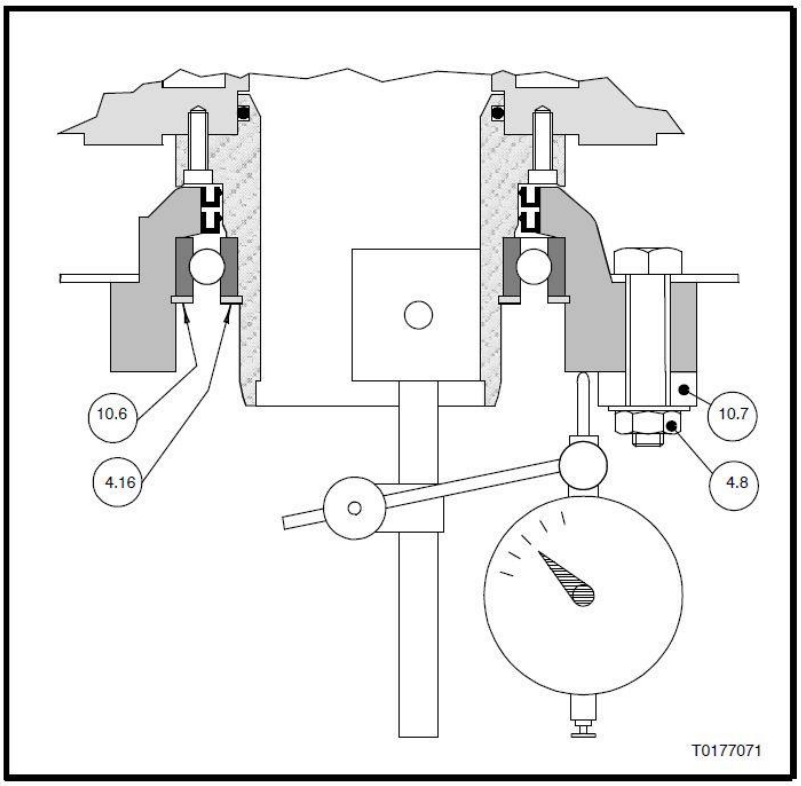
- Remove the drum support.
- Fit the intermediate piece (4.6) with gaskets (4.21) and the inlet pipe (4.5). Remember to fit the nozzle (3.8) and gaskets in the flange (3.10) in the liquid level control system.
- Connect the oil system, lubrication system and other connections.

8.6. Alignment of bearing housing

Please also refer to drawing no. T0177071.

- Mount the locking rings (10.6) in the groove in the bearing housing.
- Raise the drum is until the bearing housing rests on the frame. Mount the distance bushing (10.7) and fix the bearing housing with nuts (4.8).
- Mount a magnetic clamp inside the shaft journal.
- Place the micrometer gauge so that it can slip past the nuts. If the sealing surface of the bearing housing is not perpendicular to the drum axis, the gauge will show varying readings when the drum is rotated. Rotate the drum through 360° and note the readings in order to find the corners that must be lined up.

Aligning the bearing housing (4.10)



Loosen the nuts (4.8) so that the bearing housing drops a couple of millimetres. Insert the required liner plate (10.8) between the bearing housing and the frame. Then tighten the nuts.

Check that the gauge reading does not vary more than **max. 0.10 mm** on a 360° rotation of the drum. Poor alignment of the bearing housing can reduce the lifetime of the ball bearings (4.2) and all the seals in the stuffing box.

Support the drum soundly - as described earlier. Unload the pressure of the ball-bearings against the locking rings (10.6) and then remove them. Continue, mounting the suction connection piece as described in *section 8.5 Fitting stuffing box and lower bearing*, from the paragraph which begins: Mounting the lifting fitting (10.3) on page 54.

8.7. Protecting against frost

- The surrounding temperature for the ice ma chine must be min. +5°C during operation. If the temperature falls below 0°C, the water system **must** be emptied to prevent the pipe from bursting due to ice formation. Empty the water reservoir, the water supply pipe, the water pump, and the connection from the float valve to the nozzle under the drum.
- Before starting the ice machine up after a frosty period, ensure that the water pump impeller is not frozen solid.

9. Position number chart and spare parts

The charts on the following pages list all the position numbers referred to in this manual.

Furthermore, references to drawings, part numbers and quantities are given for each type of ice machine.

If the column headed “Type” is empty, the quantity stated for types V and VD applies to all types of ice machine.

To avoid mistakes and unnecessary delays when ordering spare parts, please order as shown in the following example.

The flexible hose (2.5) for water returning to the water reservoir (2.4) and new jubilee clips are required. The machine is type V316 AFT, shop no. 9999.

Order:

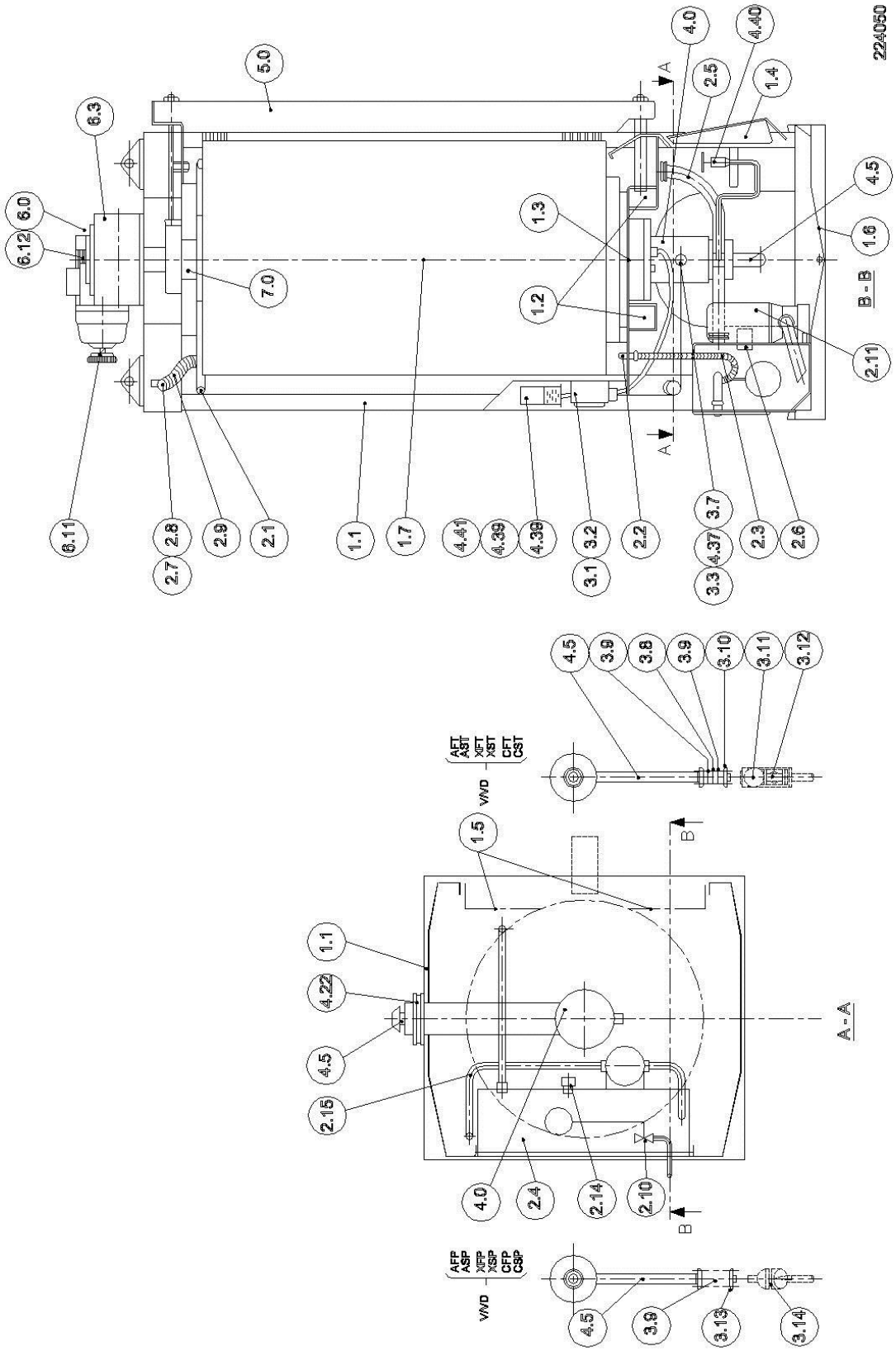
Ice machine type V316 AFT serial no. 9999

1 off flexible hose
L=800 mm no. 1241-011
2 off jubilee clips no. 1345-159
Other parts can be added if necessary

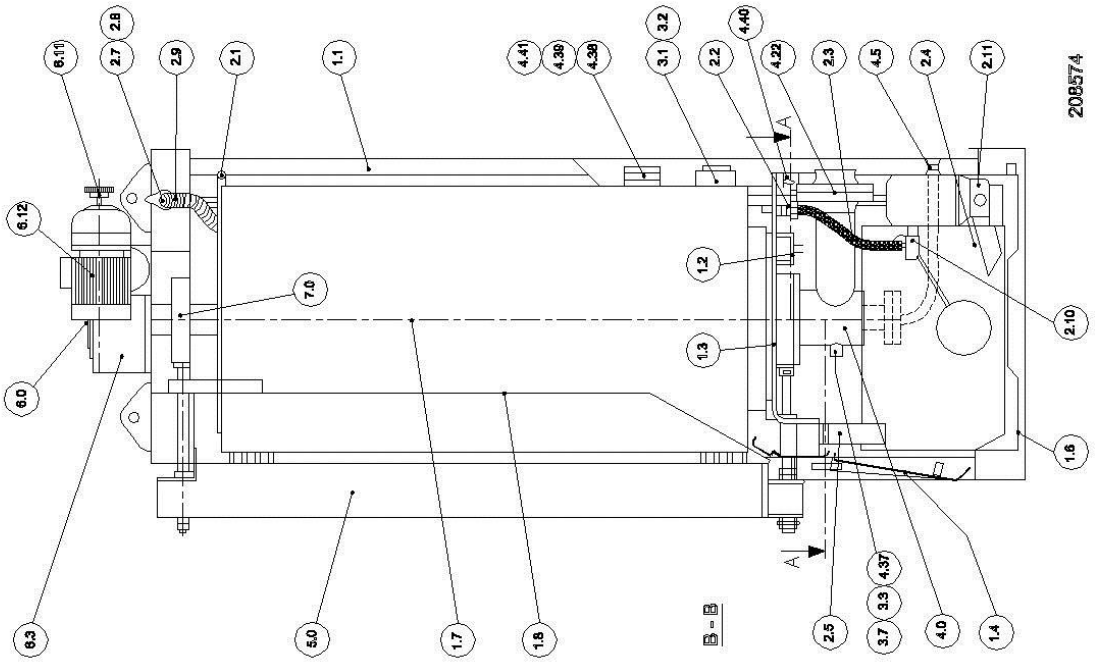
9.1. Frame parts

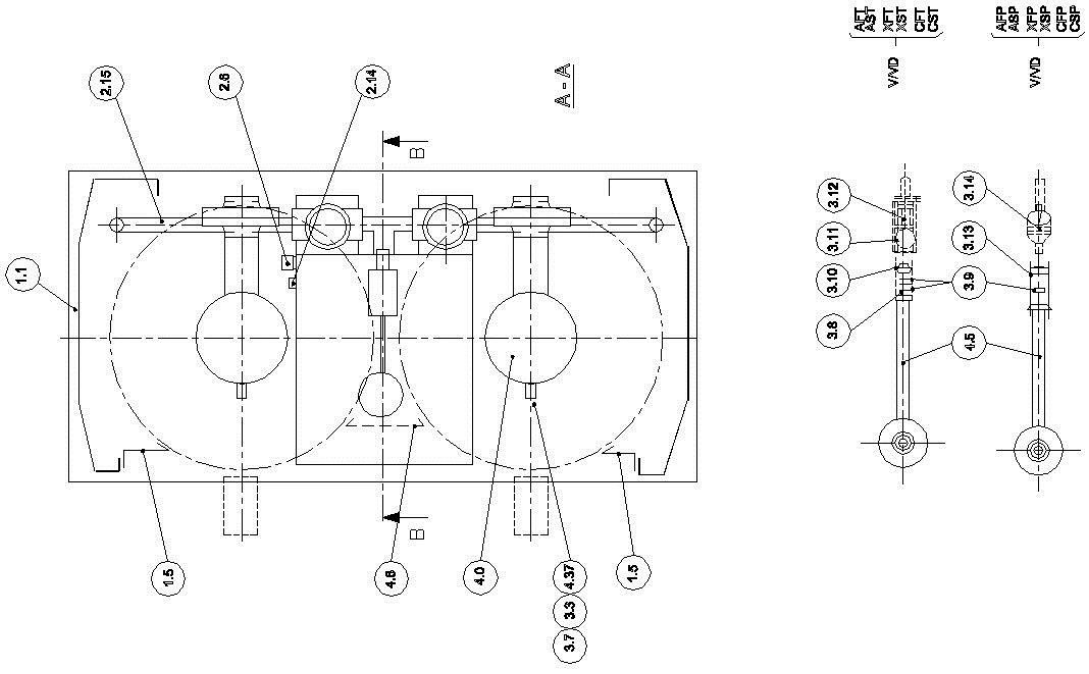
Pos. no.	Shown on drawing		Designation	Qty. for type		Type	Spare part no.
	224050	208574		V	VD		
1.1	*	*	Frame	1	1		a)
1.2	*	*	Support brackets	2	2		a)
1.3	*	*	Top base tray	1	1		a)
1.4	*		Ice chute	1			3284-153
		*			1		3284-166
1.5	*		Side screen (right and left are identical)	2		156	3284-259
	*			2		316	3284-260
	*			2		619	3284-261
		*		2	2	373/746	3284-247
		*			2	1206	3284-248
1.6	*	*	Bottom base tray	1	1		a)
1.7	*		Drum with layer of chrome/nickel	1		156	3289-010
	*			1		316	3289-011
	*			1		619	3289-013
		*		2	2	373/746	3289-012
		*			2	1206	3289-013
1.8		*	Intermediate screen		1	746	3284-398
		*			1	1206	3284-397

Sectional drawing of ice machine, type V



Sectional drawing of ice machine, type VD





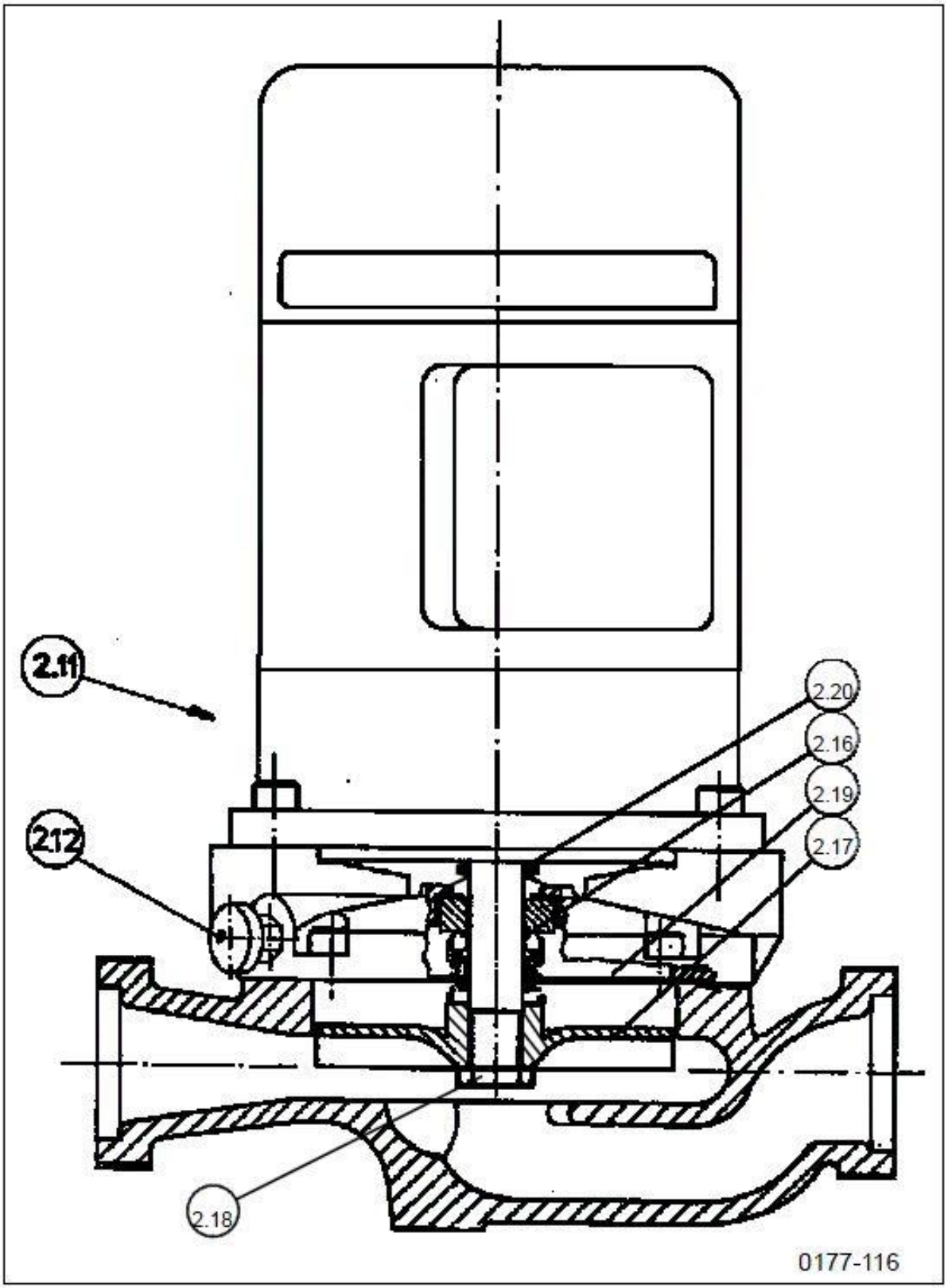
9.2. Water system

Pos. no.	Shown on drawing					Designation	Qty. for type		Type	Spare part no.
	219356	219357	224050	208574	237431		V	VD		
			*	*		Circle shaped water distr. pipe				
						- right	1	1		3284-238
				*		- left		1		3284-271
						Pipe hanger for circle-shaped pipe	4	8	f)	2212-129
						Pipe holder for circle-shaped pipe	4	8	g)	1367-021
2.1			*			Vertical water distribution pipe	1		156	3284-236
			*				1		316	3284-237
			*				1		619	3284-246
				*			1	2	373/746	3284-246
				*				2	1206	3284-246
						Bracket complete with vertical pipe	1		156/316	2211-023
							2	4	619	
			*	*		Water supply – nozzle	1	2	619/1206	3284-517
2.2			*	*		- sealing ring	1	2	156/316/373/746	3284-523
						- disc	1	2		1436-007
2.3			*	*		Hose with fittings	1	2		2315-063
2.4			*			Water reservoir	1			3283-196
					*					3283-197
2.5					*	Flexible hose – L = 800 mm	1			1241-011
					*	- L =150 mm		1		1241-011
2.6	*	*	*	*		Overflow on water reservoir	1	1		a)
2.7	*	*	*	*		Filter	1	2		1366-007
2.8	*	*	*	*		Throttling valve	1	2		1363-003

Pos. no.	Shown on drawing					Designation	Qty. for type		Type	Spare part no.
	219356	219357	224050	208574	237431		V	VD		
2.9			*	*		Flexible hose – L = 400 mm	1	2		1241-001
2.10	*	*	*			Water level control	1		b)	1300393813
				*				1	b)	1300383813
2.11	*	*	*	*	*	Water pump c) – 50 HZ	1	2		1524-002 e)
						- 60 HZ	1	2		1524-041 e)
2.12					*	Purging screw on water pump	1	2		a)
2.13	*	*				Throttle valve – freshwater supply	1	1	d)	1363-003
2.14	*	*	*	*		Rubber plug	1	1		1224-001
2.15			*	*		Hose w/cross webbing – L = 750 mm	1	2		1241-156
2.16			*	*		Jubilee clip	2	4		1345-172
					*	Stuffing box	1	2		1332-016
2.17					*	Vane wheel – Motor 50 HZ	1	2		1524-064
						- 60 HZ	1	2		1432-008
2.18					*	Nut	1	2		1432-008
2.19					*	Gasket	1	2		1333-001
2.20					*	Sealing ring	1	2		1332-014

a) Part of / included in part stated.
b) AFP, AFT, XFP, XFT, CFP, CFT
c) Motor make and type, plus voltage and frequency must be specified.
d) ASP, AST, XSP, XST, CSP, CST
e) Electrical details, see section (2.1) Main data.
f) Earlier supply
g) New supply

Sectional drawing of water pump (2.11)



9.3. Regulating refrigerant

Pos. no.	Shown on drawing						Designation	Qty. for type		Type	Spare part no.
	219356	219357	224050	208574	T0177097	237437		V	VD		
Liquid level regulation (Type AFT, AST, XFT, XST)											
3.1	*	*	*		*		Level regulator complete, incl. heating element, gasket and feeler	1	2		1993-023
3.2	*	*	*	*			Transformer for heating element	1	2		1993-131 d)
3.3			*	*	*	*	Sensor for level regulator	1	2		a)
3.4					*		Equalizing pipe – L = 1400 mm	1			1112-101
					*		- L = 1900 mm		2		1112-101
3.5						*	Heating element in feeler	1	2		1993-021
3.6					*		Capillary/wirefor level regulator	1	2		a)
3.7			*	*			Gasket for sensor	1	2		1336-001
3.8	*	*	*	*	*		Nozzle plate b)	1	2		2325-333
3.9			*	*			Gasket for nozzle plate	2	4		2356-210
3.10			*	*			Counterflange for nozzle	1	2		3432-089
3.11	*	*	*	*	*		Solenoid valve	1	2		c)
3.12	*	*	*	*			Filter for solenoid valve	1	2		c)
3.16					*	*	Overflow pipe in drum	1	2		a)

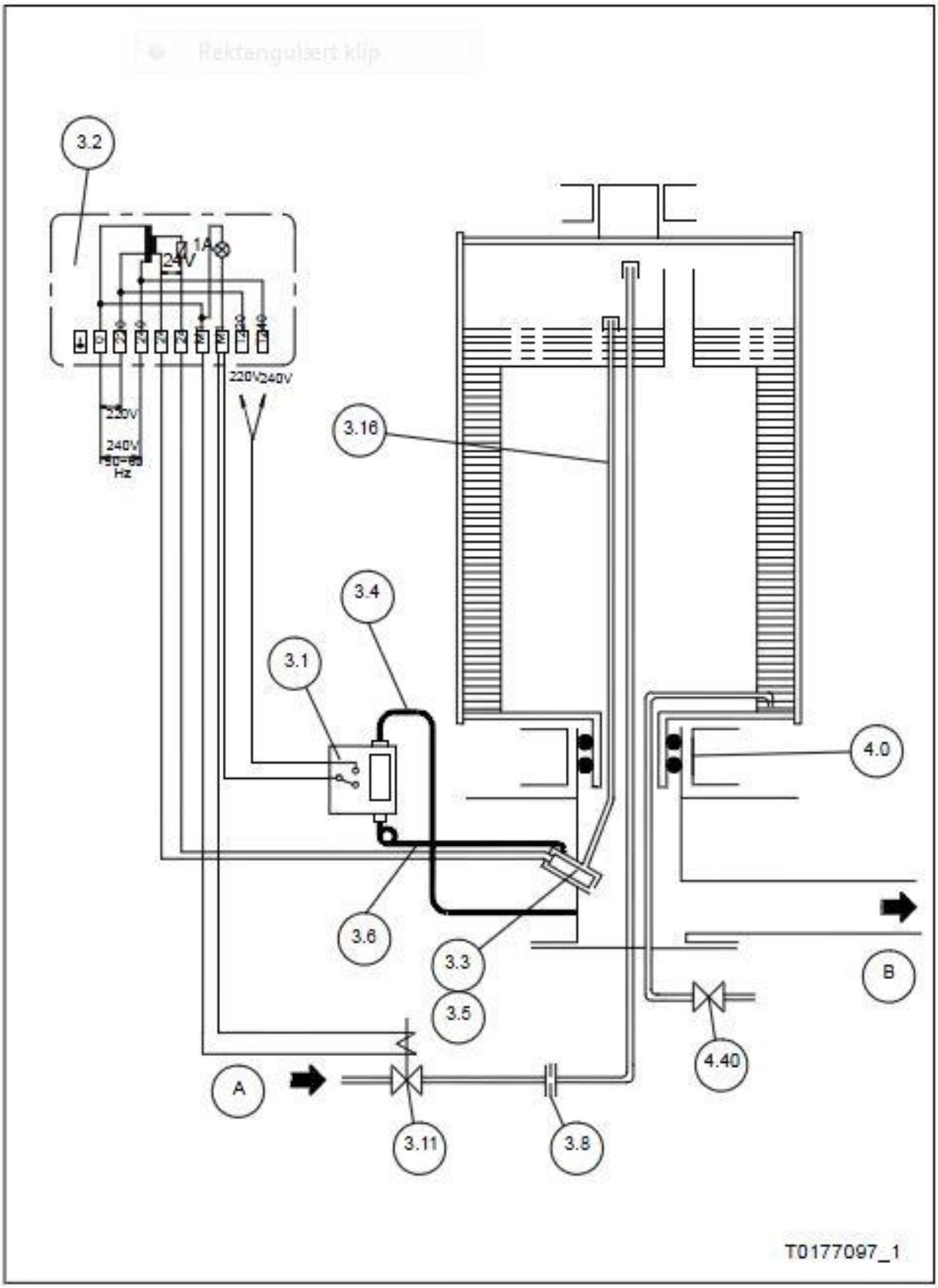
a) Part of/included in part stated. (Stamped on the nozzle plate).
b) The size of the hole in the nozzle must be specified.
c) Not included in standard supply.
d) Electrical details see section 2.1 main data.

3.1, 3.3 and 3.5: See annex.

Diagrams for different types of refrigerant, see section 4.7

Pos. no.	Shown on drawing						Designation	Qty. for type		Type	Spare part no.
	219356	219357	224050	208574	T0177097	237437		V	VD		
Liquid level regulation (Type AFP, ASP, XFP, XSP)											
3.9			*	*			Gasket for flange joint	1	2		2356-210
3.13			*	*			Conterflange	1	2		1344-131
3.14	*		*				Throttle valve – AFP, ASP	1		156	1372-141
	*		*				- XFP, XSP	1		156	2415-126
	*		*				- AFP, ASP	1		316	1372-142
	*		*				- XFP, XSP	1		316	2415-127
	*		*				- AFP, ASP	1		619	2415-126
	*		*				- XFP, XSP	1		619	2415-132
		*		*			- AFP, ASP		2	746	1372-142
		*		*			- XFP, XSP		2	746	2415-132
		*		*			- AFP, ASP		2	1206	2415-126
		*		*			- XFP, XSP		2	1206	2415-132
3.15						*	Plug	1	2		1377-011
3.16					*	*	Overflow pipe in drum	1	2		a)
a) part of/included in part stated. (Stamped on the nozzle plate).											

Principle drawing showing the liquid level regulation system



Also see section 4.7 for details on piping etc.

Pos. no.	Shown on drawing						Designation	Qty. for type		Type	Spare part no.
	219356	219357	224050	208574	237437	228496		V	VD		
4.0			*	*			Shaft seal c/w axel journal bearings, gaskets and connections for refrigerant inlet and outlet.	1	2		3283-226 3283-212
4.1					*	*	Sealing ring	2	4		1332-116
4.2					*	*	Step ball bearing	1	2		1511-002
4.3					*	*	O-ring	2	4		1331-214
4.4					*		Gasket	1	2		1336-001
4.5			*	*	*	*	Bottom flange with liquid inlet pipe	1	2		3284-120
4.6					*	*	Intermediate pcs.	1	2		3284-233
4.7					*	*	Oil pipe	1	2		3283-214
4.8					*	*	Hexagon screw Hexagon nut	4 4	8 8		1424-025 1432-053
4.9					*	*	Liner plates for aligning bearing housing (4.10)	b)	b)		a) e)
4.10					*	*	Bearing housing	1	2		3284-232
4.11					*	*	Suction connecting piece	1	2		3283-211 3283-231
4.12					*	*	Liquid pipe	1	2		3283-213
4.13					*	*	Sealing ring	1	2		1332-115
4.14					*	*	Bushing	1	2		3284-224
4.15					*	*	Locking ring	1	2		1437-160
4.16					*	*	Locking ring	1	2		1437-231
4.17					*	*	Bottom oil sealing ring	1	2		1332-003
4.18					*	*	O-ring	2	4		1331-215
4.19					*	*	O-ring	1	2		1331-109
4.20					*	*	O-ring	1	2		1331-173

a) Part of/included in stated part.
b) Quantity and size determined during fitting.
c) Used at flange joint tongue and groove.
d) Used at flange joint with level bearing surface.
e) Please also see (10.8)
f) Earlier execution
g) New execution

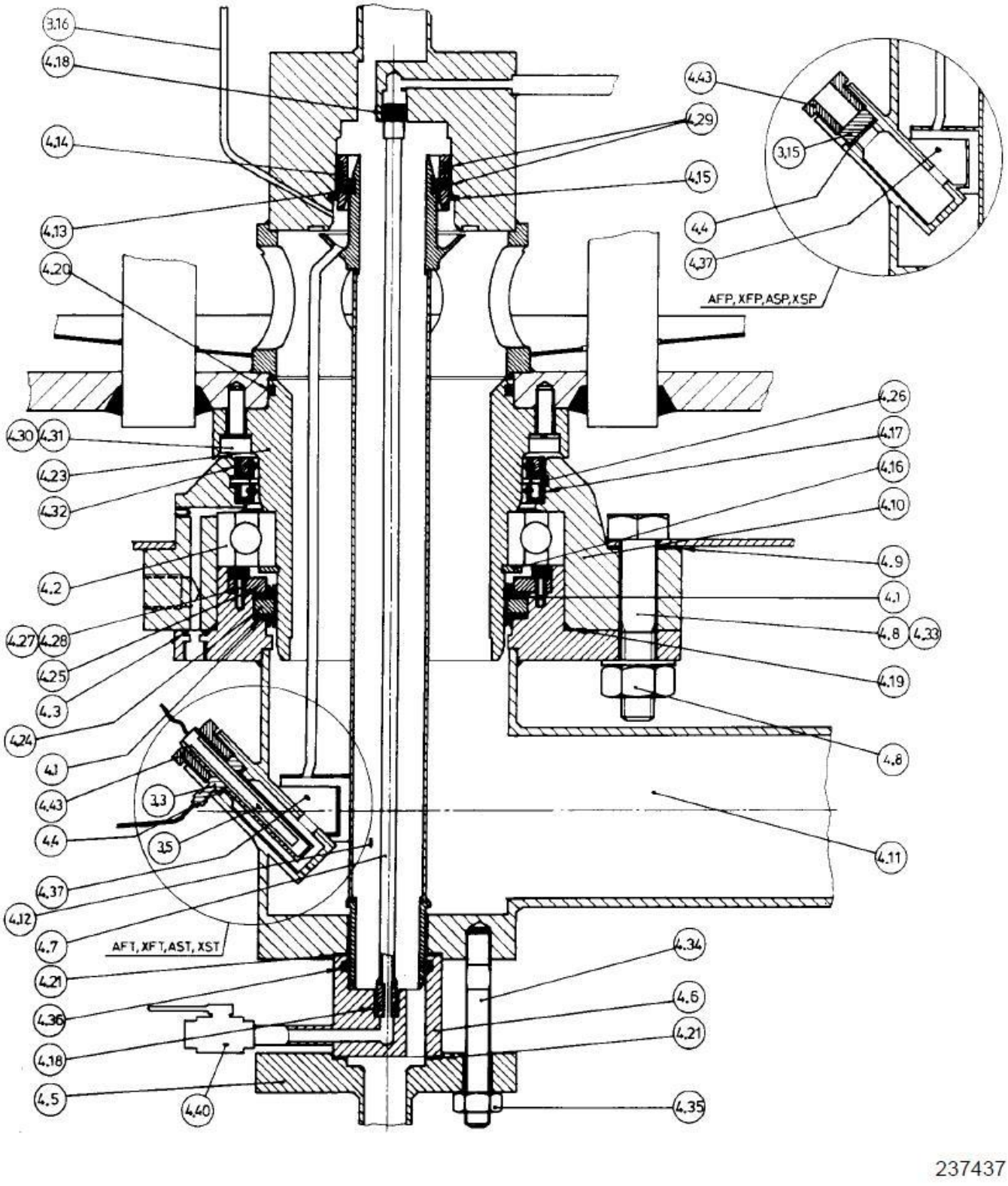
Pos. no.	Shown on drawing						Designation	Qty. for type		Type	Spare part no.
	219356	219357	224050	208574	237437	228496		V	VD		
4.21					*	*	Flat gasket	2	4		1993-154
4.22			*	*			Flange gasket	1	2	c)	2356-224
			*	*			Flange gasket	1	2	d)	2356-270
4.23					*	*	Journal	1	2		3284-222
4.24					*	*	Intermediate ring	1	2		3284-226
4.25					*	*	Tightening ring	1	2		3284-225
4.26					*	*	Locking ring	1	2		1437-178
4.27					*	*	Hexagon socket head screw	8	16		1413-341
4.28					*	*	Spring washer	8	16		1437-008
4.29					*	*	O-ring	2	4		1331-040
4.30					*	*	Cylinder screw w/internal hexagon	16	32		1413-396
4.31					*	*	Spring washer	16	32		1437-095
4.32					*	*	Top oil sealing ring (sealed with silicone)	1	2		3284-234
4.33					*	*	Tightening washer	4	8		1436-007
4.34					*	*	Stud bolt	4	8		2112-112
4.35					*	*	Hexagon screw	4	8		1432-072
4.36					*	*	O-ring	1	2		1331-035
4.37			*	*	*		Sensor housing in suction con. pipe	1	2		a)
4.38	*	*	*	*			Oil cup complete	1	2	f)	3284-119
							Oil reservoir complete	1	2	g)	3284-512
							Oil charging plug with breather	1	2	g)	1343-008
4.39	*	*	*	*			- Greasing nipple	1	2		1516-001
							- Reinforcing bushing	1	2		1349-084
							- Bulkhead elbow connection	1	2		2314-076

a) Part of/included in stated part.
b) Quantity and size determined during fitting.
c) Used at flange joint tongue and groove.
d) Used at flange joint with level bearing surface.
e) Please also see (10.8)
f) Earlier execution
g) New execution

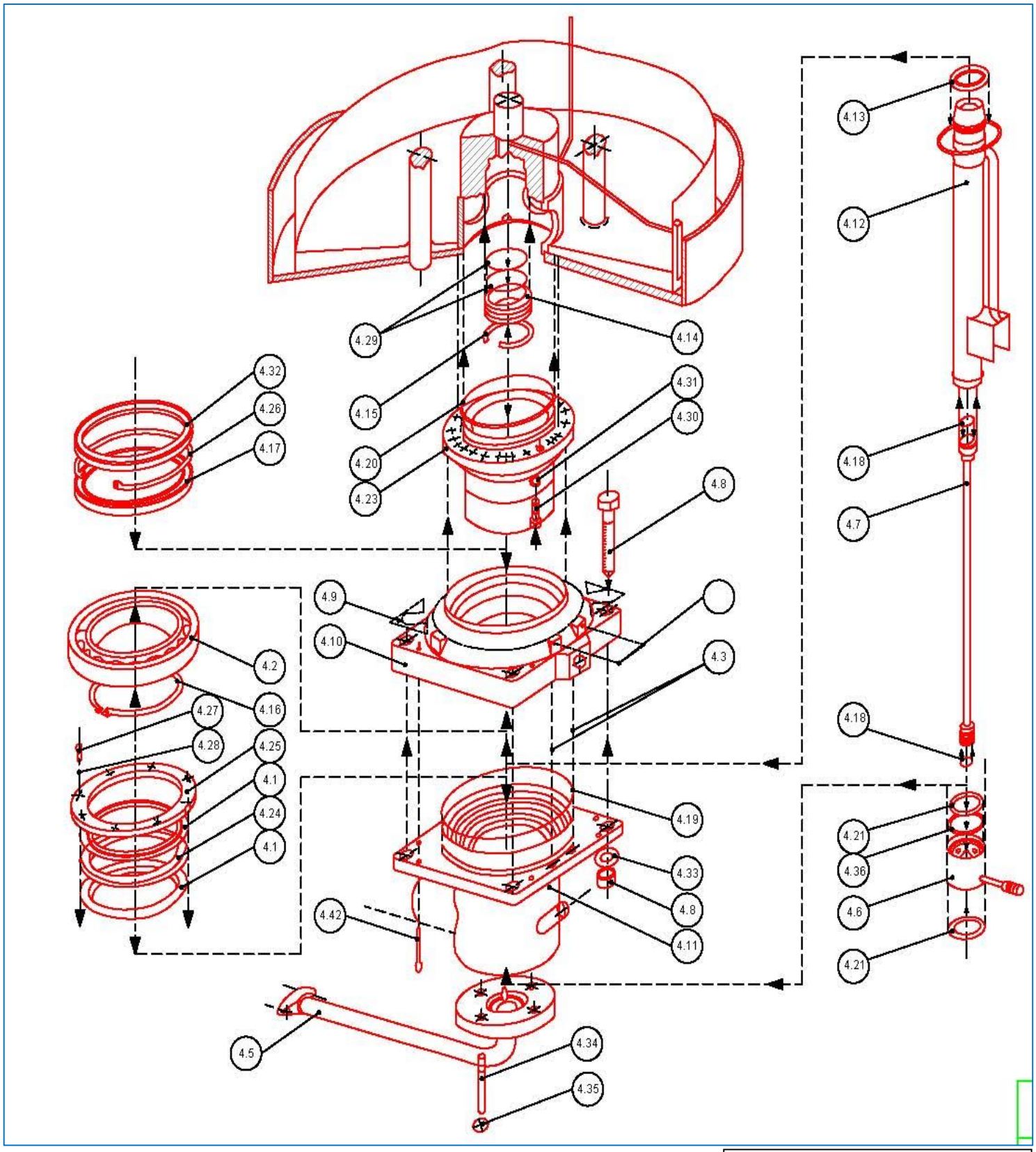
Pos. no.	Shown on drawing						Designation	Qty. for type		Type	Spare part no.
	219356	219357	224050	208574	237437	228496		V	VD		
4.40	*	*	* *				Oil draining valve (placed inside the frame) incl. suitble pipe, bracket and connections	1	 2	f) f)	3283-218 3283-219
	*	*	*	*	*		Oil draining valve (placed on intermediate piece (4.6) incl. connections)	1	2	g)	3283-266
4.41	*	*	*	*			Bleeder screw comprising: - bulkhead elbow connection - plug	1 1	2 2		1349-161 1349-182
4.42						*	Conical pin	2	4		1445-007
4.43					*		compression unit	1	2		1377-007

a) Part of/included in stated part.
b) Quantity and size determined during fitting.
c) Used at flange joint tongue and groove.
d) Used at flange joint with level bearing surface.
e) Please also see (10.8)
f) Earlier execution
g) New execution

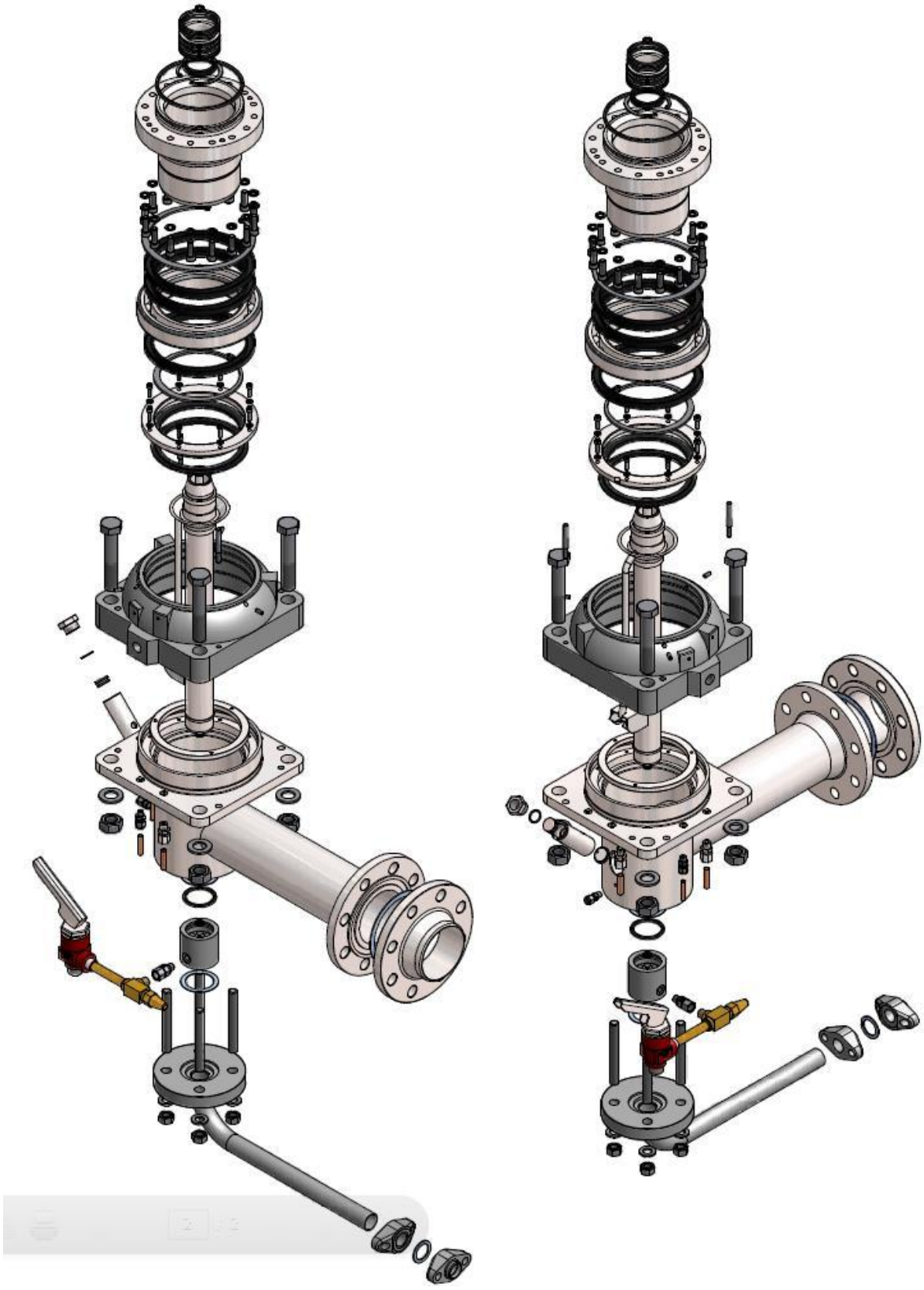
Sectional drawing of stuffing box (4.0)



Exploded drawing of stuffing box. (4.0)



Stuffing box
228496



9.5 Ice knife

Freshwater (Type AFP, AFT, XFP, XFT)

Pos. no.	Shown on drawing			Designation	Qty. for type		Type	Spare part no.
	224050	208574	T0177079		V	VD		
5.0	*			Knife complete with retaining bolt and nuts	1		156	3282-063
	*				1		316	3282-065
	*				1		619	3282-058
		*				1	746	3282-067 a)
		*				1	1206	3282-060 a)
5.1			*	Hexagon nut	6	12		1432-051
5.2			*	Knife beam	1		156	3282-064
					1		316	3282-066
					1		619	3282-059
				- right		1	746	3282-068
				- left		1	746	3282-069
				- right		1	1206	3282-061
				- left		1	1206	3282-062
5.3			*	Hexagon screw	3	6		1424-001
5.4			*	Washer plate	3	6		1436-005
5.5			*	Hexagon nut	1	2		1432-053
5.6			*	Nut with guide	1	2		2113-022

a) Includes both left and right knives

Pos. no.	Shown on drawing			Designation	Qty. for type		Type	Spare part no.
	224050	208574	T0177079		V	VD		
5.7			*	Top retaining bolt	1		156	2112-134
					1		316	2112-116
					1		619	2112-118
						2	746	2112-116
						2	1206	2112-118
			*	Bottom retaining bolt	1		156	2112-113
					1		316	2112-117
					1		619	2112-119
						2	746	2112-117
						2	1206	2112-119
5.8			*	Threaded plate	1	2		3284-421
5.9			*	Washer plate	4	8		1436-007
a) Includes both left and right knives								

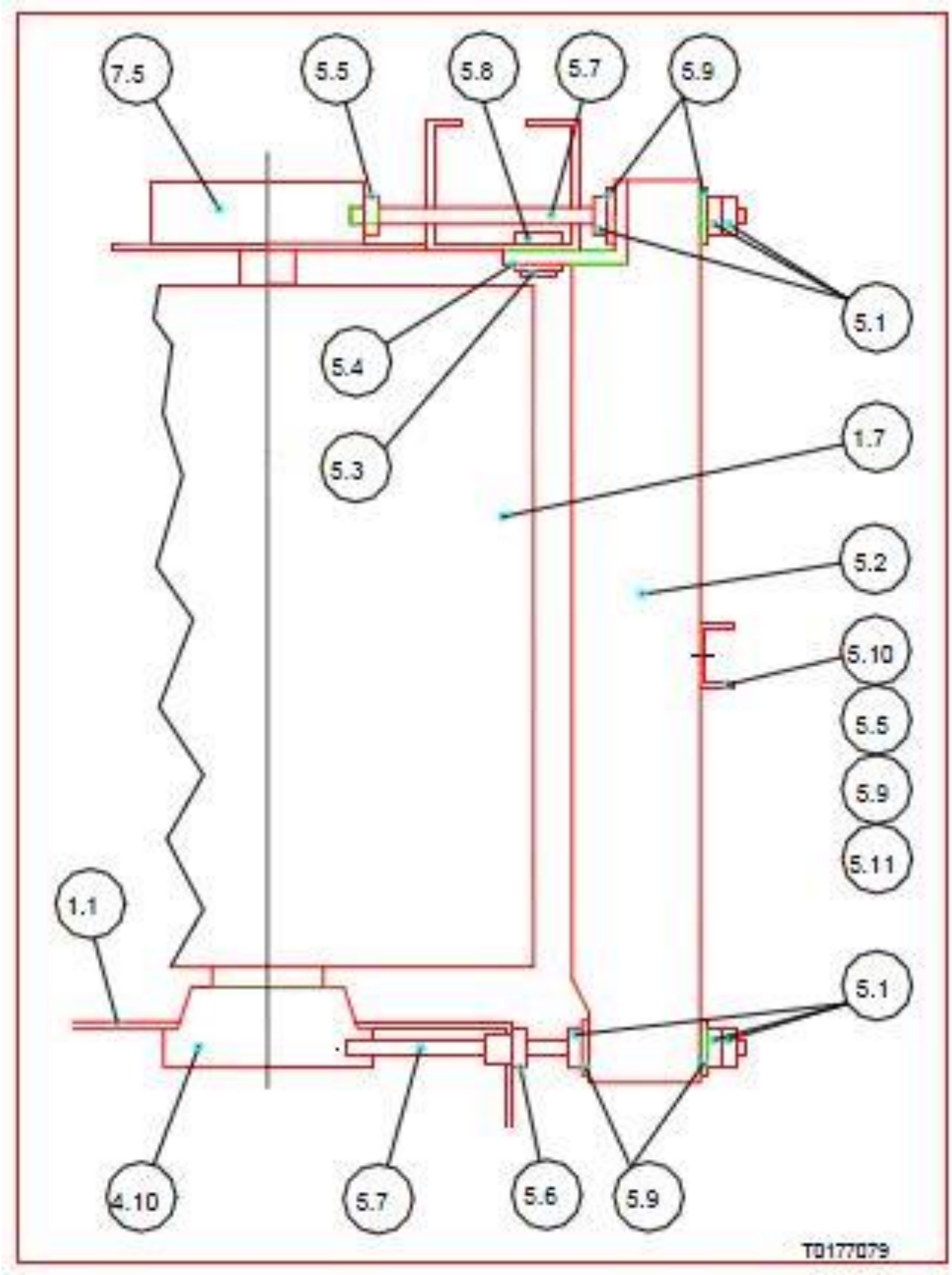
Sea water (Type AFP, AST, XFP, XST)

Pos. no.	Shown on drawing			Designation	Qty. for type		Type	Spare part no.
	224050	208574	T0177079		V	VD		
5.0	*			Knife complete with retaining bolt and nuts	1		156	3282-070
	*				1		316	3282-071
	*				1		619	3282-084
		*				1	746	3282-072 a)
		*				1	1206	3282-073a)
5.1			*	Hexagon nut	6	12		1432-051
5.2			*	Knife beam	1		156	3282-074
					1		316	3282-075
					1		619	3282-085
				- right		1	746	3282-080
				- left		1	746	3282-081
				- right		1	1206	3282-082
				- left		1	1206	3282-083
5.3			*	Hexagon screw	3	6		1424-001
5.4			*	Washer plate	3	6		1436-005
5.5			*	Hexagon nut	1		156/316/619	1432-053
						2	746	1432-053
						6	1206	1432-053
5.6			*	Nut with Guide	1	2		2113-022

a) Includes both left and right knives

Pos. no.	Shown on drawing			Designation	Qty. for type		Type	Spare part no.
	224050	208574	T0177079		V	VD		
5.7			*	Top retaining bolt	1		156	2112-134
					1		316	2112-116
					1		619	2112-138
						2	746	2112-137
						2	1206	2112-138
			*	Bottom retaining bolt	1		156	2112-113
					1		316	2112-117
			*		1		619	2112-118
						2	746	2112-127
						2	1206	2112-118
5.8			*	Threaded plate	1	2		3284-421
5.9			*	Washer plate	4		156/316/619	1436-007
						8	746	1436-007
						12	1206	1436-007
5.10			*	Centre bracing		1	1206	2214-032
5.11			*	Hexagon screw		4	1206	1424-319

Knife arrangement



9.6. Drive station

For type V156, V316, V373, VD746

Part of the drive station.
Motor make and type, plus voltage and frequency must be stated.
Electrical details, see section 2.1 Main data.
When ordering spare parts, state the serial no. of the gear.

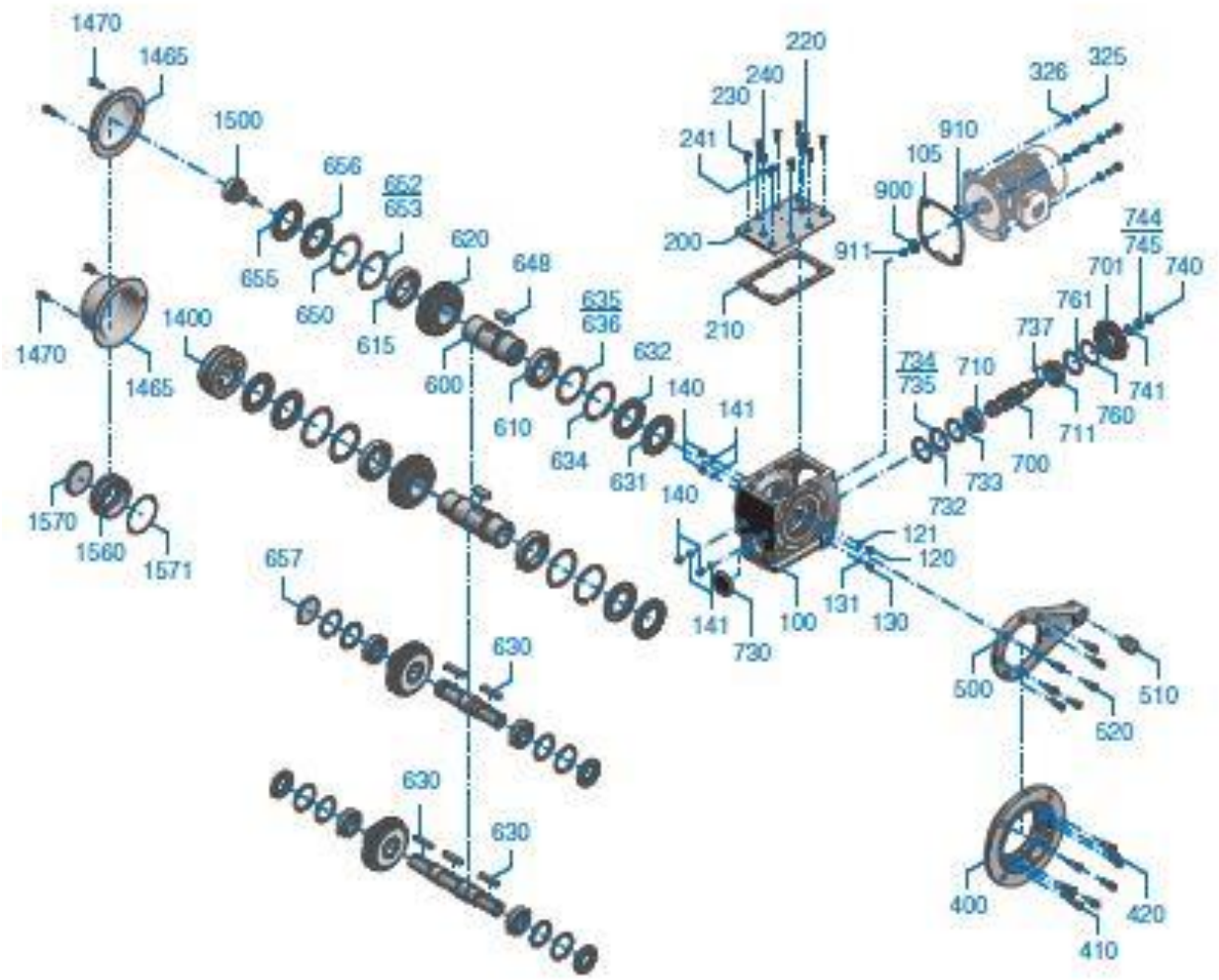
COMPLETE GEAR INCL. MOTOR AND VFD DRIVE IS PARTNUMBER 130072080611

For type V619, VD1206

Part of the drive station.
Motor make and type, plus voltage and frequency must be stated.
Electrical details, see section 2.1 Main data.
When ordering spare parts, state the serial no. of the gear.

COMPLETE GEAR INCL. MOTOR AND VFD DRIVE IS PARTNUMBER 130072080711

Spare parts for gear motor incl. VFD drive.

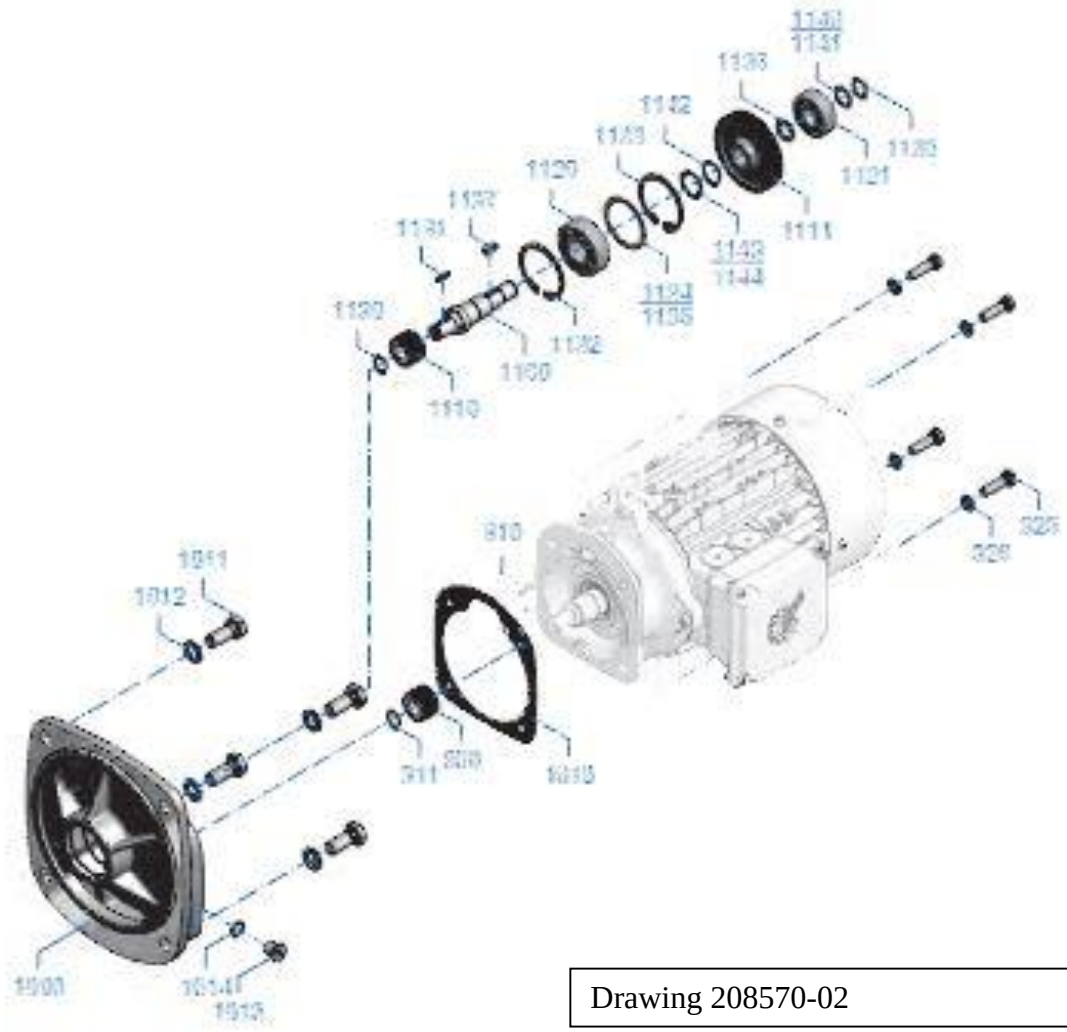


Drawing 208570_01

Spares after drawing 208570_01

DE	GB	FR
100 Gehäuse	100 Housing	100 Base
105 Dichtung	105 Seal	105 Bague d'étanchéité
120 Schraube	120 Screw	120 Vis
121 Dichtung	121 Seal	121 Bague d'étanchéité
130 Schraube	130 Screw	130 Vis
131 Dichtung	131 Seal	131 Bague d'étanchéité
140 Schraube	140 Screw	140 Vis
141 Dichtung	141 Seal	141 Bague d'étanchéité
200 Gehäusedeckel	200 Housing cover	200 Couvercle du carter
210 Dichtung	210 Seal	210 Bague d'étanchéité
220 Schraube	220 Screw	220 Vis
230 Schraube	230 Screw	230 Vis
240 Schraube	240 Screw	240 Vis
241 Dichtung	241 Seal	241 Bague d'étanchéité
325 Schraube	325 Screw	325 Vis
326 Federring	326 Lock washer	326 Rondelle élastique
400 Flansch	400 Flange	400 Bride
410 Schraube	410 Screw	410 Vis
420 Stift	420 Pin	420 Goupille
500 Drehmomentenstütze	500 Torque arm	500 Bras de réaction
510 Schwingmetallbuchse	510 Rubber bonded metal bush	510 Joint anti-vibratile
520 Schraube	520 Screw	520 Vis
600 Abtriebswelle	600 Output shaft	600 Arbre de sortie
610 Wälzlager	610 Roller bearing	610 Roulement
615 Wälzlager	615 Roller bearing	615 Roulement
620 Abtriebsrad	620 Output gear	620 Roue de sortie
630 Passfeder	630 Key	630 Clavette
631 Wellendichtring	631 Radial shaft seal	631 Bague d'étanchéité de l'arbre
632 Wellendichtring	632 Radial shaft seal	632 Bague d'étanchéité de l'arbre
634 Sicherungsring	634 Circlip	634 Circlip
635 Passscheibe	635 Shim	635 Rondelles d'ajustage
636 Passscheibe	636 Shim	636 Rondelles d'ajustage
648 Passfeder	648 Key	648 Clavette
650 Sicherungsring	650 Circlip	650 Circlip
652 Passscheibe	652 Shim	652 Rondelle d'ajustage
653 Passscheibe	653 Shim	653 Rondelle d'ajustage
655 Wellendichtring	655 Radial shaft seal	655 Bague d'étanchéité de l'arbre
656 Wellendichtring	656 Radial shaft seal	656 Bague d'étanchéité de l'arbre
657 Verschlusskappe	657 Sealing cap	657 Bouchon
700 Ritzelwelle	700 Pinion shaft	700 Arbre de pignon
701 Antriebsrad	701 Drive gear	701 Roue d'entrée
710 Wälzlager	710 Roller bearing	710 Roulement
711 Wälzlager	711 Roller bearing	711 Roulement
730 Verschlusskappe	730 Sealing cap	730 Bouchon
732 Sicherungsring	732 Circlip	732 Circlip
733 Stützscheibe	733 Supporting disc	733 Rondelle d'appui

734 Passscheibe	734 Shim	734 Rondelle d'ajustage
735 Passscheibe	735 Shim	735 Rondelle d'ajustage
737 Passfeder	737 Key	737 Clavette
740 Sicherungsring	740 Circlip	740 Circlip
741 Stützscheibe	741 Supporting disc	741 Rondelle d'appui
744 Passscheibe	744 Shim	744 Rondelle d'ajustage
745 Passscheibe	745 Shim	745 Rondelle d'ajustage
760 Sicherungsring	760 Circlip	760 Circlip
761 Stützscheibe	761 Supporting disc	761 Rondelle d'appui
900 Antriebsritzel	900 Driving pinion	900 Pignon d'entrée
910 Passfeder	910 Key	910 Clavette
911 Sicherungsring	911 Circlip	911 Circlip
1400 Baugruppe Schrumpfscheibe	1400 Shrink disc assembly	00 Module de frette de serrage
1465 Haube	1465 Cover	1465 Capot
1470 Schraube	1470 Screw	1470 Vis
1500 Befestigungselement	1500 Fixing element	1500 Elément de fixation
1560 Buchse	1560 Socket	1560 Douille
1570 Verschlusskappe	1570 Sealing cap	1570 Bouchon
1571 O-Ring	1571 O-ring	1571 Joint torique

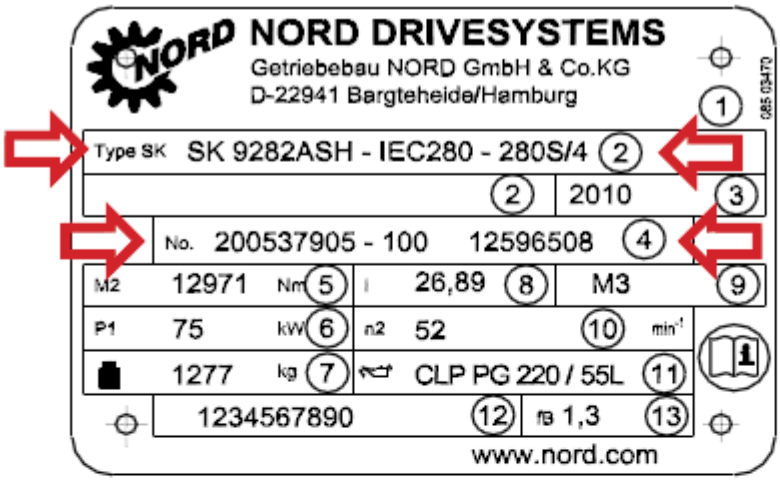


Drawing 208570-02

Spares after drawing 208570_02

DE	GB	FR
325 Schraube	325 Screw	325 Vis
326 Federring	326 Lock washer	326 Rondelle élastique
900 Antriebsritzel	900 Driving pinion	900 Pignon d'entrée
910 Passfeder	910 Key	910 Clavette
911 Sicherungsring	911 Circlip	911 Circlip
1000 Anbaugehäuse	1000 Add-on housing	1000 Carter
1010 Motordichtung	1010 Seal	1010 Joint moteur
1011 Schraube	1011 Screw	1011 Vis
1012 Federring	1012 Lock washer	1012 Rondelle élastique
1013 Schraube	1013 Screw	1013 Vis
1014 Dichtring	1014 Seal	1014 Bague d'étanchéité
1100 Zwischenwelle	1100 Intermediate shaft	1100 Arbre de pignon
1110 Antriebsritzel	1110 Driving pinion	1110 Pignon d'entrée

1111 Antriebsrad	1111 Drive gear	1111 Roue d'entrée
1120 Wälzlager	1120 Roller bearing	1120 Roulement
1121 Wälzlager	1121 Roller bearing	1121 Roulement
1130 Sicherungsring	1130 Circlip	1130 Circlip
1131 Passfeder	1131 Key	1131 Clavette
1132 Sicherungsring	1132 Circlip	1132 Circlip
1133 Sicherungsring	1133 Circlip	1133 Circlip
1134 Passscheibe	1134 Shim	1134 Rondelle d'ajustage
1135 Passscheibe	1135 Shim	1135 Rondelle d'ajustage
1136 Buchse	1136 Socket	1136 Douille
1137 Passfeder	1137 Key	1137 Clavette
1139 Sicherungsring	1139 Circlip	1139 Circlip
1140 Passscheibe	1140 Shim	1140 Rondelle d'ajustage
1141 Passscheibe	1141 Shim	1141 Rondelle d'ajustage
1142 Sicherungsring	1142 Circlip	1142 Circlip
1143 Passscheibe	1143 Shim	1143 Rondelle d'ajustage
1144 Passscheibe	1144 Shim	1144 Rondelle d'ajustage



DE

1 Matrix – Barcode
2 NORD - Getriebetyp
3 Herstellungsjahr
4 Fabrikationsnummer
5 Nenndrehmoment der Getriebeabtriebswelle
6 Antriebsleistung
7 Gewicht entsprechend Auftragsausführung
8 Gesamte Getriebeübersetzung
9 Einbaulage
10 Nenndrehzahl der Getriebeabtriebswelle
11 Schmierstoffart, -viskosität und –menge
12 Kundenmaterialnummer
13 Betriebsfaktor

GB

1 Matrix – Barcode
2 NORD gear unit type
3 Year of manufacture
4 Serial number
5 Rated torque of gear unit output shaft
6 Drive power
7 Weight according to ordered version
8 Overall gear unit ratio
9 Installation orientation
10 Rated speed of gear unit output shaft
11 Lubricant type, viscosity and quantity
12 Customer's part number
13 Operating factor

FR

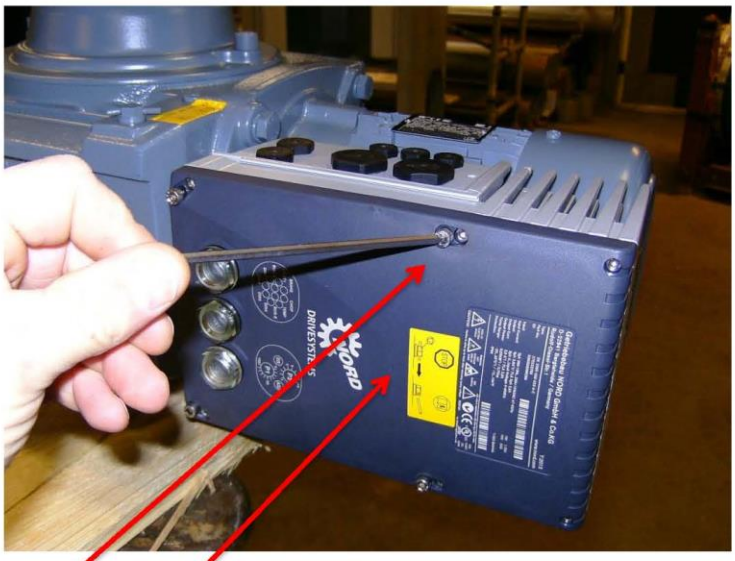
1 Code matriciel, à barres
2 Type de réducteur NORD
3 Année de fabrication
4 Numéro de série
5 Couple nominal de l'arbre de sortie du réducteur
6 Puissance d'entraînement
7 Poids selon l'exécution du contrat
8 Rapport de réduction total
9 Position de montage
10 Vitesse de rotation nominale de l'arbre de sortie du réducteur
11 Type de lubrifiant, viscosité et quantité
12 Numéro d'article client
13 Facteur de service

Description and setup of gear VFD drive.

The VFD is normally setup before delivery from Buus Ice A/S.

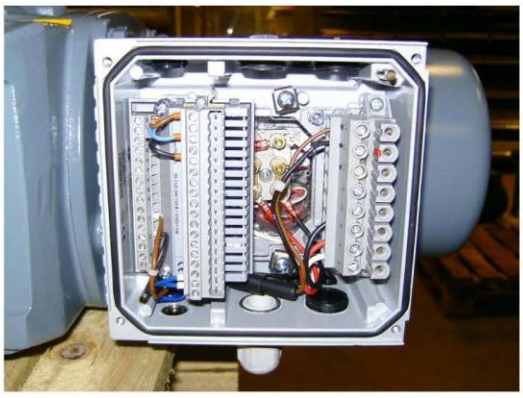
Mounting of frequency converter on motor.

Picture 1:



1	Remove bolts
2	Remove frequency converter.

Picture 2:



After the old converter is removed, the new one is mounted in the same position.

Check also picture 5 for JUMPER terminal 44 and 22/21

Picture 3:

The new frequency converter is mounted.

Power supply is connected, **see nameplate for details**.

Picture 4:

The Simple box can be connected for setup of the converter.

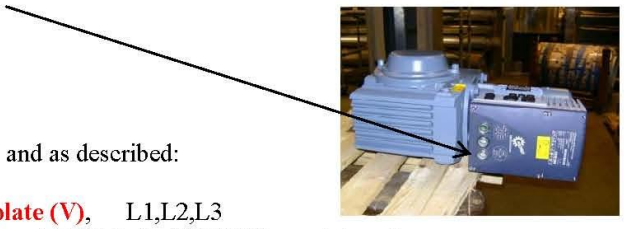
***** The instruction on the following pages is now followed for setup. *****

Basic adjustment of frequency converter type SK205 for V og VD icemachines.

Before mounting of gear or before shipment as sparepart the gear parameters are controlled and adjusted.

In the following describtion reference is made to some parts of the instruction manual attached in the below paged.
Full manual is on the CD.

Adjustments/communicationis made through the loose Simple box, picture 4.
The frequency is adjusted with the pot-meter P1 on the box, outside by a screwdriver.



Control of the gear:
Visuel control of all surfaces connections etc.

Connection:
Powersupply is connected as mentioned below and as described:

Powersupply is connected 3x **as on the nameplate (V)**, L1,L2,L3
24V + on terminal 44 and 22/21, 44 and 22/21 to be JUMPED, se picture 5

Using terminal 21 or 22 can change the direction of rotation.

Parametre:
The following parameters to be checked/adjusted:

Basic adjustments, parameter P201 til P207 after the nameplate of the motor.
All motor parameters can be transmitted by parameter P220, automatically transmitted into P201 to P209
To be controlled with the nameplate afterwards.

Automatic parameter reading from motor:

Parameter	Describtion	Value	Control	Adjusted
P220	Auto inst. of converter	2	Yes	Confirm with ok

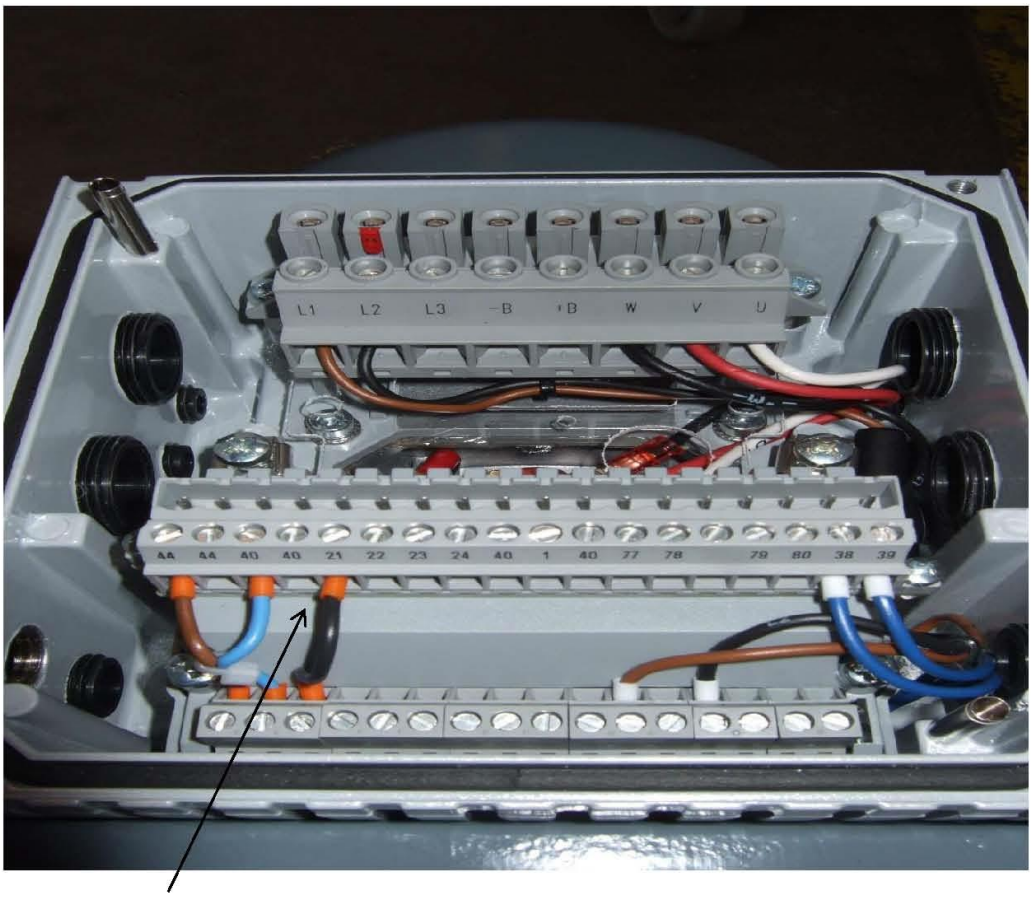
Parameter to be changed:

P428	Automatic start	1	Yes	Yes, conf. with ok

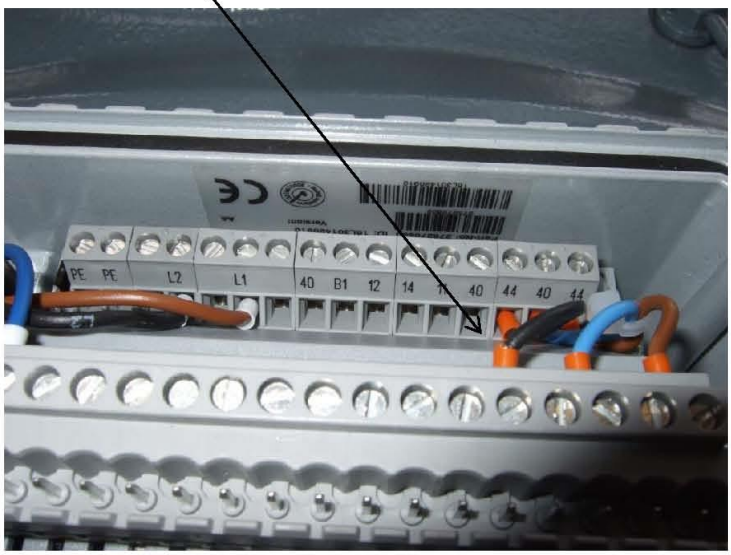
Control of parameters:

Parameter	Describtion	Value	Control	Adjusted
P200	Motor data	12 for 0,55kw 400v 16 for 0,75kw 400v	Yes	
P201	Nominel Hz	50 or 60 Hz	Yes	
P202	Nominel RPM	1375	Yes	
P203	Nominel motor I	2,1A	Yes	
P204	Motor nominel supply	See motor nameplate 400/230V	Yes	
P205	Motor nominel power	See motor nameplate 0,55/0,75kw	Yes	
P206	Motor cosφ	See motor nameplate	Yes	
P207	Star/delta γ/Δ	γ = 0 Δ = 1	Yes	
P104/P105	Min/Max frequency at 50Hz	Min=25 Hz Max=65Hz	Yes	
P104/P105	Min/Max frequency at 60Hz	Min=30 Hz Max=75Hz	Yes	

Picture 5:



44 and 22/21 to be jumped

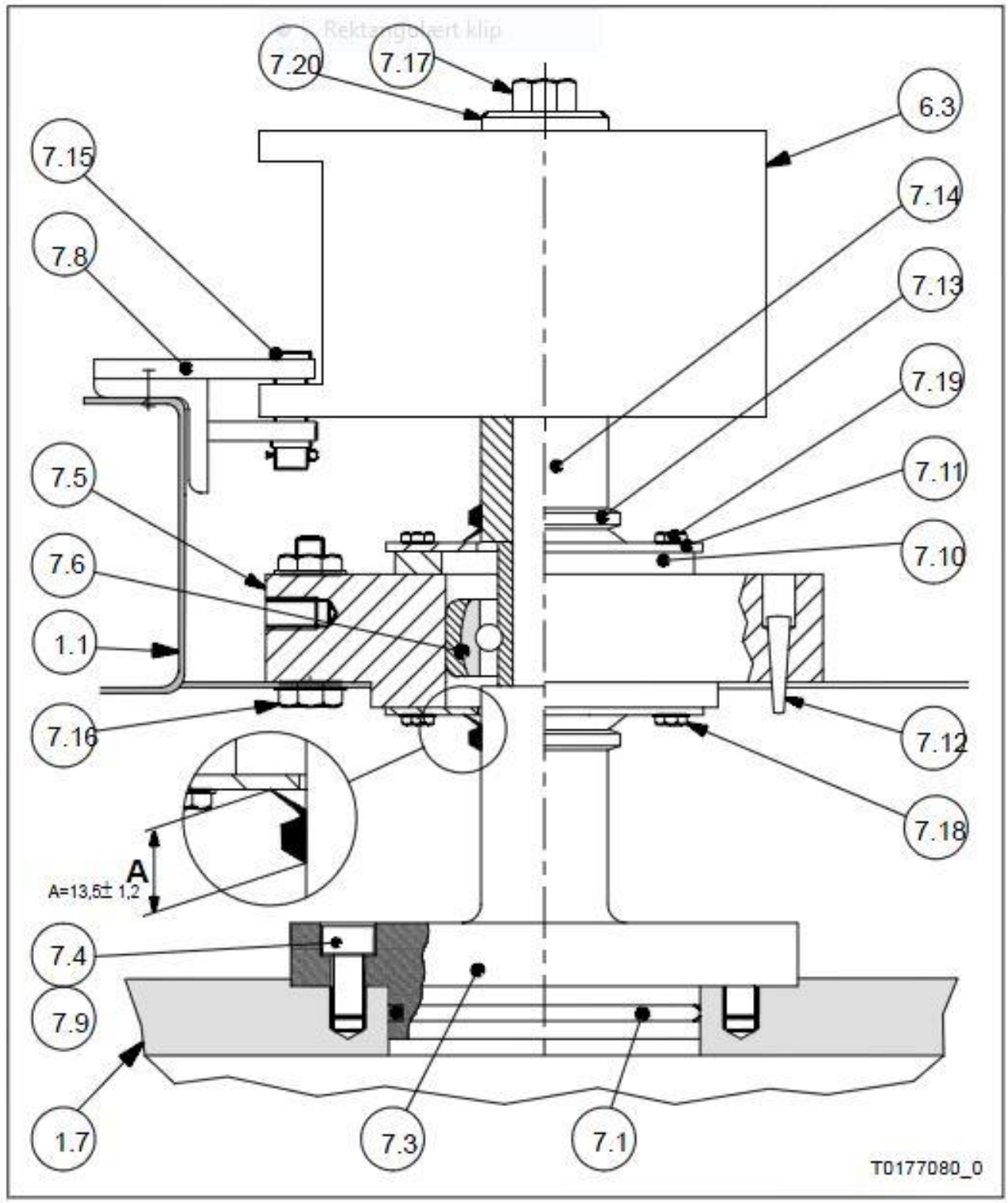


9.7. Top bearing system

Pos.no.	Shown on drawing			Designation	Qty. for type		Type	Spare part no.
	224050	208574	T0177080		V	VD		
7.0	*	*		Top bearing system, complete	1		156/316	3284-478
						2	746	3284-478
					1		619	3284-395
						2	1206	3284-395
7.1			*	O-ring	1	2		1331-173
7.3			*	Axle journal	1		156/316	3284-475
						2	746	3284-475
					1		619	3284-474
						2	1206	3284-474
7.4			*	Cylinder screw with internal hexagon	16	32		1413-396
7.5			*	Bearing housing	1		156/316	3284-476
						2	746	3284-476
					1		619	3284-477
						2	1206	3284-477
7.6			*	Ball bearing	1		156/316	1513-007
						2	746	1513-007
					1		619	1513-011
						2	1206	1513-011
7.8			*	Bracket	1		156/316	3284-406
						2	746	3284-406
					1		619	3284-370
						2	1206	3284-370
7.9			*	Spring washer	16	32		1437-008
7.10			*	Flange	1		619	2341-058
						2	1206	2341-058
7.11			*	Sealing plate	1		156/316	2341-056
						2	746	2341-056
					1		619	2341-057
						2	1206	2341-057

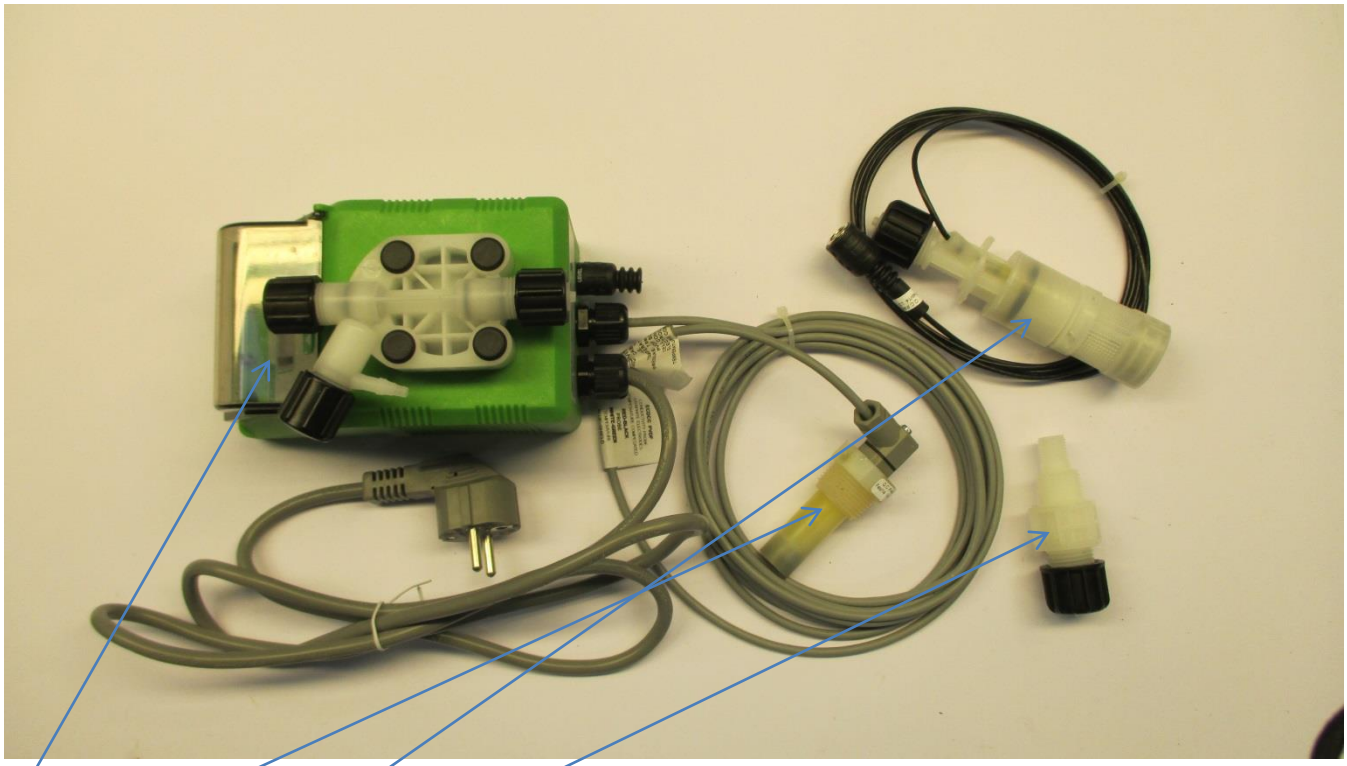
Pos.no.	Shown on drawing			Designation	Qty. for type		Type	Spare part no.
	224050	208574	T0177080		V	VD		
7.12			*	Conical pin	2	4		1445-034
7.13			*	Sealing ring (V-ring)	1		156/316	1332-006
						2	746	1332-006
					1		619	1332-005
						2	1206	1332-005
7.14			*	Spacing bush	1		156/316	2114-028
						2	746	2114-028
					1		619	2114-027
						2	1206	2114-027
7.15			*	Pin	1		156/316	2122-026
						2	746	2122-026
					1		619	2122-025
						2	1206	2122-025
7.16			*	Hexagon screw with nut	4	8		1422-001
7.17			*	Hexagon screw	1	2		1424-319
7.18			*	Hexagon screw	4	8		1425-002
7.19			*	Hexagon screw	1		156/316	1425-002
						2	746	1425-002
					1		619	1425-001
						2	1206	1425-001
7.20			*	Disc	1	2		2114-026

Sectional drawing of top bearing system (7.0)



9.8. Salt dosing pump

Please revert for section 4.9 for details about setup.



1. Dosing pump incl. display for setup
2. Sensor for water tank
3. Suction filter for inlet brine
4. Delivery connection for brine

Ordering spare parts

Exploded drawing of salt dosing pump.

Pos.no.	Shown on drawing no. 237438	Designation	Qty. for type		Type	Spare part no.
			V	VD		
0.0	*	Salt dosing pump complete	1	1		DFFCD1810000
1.0	*	Inlet- outlet housing	1	1		
2.0	*	Diaphragm	1	1		
3.0	*	Screw	1	1		
4.0	*	Pump housing	1	1		
5.0	*	Filter holder w/non return valve	1	1		
6.0	*	Nozzle	1	1		
7.0	*	Adjustment connector	2	2		
8.0	*	Power supply wire	3	3		
9.0	*	Cover plate, knob	2			
10.0	*	Knob for adjustement	2			
11.0	*	O-ring	2			
12.0	*	O-ring	1	1		
13.0	*	Suction hose	1	1		
14.0	*	Pressure hose	1	1		
15.0	*	Hose branch w/non-return valve	1	1		

Drawing 237438

9.9. Standard spare parts set

Pos. no.	Shown on drawing				Designation	Qty for type		Type	Spare part no.
	237437	228496	224050	208574		V	VD		
9.0					Standard spares set, complete	1 1	2 2	a) b)	3284-279 3284-280
9.1	*	*			(4.1) Sealing ring	2	4		1332-116
9.2	*	*			(4.3) O-ring	2	4		1331-214
9.3	*	*			(4.13) Sealing ring	1	2		1332-115
9.4	*	*			(4.17) Bottom oil sealing ring	1	2		1332-003
9.5	*	*			(4.18) O-ring	2	4		1331-215
9.6	*	*			(4.19) O-ring	1	2		1331-109
9.7	*	*			(4.20) O-ring c)	1	2		1331-173
9.8	*	*			(4.21) Flat gasket	2	4		1993-154
9.10			* *	* *	(4.22) Flange gasket	1 1	2 2	d) e)	2356-224 2356-270
9.11	*	*			(4.29) O-ring	2	4		1331-040
9.12	*	*			(4.32) Top oil sealing. (Filled with silicone)	1	2		3284-234
9.13	*	*			(4.36) O-ring	1	2		1331-035
9.14			* *	* *	(3.9) Flat gasket	1 2	2 4	a) b)	 2356-210
9.15	*				(3.5) Heating element	1	2	b)	1993-021
9.16			*	*	(3.7) Feeler gasket	1	2		1336-001

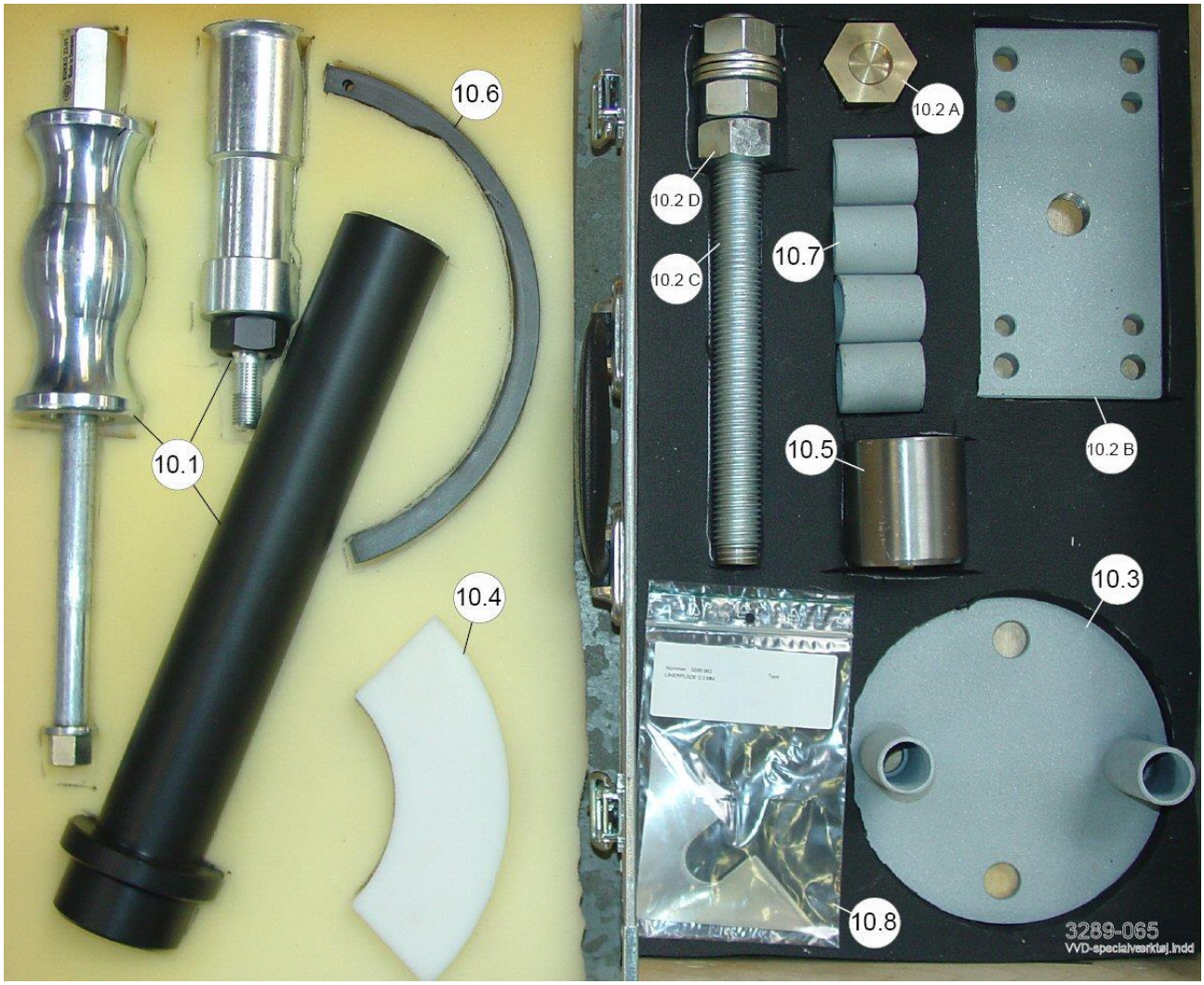
a) AFP, ASP, XFP, XSP
b) AFT, AST, XFT, XST
c) Can replace (7.1)
d) Used at flange joint tongue and groove
e) Used at flange joint with level bearing surface

10. Special tools.

Pos. no.	Shown on drawing		Designation	Qty for type		Type	Spare part no.
	T0177107	T0177108		V	VD		
10.0	*		Special tool set, complete (incl. 10.1 to 10.8)	1	1		3289-044
10.1	*		Punch for bushing (4.14)	1	1		3289-086
10.2	*		Tool for dismounting/mounting drive station (6.0)	1	1		3289-052
10.3	*		Fitting for lifting suction connection piece (4.11)	1	1		3289-056
10.4	*		Protective ring for sealing ring (4.1)	1	1		3289-057
10.5	*		Punch for mounting sealing ring (4.13)	1	1		3289-058
10.6	*		Locking ring for use in aligning the bearing housing (4.10)	a)	a)		3289-059
10.7	*		Distance bushing used in aligning the bearing housing (4.10)	4	4		2163-761
10.8	*		Set of liner plates, with following thickness:	1	1		
			1.0 mm	4	4		
			0.5 mm	4	4		3289-060
			0.3 mm	4	4		
			0.1 mm	8	8		
10.20	* (see instr.)		Water filter with housing and filter cartridge	1		156/316	1375-044
				1		619	1375-045
					1 b)	746/1206	3284-519
10.21		*	Filter cartridge for water filter	1		156/316	1375-146
				1		619	1375-047
					1 b)	746/1206	3284-520

a) 1 set comprising two halves
b) 1 set comprising two water filters, which should be mounted in parallel
c) 1 set comprising two filter cartridges

Special tools, overview



11. Machine data and identification.

Copy of data from Buus Ice servicearticle system NAV.

Declaration of conformity for components.

Documentation for flange.

Installation, Operation and Maintenance manual for Drum for Flake Ice machine

Design.

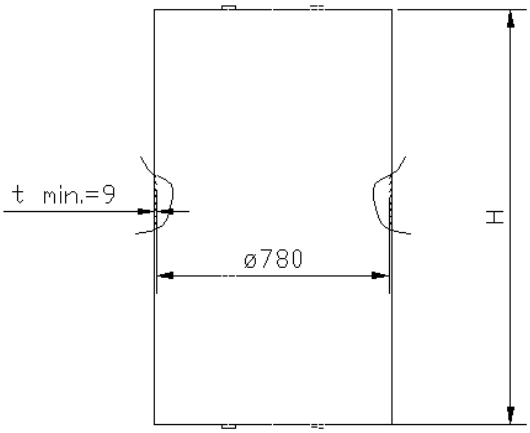
The drum consists of a shell with end cover welded-on to each end.

Product description.

Type code:

Type	H (mm)	Vol. (l)
V156	646	290
V316	1296	590
V376	1526	700
V606	2396	1110

Surface treatment:
Grinding and chroming or ARC-sprayed aluminium.



Application.

The drum is in a series of vessels designed for Flake ice machine.

Shipping.

The Vessel must be delivered blanked off and primed. The primer is not intended for storage outdoors. If the heat exchanger is not to be placed in immediate services, take precautions to prevent rusting or contamination.
The Vessel must only be lifted when empty and must no be subject to strokes or bumps during transport. When lifting the Vessel before it is built into the unit, straps around the shell must be used.
Please note that the weight appears from the technical data.
At the time when the Vessel is built together with the unit a shipping description can be made.

Installation.

The site and personal protection must be in accordance with EN378-3 or national requirements. Immediately upon receipt the Vessel must be checked for damages occurred during transport. If the Vessel is damaged, it must not be installed and started.

The Vessel must be placed in such a way that there is enough space for inspection, maintenance, escape and emergency.
Foundations must be sufficiently robust as to provide permanent support without settling, and so absorb any normal vibrations from outside causes.
The Vessel is for vertical installation.
Blanked off branches to be cut off at cutting groove depending on metal thickness on adjoining tubes. It must be ensured that dirt or other unknown elements do not get into the Vessel during installation.
Do not remove protective plugs and covers until immediately before installation. The entire system should be clean before starting the operation. Tube connections must be fitted in such a way that tensions in the Vessel during test, operation and stand still do not exceed the allowable values. Vibrations must be minimized possibly by means of vibration damper.
Besides from branch connections welding must not be carried out on the Vessel.
The Vessel must be secured against exceeding of the allowable pressures and temperatures.
The outer surfaces must have a topcoat, which corresponds to the environment so that corrosion does not arise.
Before start it must be ensured that connections are tight.

Safety equipment.

Before the Vessel is put into service it must be provided with safety equipment according to EN378 so that PS is not exceeded.
The manufacturer of the refrigerating plants carries the responsibility for the equipment, as the safety equipment is not included in the Vessel supply.

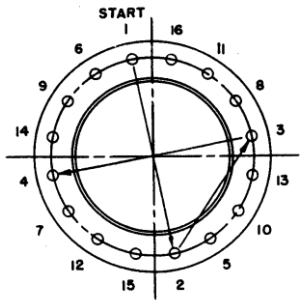
Starting up and operation:

To avoid accidents to the operation staff and others the person responsible for the plant must, before the refrigeration plant is started, ensure that the operation staff have been duly trained and instructed on basis of the instruction manuals. Including instruction in construction, supervision, operation and maintenance of the system and handling of used refrigerant.
Evacuation and filling with refrigerant must be carried out according to the description in the unit description for use.
Before use the refrigerant must be carried out according to the description in the unit description for use. Before use the refrigeration plant must be leak tested an inspected by an expert.
Local safety and health regulation must be observed.
The expert makes out a certificate, which must be kept by the user.
Local safety legislation must be observed prior to commissioning the refrigeration plant.

General for bolted connections.

Normal relaxing of the joints may occur in the interval between testing at manufacturer and installation at the job site. Therefore, all external bolted joints may require re-tightening after installation and if necessary, after the vessel has reached operation temperature. It is important that all bolted joints being tightened uniform and in a diametrically staggered pattern.

Bolts to be tightened even torque wrench.



Maintenance:

The Vessel should be inspected at the inspections intervals stipulated in the compressor specification. The inspection must only be carrying out by qualified personnel.
Operating experience will show how often the Vessel has to be inspected/checked. It depends on operating conditions. Buus Ice recommends that the Vessel must be inspected at monthly intervals during the running-in period.
After a running-in period of six months, a maintenance plan must be made. As a minimum Buus Ice recommends inspection every third month.
Connections must not be dismounted or tightened when the equipment is under pressure.
Periodic inspection during the lifetime of the Vessel shall meet the requirements in national instructions or EN 378-2.
Visual inspection includes: connections, outer surfaces, bases, vibration damper and safety equipment.
If corrosion, erosion or other weaknesses in the Vessel are found, the Vessel has to be scrapped or be inspected by a qualified authorized third part, which makes the necessary permission to continuously use of the vessel. If a repair is requested, approved personnel in concert with qualified third part and Buus Ice will carry out the repair.

Before disassembly for inspection or cleaning, the user must assure oneself that the Vessel has been depressurized, vented and drained, neutralized and /or purged of hazardous material.

General for gasket connections.

Gasket and gasket surface should be thoroughly cleaned and should be free of scratches and other defects. Gasket should be properly positioned before attempting to retighten bolts. When a Vessel is dismantled for any cause, it must be reassembled with new gaskets. This will tend to prevent further leaks and/or damage to the gasket surface of the Vessel.

Spare parts and replacements parts.

Spare part and replacement parts see unit spare parts.

Environmentally correct removal:

The Vessel does not contain environmentally damaging material, such as asbestos, mercury or heavy metals.
All parts of the Vessel can be re-used after being scrapped.

- The refrigerant must be drained before destruction.
- All seal materials can be used again after re-melting.
- During re-melting process coating will disappear without damaging the environment.

The abovementioned manual is also covering the suction connection, the term "vessel" is changed to "suction connection".

12. Electrical documentation and diagrams

Copy of relevant diagrams and descriptions.

13. Auxiliary parts, documentation.