



AC-00872 - Hull No.: CX0345 - Name of Yard: Chengxi Shipyard

Installation Manual

Freshwater Generator AQUA type HW:

AQUA-65-HW, AQUA-80-HW

AQUA-100-HW, AQUA-125-HW

Alfa Laval Copenhagen A/S



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1	Technical Specifications in overview		9
1.1	Technical data	page	9
1.2	Parts included in delivery	page	10
2	Safety Instructions and Warnings		11
2.1	Safety Instructions and Warnings	page	11
3	System Description – AQUA type HW		15
3.1	Freshwater Quality	page	17
3.1.1	Main Components	page	18
4	Storage		19
5	Installation		20
5.1	Extent of Delivery	page	20
5.1.1	Space Requirements	page	20
5.1.2	Ambient Conditions	page	20
5.1.3	Vibrations	page	20
5.2	General Safety Precautions	page	20
5.2.1	Electric Equipment	page	21
5.2.2	Transportation	page	21
5.3	Installation Instructions	page	21
5.3.1	Hot Water System	page	22
5.3.2	Sea Water System	page	22
5.3.3	Ejector Pump (if supplied)	page	23
5.3.4	Brine/Cooling Water Discharge	page	23
5.3.5	Freshwater System	page	23
5.3.6	Control Panel (if supplied)	page	24
5.3.7	Motors (if supplied)	page	24
5.3.8	Scale Inhibitor Dosage Equipment for Feed Water	page	24
6	Operating Instructions		26
6.0.1	Daily operation	page	31
6.1	Adjustment of Hot Water Flow	page	31
6.2	Adjustment of Sea Cooling Water	page	32
6.3	Stopping the Plant	page	32
7	Long Term Standstill		34
7.1	Standstill	page	34



7.1.1	Preservation Procedure for Freshwater Generator	page	34
7.1.2	Restart	page	34
7.2	Long Term Standstill	page	34
7.2.1	Preservation Procedure for Freshwater Generator	page	34
7.2.2	Restart Freshwater Generator	page	34
7.2.3	Preservation Procedure for Pumps	page	35
7.2.4	Restarting of Pumps	page	35
7.2.5	Preservation Procedure for Electric Motors	page	35
7.2.6	Restarting of Electric Motors	page	36
7.2.7	Preservation Procedure for Electric Panel	page	36
7.2.8	Restarting of Electric Panel	page	37
7.2.9	Solenoid Valve	page	37

8 Maintenance 38

8.1	Overhaul Intervals	page	39
8.2	Maintenance of Plate surface	page	39
8.3	Renewal of Plate Heat Exchanger Gaskets	page	42
8.3.1	Removal of Old Gaskets	page	42
8.3.2	Cleaning	page	42
8.3.3	Preparation of new Gaskets	page	42
8.3.4	Fitting new Gaskets	page	42

9 Vacuum test 44

10 Chemical Dosing of Scale Control Chemicals 45

10.1	Feed Water Ratio	page	45
10.2	Evaporating Temperature	page	46
10.3	Operational Notes	page	46
10.3.1	Normal Operation Conditions	page	46
10.3.2	Maintaining Distillate Output	page	46
10.4	Chemical Dosage	page	47
10.4.1	Scale Inhibitor Dosage Equipment for Feed Water	page	48
10.4.2	Safety Precautions with the use of Chemicals	page	49
10.4.3	Alpacon Altreat 400	page	49
10.5	Preparation of chemical solution	page	50
10.5.1	Anti Scalant type Alpacon Altreat 400	page	50
10.5.2	Dosing flow calculation	page	50
10.5.3	Calculating Chemical solution	page	50
10.6	Dosing Instructions – Anti Scalant	page	52

11 Operation and maintenance instructions for Freshwater Pump type 1525/1532/2040 53

11.1	Product description	page	53
------	---------------------	------	----



11.2	Technical data	page	53
11.2.1	Noise level	page	54
11.3	Installation / start-up	page	54
11.4	Application	page	54
11.5	Service	page	54
11.5.1	Pump overhaul	page	54
11.5.2	Clearance	page	56
11.5.3	Dismantling Pump Shaft	page	56
11.6	Maintenance	page	58
11.7	Transport / storage	page	58
11.8	Spare parts	page	58

12 Salinometer 59

12.1	Specification of Salinometer type DS-21	page	60
12.2	Installation of Salinometer type DS-21	page	60
12.3	User instruction for Salinometer type DS-21	page	61
12.4	Maintenance of Salinometer type DS-21	page	61

13 Trouble-Shooting 63

13.1	Trouble Shooting Table	page	64
------	------------------------	------	----

14 Spare Parts - 69

14.1	Alfa Laval Service	page	69
------	--------------------	------	----

15 FWG Order Specification - Drawings and Parts lists 70

General description AQUA	page	71
Technical data: AQUA 80 0.5 mm plates	page	75
Tech. data - Pumps and motors for FWG type AQUA-80-HW/HWS	page	77
Flow chart for FWG type AQUA-80-HW 70-84	page	79
Equipment specification - FWG type AQUA-80-HW/HWS	page	81
AQUA-80-HW 78-84-1	page	83
Vertical plant positioning - AQUA	page	85
Motor size 80 B, 1.30 kW outline drawing	page	87
Feed water treatment unit incl. chemical dosage pump dimension	page	89
Control Panel option A - Technical data	page	91
Control Panel option A - Dimensional drawing	page	93
Control Panel option A - Electrical diagram	page	95

Instructions manual for CNL pumps size 160 and 200 Alfa Laval Freshwater Generators 103



1	General	105
1.1	Introduction	page 105
1.2	Identification	page 105
1.3	Directions & warning signs	page 106
1.4	Warning symbols	page 106
1.5	General safety	page 106
1.5.1	Electrical hazards	page 107
1.5.2	Temperature hazards	page 107
1.5.3	Chemical hazards	page 108
1.5.4	Dry running	page 108
1.5.5	Noise level	page 108
2	Installation	109
2.1	Condition on delivery	page 109
2.2	Inspection on delivery	page 109
2.3	Storage instructions	page 109
2.3.1	Preservation procedure	page 110
2.3.2	Restarting of Pumps	page 110
2.3.3	Preservation Procedure for Electric Motors	page 110
2.3.4	Restarting of Electric Motors	page 111
2.4	Foundation	page 111
2.5	Environment conditions	page 111
2.6	Piping	page 112
2.7	Piping connections	page 112
2.8	Electrical installation	page 113
2.9	Recommended accessories	page 113
3	Operation	114
3.1	Start-up procedures	page 114
3.2	Starting the pump	page 115
3.3	Stand-by	page 115
3.4	Pump vibrations	page 115
4	Maintenance	116
4.1	Inspections	page 116
4.1.1	Three-month inspection	page 116
4.1.2	Twelve-month inspection	page 116
4.1.3	Lubrication	page 117
4.2	Disassembly and assembly	page 117
4.2.1	Disassembly	page 117
4.2.2	Assembly	page 117
4.3	Fitting instructions for mechanical seals	page 118
4.3.1	Fitting instructions	page 119
4.4	Centrifugal pump wear ring clearance	page 120

5 Spare Parts 122

5.1	Ordering	page 122
5.2	Alfa Laval Service	page 122
5.3	Returning parts	page 122
5.4	Decommissioning	page 122
5.5	Type CNL - table of materials	page 123
5.6	Spare parts drawing for CNL 160 and 200 with flanged coupling	page 123

6 Trouble Shooting 124

6.1	Trouble Shooting Table	page 124
-----	------------------------	----------

7 Drawings and Part Lists 128

Assembly Scheme AQUA 0.5 mm Plates	page 129
Ejector pump type CNL 65-65/160, Pump curve	page 131
Ejector pump type CNL 65-65/160, Dim drawing	page 133
Ejector pump type CNL 65-65/160, Tech. data	page 135
Set of Manometers for Pumps	page 137
Dim drw: pH adj. filter (Rehardening): Type URF 325/50 2,5 m ³ /hr	page 139
pH adjustment filters - flow chart	page 141
pH adjustment filters - PID	page 143
pH adjustment filters - equipment specification list	page 145
Process and Instrument Diagram AoT	page 147
Flow Chart - Ultraviolet Sterilizer, AlfaLaval AOT 3F	page 149
Dimensional and Installation Drawing - AOT	page 151
Main Electrical Comp. AOT 3F - Electrical Cabinet	page 153
985 22764 - Electrical Cabinet Parts list	page 155



1 Technical Specifications in overview

Serial No.: AC-00872

1.1 Technical data

Amount:	1	Pcs
Type:	AQUA-80-HW	
Number of plates:.....	84	Pcs
Capacity:	20	m ³ /24h
El. Power supply:.....	3x440	Volt
Frequency.....	60	Hz
Control voltage:	230	Volt
Connection standard:	DIN	
Hot water flow:	53.42	m ³ /h
Hot water inlet temp:	80	°C
Hot water outlet temp:	70.8	°C
Heat consumption:	572.4	kW
Hot water pressure drop:	0.13	bar
Sea water inlet temp.....	32	°C
Sea water outlet temp.....	49.7	°C
Sea water flow.....	26.64	m ³ /h
Sea water pressure drop	0.12	bar

1.2 Parts included in delivery

AB-HW-84	1	Basic equipment cost - AQUA-80-HW 78-84
39508649-88	1	AQUA Start plate
39508649-03	41	AQUA Process plate
39508650-03	41	AQUA Utility plate
39508650-76	1	AQUA End plate
985 21465-80	1	Frame plate and parts
985 21467-82	1	Frame parts L=1000
985 21478-80	1	Seawater system 70-84
985 21470-13	1	Ejector size 17,5-26,4/30,9
985 21386-41	1	Feed water orifice \varnothing 8,6
985 00091-94	1	Freshwater outlet system
984 23486-00	1	Solenoid valve - NO/230V
985 21510-01	1	Fresh water pump type PVVF-1532
985 63304-04	1	Motor size 80 B, 1.30 kW
985 23179-01	1	Name plate AQUA
985 22956-80	1	Packing for AQUA-80-HW 78-84
AB-TR-80-HW	1	Transport FCA/FOB cost
985 21670-80	1	Ejector pump type CNL 65-65/160
985 63310-04	1	Motor 132M, 11 kW
985 64722-00	1	Control Panel option A
985 21837-82	1	Dosing unit incl. chemical dosage pump - 230 Volt -loose supply
985 21736-79	1	Parts enclosed with delivery - standard
985 23181-82	1	Distance indicators for tightening bolts
985 21857-01	1	Name tags for FWG unit
985 21748-80	1	Root valves for pressure gauges on FWG
985 00089-47	1	Control panel wall mounting brackets
MM-XX-62S	1	Standard certificate
MANUALS	1	Electronic Installation manual in English in SenseiViewIB
MANUALS	1	Electronic Instruction manual in English in SenseiViewIB
985 22763-81	1	Alfa Laval AOT 3F (230V - 60 Hz) 3.0 m ³ /h
985 22581-01	1	pH filter Alfa Laval 2.5 m ³ /h
Non Standard		
CPT	1	CPT FE

2 Safety Instructions and Warnings

Should you need further clarification regarding this manual, do not hesitate to contact your local Alfa Laval representative - or call Alfa Laval Copenhagen A/S directly.

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2.1 Safety Instructions and Warnings

The following symbols in this manual point out safety precautions. It means your attention is needed and your safety is involved.

WARNING!

This symbol is used to indicate the presence of a hazard, which can or will cause severe personal injury, if the warning is ignored.

CAUTION!

Certain passages of the text will be marked with a caution mark. This mark indicates the presence of hazard, which will or can cause property damage if the instructions are not observed.

NOTE!

This type of instruction indicates a situation, which, if not avoided, could result in damage to the equipment.

It is the owner and operator's responsibility to see that any person involved with the use or operation of this equipment follow all safety instructions.



Read all safety instructions carefully and insist that those working with you and for you will follow them. Not following the instructions may cause severe personal injury or damage the equipment beyond repair.

Do not allow this equipment to be used if it is faulty or the operator does not understand the proper use.

WARNING!

Fresh water must not be produced from polluted water, as the produced water can be unsuitable for human consumption.

Fresh water shall in general only be produced when the vessel is at least 20 miles from land or remote from any risk of estuarial pollution which in some sea areas can extend well in excess of 20 miles from land.

CAUTION!

- Do not adjust spring loaded valves – they are pre adjusted
- Do not run pumps dry – mechanical seals will be damaged
- Do not operate the fresh water generator without recommended chemicals – else, frequent cleaning will be necessary.

NOTE!

- Maximum ambient temperature for the equipment is **50°C (122°F)**.
- Minimum ambient temperature for the equipment is **0°C (32°F)**.

NOTE!

If manuals are translated to local language the unit comply with the EEC Machinery Directive and EN 292-1/2 standards. For EEC land installations manuals **MUST** be available in local language before installing and operating the unit.

The unit also complies with EN 50081-2 and EN 50082-2 “Industry” with regards to the EMC directive from EEC.

WARNING!

Read carefully the safety data sheet before using any chemicals.

WARNING!

Noise hazards

- Use ear protection in noisy environments.

Crush hazards:

- Use correct lifting tools.
- Do not work under hanging load.

Burn hazard:

- Wear gloves to avoid burns by hot surfaces.

Cut hazards:

- Wear gloves to avoid cuts by sharp edges when handling machined parts.
- Wear helmet to avoid cuts by sharp edges during maintenance of the equipment.



3 System Description – AQUA type HW

3.0 Working principle

The combined brine/air ejector driven by the cooling water creates the necessary vacuum in order to lower the evaporation temperature of the feed water.

The feed water is introduced into the evaporator section through an orifice, and is distributed into every second plate channel (evaporation channels).

The hot water is distributed into the remaining channels, thus transferring its heat to the feed water in the evaporation channels.

Having reached boiling temperature – which is lower than atmospheric pressure – the feed water undergoes a partial evaporation and generates a mixture of vapour and brine. The brine is separated from the vapour and extracted by the combined brine/air ejector.

Having passed a separation zone the vapour enters every second plate channel in the condenser section.

The cooling water supplied distributes itself into the remaining channels, thus absorbing the heat being transferred from the condensing vapour.

The produced fresh water is extracted by the freshwater pump and pumped to the freshwater storage tank.

3.1 Freshwater Quality

To continuously check the quality of the produced fresh water, a salinity meter is provided together with an electrode unit fitted on the freshwater pump delivery side.

If the salinity of the produced fresh water exceeds a chosen maximum value, the dump valve and alarm are activated to automatically dump the produced water back to the freshwater generator.

3.1.1 Main Components

The freshwater generator consists of the following main components:

1. **Production unit**

The production unit is build up of Titanium plates encased in a cast iron steel frame. The plates include the tree main functions. Evaporation, separation and condensation. Evaporation in the lower part, separation in the middle and condensation in the upper part.

2. **Combined brine/air ejector**

The ejector extracts brine and non condensable gases from the process.

3. **Ejector pump**

The ejector pump is a single-stage centrifugal pump. This pump supplies the condenser with the necessary seawater and the brine/air ejector with jet water. A part of the seawater is used as feed water for evaporation.

4. **Freshwater pump**

The freshwater pump is a single-stage centrifugal pump. The freshwater pump extracts the produced fresh water after condensing, and pumps the freshwater to the freshwater tank.

5. **Salinometer**

The salinometer continuously measures the salinity of the produced freshwater. At too high salinity the produced freshwater is automatically diverted back to the freshwater generator. The alarm set point is adjustable (the salinometer is mounted in the control panel).

6. **Control panel**

Contains motor starters with thermal overload relays and running lights for each pump, salinometer and voltage free NC / NO contacts for remote alarm, further the Control panel is prepared for remote start/stop of the pumps

4 Storage

4.0 Storage

Unless otherwise agreed, Alfa Laval delivers the equipment ready to be put in service upon arrival and after installation.

However, should it be necessary to store equipment for a longer period (1 month or more), certain precautions should be made in order to protect and prevent unnecessary wear of the equipment.

The best solution is often to leave the equipment in the packing until it's time for installation. In this case Alfa Laval should be informed, in order that proper preparation can be done prior to packing.

Preferably, the equipment should be stored inside in a vibration free area at a temperature around **15 to 45°C (59 to 113°F)** and humidity around **70%**.

NOTE!

There should **ABSOLUTELY NOT** be any **OZONE PRODUCING** equipment in the room, like operating electric motors or arc-welding, since ozone destroys many rubber materials.

Do not store organic solvents or acids in the room.

Avoid heat and ultraviolet radiation.

If the equipment must be stored outdoor, the precautions mentioned above should be taken as far as practical. The need for protection against the climate etc. is of course even more important in this case.

5 Installation

5.0 General Information

5.1 Extent of Delivery

The extent of delivery appears from the installation Flow chart drawing (For order specific drawing number see attached Order Specification). The freshwater generator is delivered as a unit that can be either bolted or welded to the flo or plate.

The control panel with salinometer and starters for the electric motors is normally delivered separately and has to be fitted on site. The salinometer is delivered build into the control panel while terminals for the salinometer must be connected on site.

Please refer to installation diagram for recommended pipe dimensions.

5.1.1 Space Requirements

The space requirements are indicated on the dimensional drawings of the freshwater generator, ejector pump, control panel and scale inhibitor unit, see “FWG Order Specification”.

5.1.2 Ambient Conditions

When determining where to place the freshwater generator in the engine room, due consideration must be paid to a number of ambient conditions such as vibrations, service space, allowable back pressure, and pressure loss.

5.1.3 Vibrations

It is recommended not to place the plant in an area known to be subject to frequent and very high vibrations.

However, under normal engine room conditions no further precautions are necessary.

5.2 General Safety Precautions

Always handle the equipment with great care. Make sure not to damage the parts during transportation or installation.



During erection all inlets and outlets must be covered to be protected from dirt and particles.

5.2.1 Electric Equipment

All electric installations must be carried out by a professional electrician in full accordance with local regulations.

Before initial start-up

- check all connections and cables to make sure that the frequency and voltage agrees with the electrical specifications and motors is connected in **star** or **delta** according to the motor name plate (**way of connection is stated after the actual voltage on the motor name plate**).

WARNING!

Check that all connections are properly **earthened (grounded)** in accordance with local regulations, and properly insulated.

WARNING!

Wrong connection, star or delta, of the motors will occur overheating and burn out of the motors.

5.2.2 Transportation

All transportation of the equipment must be in accordance with local regulations.

The freshwater generator must be lifted using lifting brackets as illustrated in dimensional drawing (See FWG Order Specification)

Make sure that the straps have the required breaking strength to lift the unit. See weight in dimensional drawing.

5.3 Installation Instructions

The freshwater generator should be mounted according to diagram “Vertical plant positioning” drawing (See FWG Order Specification).

5.3.1 Hot Water System

The branches for jacket water inlet and outlet to the evaporator section are marked **C3** and **C4**, respectively. They should be connected to the hot water system according to the Flow chart drawing, see “FWG Order Specification”.

CAUTION!

A thermometer must be fitted **0.5** m from respectively branch **C3** and branch **C4**.

WARNING!

Design pressure of the evaporator section is **4.0 Barg (58 Psig)**, Leakage test pressure **4.0 Barg (58 Psig)**.

5.3.2 Sea Water System

The seawater supplied to the unit has to pass a filter (Yard supply) in the seawater line before the ejector pump.

Recommended filter mesh size 2 mm.

The branch for sea water (cooling water) inlet to the condenser is marked **C1**. This branch has to be connected to the ejector pump discharge according to the Flow chart drawing, see “FWG Order Specification”.

CAUTION!

A thermometer must be fitted **0.5** m from branch **C1**.

CAUTION!

Pipe sizes indicated on the Flow chart drawing, see “FWG Order Specification” are **minimum** recommended sizes.

Smaller sizes will affect too high-pressure losses in the system with influence on the distiller performance. Do not install valves etc. with higher pressure losses than a total of 0.1 bar.

WARNING!

Design pressure of the condenser section is
4,0 Barg (58 Psig), Leakage test pressure **4,0 Barg (58 Psig)**.

5.3.3 Ejector Pump (if supplied)

The ejector pump/motor shall be mounted vertically.

The ejector pump is not self-priming and must be mounted below lowest water line or feed from a low pressure raised system.

The inlet and outlet pipes must be fitted according to Flow chart drawing, see “FWG Order Specification”.

The suction branch **B2** and the discharge branch **B1** for the ejector pump have to be fitted with reducers if necessary. Branch dimensions in accordance with pump dimensional drawing, see “FWG Order Specification”.

CAUTION!

Pressure on suction side of ejector pump under working conditions must be minimum **0.2 Barg (2.8 Psig)** including pressure drop over filter.

5.3.4 Brine/Cooling Water Discharge

Sea cooling water and brine are discharged overboard through the same pipe (branch **B7**).

Maximum back pressure at branch **B7** to be **0.6 Barg (8.5 Psig)**.

CAUTION!

A pressure gauge must be fitted **0,5 m** from branch **B7**.

5.3.5 Freshwater System

The discharge branch for produced water to tank is marked **D1**.

- Max. back pressure according to Technical data, see “FWG Order Specification”.
- It is an advantage to establish a drain below the fresh water generator to drain in case of maintenance.

5.3.6 Control Panel (if supplied)

For document numbers, see “FWG Order Specification”.

The panel contains motor starters with thermal relays, transformer for control voltage, running lights, salinometer, voltage free NO and NC contacts for running indication and remote alarm, it is prepared for remote start/stop.

The panel requires a supply voltage as specified in the “FWG Order Specification”.

Cabling from the panel to the ejector pump (**PU-SC-01**), the freshwater pump (**PU-FR-01**), dump valve (**VA-FR-06**) and the salinity sensor (**QT-FR-01**) to be done at the yard and are not Alfa Laval supply.

Cabling and installed power:

Control panel power supply:	“See FWG Order Specification”
Ejector pump motor:	“See FWG Order Specification”
Freshwater pump motor:	“See FWG Order Specification”
Solenoid valve:	1 phase, 0.015 kW
Salinity sensor:	5 core cable with screen

WARNING!

Check that all connections are properly **earthened (grounded)** in accordance with local regulations, and properly **insulated**.

5.3.7 Motors (if supplied)

Check all connections and cables to make sure that the frequency and voltage agrees with the electrical specifications and the motors are connected in **star** or **delta** according to the motor name plate (**way of connection is stated after the actual voltage on the motor name plate**).

WARNING!

Wrong connection, star or delta, of the motors will occur overheating and burn out of the motors.

5.3.8 Scale Inhibitor Dosage Equipment for Feed Water

Please refer to Dimensional drawing, see “FWG Order Specification”

The injection shall be connected to the feed water inlet to the evaporator section just after the orifice **OC-FE-01**, see “FWG Order Specification”



CAUTION!

In order to avoid malfunctions, we recommend following the pipe dimensions indicated in the Flow chart drawing.

6 Operating Instructions

WARNING!

Fresh water must not be produced from polluted water, as the produced water can be unsuitable for human consumption.

WARNING!

Fresh water shall in general only be produced when the vessel is at least 20 miles from land or remote from any risk of estuarial pollution which in some sea areas can extend well in excess of 20 miles from land.

NOTE!

- Maximum ambient temperature for the equipment is **50°C (122°F)**.
- Minimum ambient temperature for the equipment is **0°C (32°F)**.

6.0 Start up and operating procedure

CAUTION!

Before starting up please observe instructions for feed water treatment, See “10 Chemical Dosing of Scale Control Chemicals”

1. Open valves on the suction and discharge side of the ejector pump PU-SC-01.
2. Open overboard valve for combined brine/air ejector discharge.
3. Switch on power supply.
4. Close air Bleed valve VA-E1-01 on air suction line.
5. Start Ejector Pump PU-SC-01 and create vacuum min 85%.

Adjust the pressure at the ejector inlet to be in the **green** working area. In cold water (below 12 °C) it is recommended to keep the inlet pressure at 3.0 barg, as this will result in a minimum SW flow in the condenser section.

Figure 6-1. *Push ejector pump Start button, and switch on salinometer*

Figure 6-2. *Keep inlet SW pressure in the green range.*

- Secure that feed water treatment has started with the ejector pump.
- Check feed water treatment and adjust to required dosing rate.

Figure 6-3. *Open for feed water treatment and adjust to app. 70 (see table in chapter 10.5.3 for dosing amount) and keep the other button at 100% as on the picture.*

6. Open HW on/off outlet valve 50% and HW on/off inlet valve 100% (Yard supply)

This will secure that the HW by-pass valve adjustment is more optimal. In running condition, the total pressure loss should be in the range of 0.3 bar (unit alone is around 0.13 bar).

7. Close partly the HW by-pass valve (Yard supply)

This will send HW to the unit starting it up slowly by only sending a small part of the HW to the unit.

NOTE!

The maximum freshwater pump discharge pressure can be found in the attached technical data.

8. Start the freshwater pump PU-FR-01

Distillate production is started when water can be seen in the flow sight glass check valve, and the differential temperature in the condenser is more than 3-5°C.

When the salinity is below the set point, check the production rate and compare it with the design production rate.

In cold seawater (below 12 °C), closing the HW by-pass valve too much can result in a too high production rate and causing too high salinity. In some cases in very cold seawater, it will also be needed to open the air bleed valve to get the desired salinity level. This action will increase the boiling temperature and lower the production rate.

Figure 6-4. *Observe when there is water in the flow sight glass FG-ES-01 on the ejector vacuum suction line*

Figure 6-5. *Push Freshwater pump start button*

9. Adjust the HW by-pass valve until the design production rate is reached

Adjust the HW by-pass valve until the design production rate is reached. The AQUA type has a very low pressure loss in the HW side. If this gives regulation problems, this can be improved by partly closing one of the HW on/off valves at the unit

Running the unit at higher production rates than design rate, will result in higher brine salinities and higher scale rates than normal. The freshwater salinity level will be higher, and unstable utilities can cause high salinity dumping and alarms.

10. Open air bleed valve VA-E1-01 slowly if salinity is too high

In cold seawater the production rates will increase. It could be needed also to open the air bleed valve to get the design production and desired salinity level. This action will increase the boiling temperature and lower the production rate.

Figure 6-6. *Air bleed valve. Open this partly in very cold seawater operation.*

This operation will send air into the condenser and vacuum system, and secure that the capacity is not increasing, and the salinity kept low.

6.0.1 Daily operation

- During normal operation it is strongly recommended to make daily logs (by filling in the test sheet enclosed in the manual).
- If production rates are too high or too low then adjust the HW by-pass valve, and/or the air bleed valve (VA-E1-01).
- If production rates are below the design and the unit is operated with design utilities (temperature & flow), then clean the unit manually or by CIP.
- Never run the unit without an anti-scale chemical. Secure correct dosing rates by keeping a log of the chemical consumptions.

6.1 Adjustment of Hot Water Flow

Please refer to “FWG Order Specification”

In order to help adjusting to the specified flow of hot water to the freshwater generator below calculations can be done.

It is necessary to adjust the bypass valve until desired flow is achieved.

The flow can be calculated as follows:

$$M_{JW} = \frac{K_{JW} \times \text{Cap. m}^3/24\text{h}}{\Delta t_{JW}} \text{ [m}^3/\text{h]}$$

Where:

M_{JW} = Hot water flow. [m³/h]

K_{JW} = Constant = 25.6

Δt_{JW} = Difference in temperature of hot water in and out. [°C]

Cap. m³/24h = Freshwater production in 24 hours,
i.e. production in 5 min. times 288. [m³]

Example: Cap. m³/24h = 15 m³

Δt_{JW} = 18.4°C

$$M_{JW} = \frac{25.6 \times 15}{18.4} = 20.9 \text{ m}^3/\text{h}$$

Alternatively adjust the by-pass valve until the fresh water production is according to design. If to high production, salinity in the product can be to high.

6.2 Adjustment of Sea Cooling Water

The sea cooling water flow is correct, when the pressure at the inlet side of the combined air/brine ejector (**PI-ES-01**) is between **3.0** and **4.0 Barg (42.7** and **56.9 Psig)**.

6.3 Stopping the Plant

1. Close hot water inlet and outlet on/off valves (Yard supply).
2. Close hot water inlet and outlet valves
3. Close valve for feed water treatment and adjust to zero.
4. Stop the freshwater pump PU-FR-01 and close valve to storage tank (Yard supply).
5. Let the ejector pump PU-SC-01 run for approx. 5 minutes to cool down the unit. Then stop the pump.
6. Switch off power supply.



7. Open air bleed valve VA-E1-01 on air suction line. It is important to release the vacuum at standstill.
8. Close valves on the suction and discharge side of the ejector pump PU-SC-01 (Yard supply).
9. Close overboard valve for the combined brine/air ejector discharge (Yard supply).

CAUTION!

If water remains in the flow sight glass (**FG-ES-01**) in the air suction pipe, please refer to “Trouble shooting”.

CAUTION!

Close overboard valve for the combined brine/air ejector discharge.

All valves must be shut, while the freshwater generator is out of operation. Except the air screw **VA-E1-01**

NOTE!

If the freshwater generator is out of operation for a longer period than 14 days, please refer to part 7.1.0 Standstill and part 7.2.0 Long Term Standstill.

7 Long Term Standstill

7.1 Standstill

7.1.1 Preservation Procedure for Freshwater Generator

If the freshwater generator is out of operation for a period of **14 to 30 days**.

Close all valves in connection with the unit and its pumps.

Open drain valve on the freshwater generator.

Turn the pump/motor shafts **once a week** to avoid damaging the mechanical shaft seal and motor bearings.

7.1.2 Restart

Close drain valve on the freshwater generator and visually check outside for defects.

Before restart turn the pump/motor shaft by hand to check for any obstructions, after starting the pump watch the operation of the pump and electric motor for **approx. 10 minutes**.

7.2 Long Term Standstill

7.2.1 Preservation Procedure for Freshwater Generator

If the freshwater generator is taken out of operation for a period longer than **30 days**.

Close all valves in connection with the unit and its pumps.

Open drain valve on the freshwater generator.

7.2.2 Restart Freshwater Generator

Close drain valve on the freshwater generator and check visually outside for defects.

For other equipment in connection with the freshwater generator follow procedures as described below.

7.2.3 Preservation Procedure for Pumps

NOTE!

Freshwater pump only to be drained and flushed with fresh water.

Other pumps as following:

1. Drain the pump through the bottom drain.
2. Flush the pump with hot fresh water (maximum **60°C, 140°F**), flushing can take place through the manometer connections.
3. Let the pump dry out.
4. Mount drain plug and manometer connections.
5. Turn the **pump shaft** once a week to avoid damaging the mechanical shaft seal.

7.2.4 Restarting of Pumps

1. Fill the pump with hot fresh water through the manometer connections.
2. Mount the manometer connections.
3. Turn the pump shaft by hand to check for any obstructions.
4. Open valves and check that the mechanical shaft seal is not leaking (if leaking start the pump and let it run for **1 to 2 minutes**, if still leaking the mechanical seal must be replaced).
5. Start the pump and watch the operation of the pump and electric motor for approx. **10 minutes**.

7.2.5 Preservation Procedure for Electric Motors

Factory fitted bearings use a lithium based grease with a recommended shelf life of two years. If stored for a longer period, grease may need to be replaced.

Shielded bearings have a storage life of five years and a further two years operational life following the installation.

To avoid static indentation during long term standstill, the area should be vibration free.

Where exposure to some vibration is unavoidable, the shaft should be looked. Roller bearings may be fitted with a shaft locking device, which should be kept in place during long term standstill.

Shaft should be rotated by hand, one quarter of revolution weekly.

WARNING!

Where anti-condensation heaters have been fitted, it is strongly recommended that they are energized.

In such case, **prominent warnings of live terminals** inside the terminal box must be posted inside and outside the motor terminal box.

Where anti-condensation heaters are not fitted, the use of desiccant is recommended.

7.2.6 Restarting of Electric Motors

1. Before taking a motor into service, ensure that anti-condensation heaters (if fitted) have been disconnected and isolate before starting the motor.
2. Check that no foreign matter is present.
3. Remove all surface dust and dirt.
4. Test the stator insulation resistance between phases and also to earth.
5. If an insulation resistance lower than one mega ohm at **20°C (68°F)** is measured, the windings must be dried out until a minimum of one mega ohm is obtained.
6. Start the motor.
7. Watch the operation of the electric motor for approx. **10 minutes**.

7.2.7 Preservation Procedure for Electric Panel

The electric panel normally includes motor starters with thermal relays, transformer, contactors and salinometer.

The panel has to be disconnected from the main supply and kept clean and dry during the long term standstill period.

The panel is kept dry inside either by an anti-condensation heating element (**25 W**) or by use of a desiccant.

WARNING!

If anti-condensation heater is used, **prominent warnings of live terminals** inside the panel must be posted inside and outside the panel.

Remove the conductivity sensor in the freshwater pipe after the freshwater pump, clean the sensor and store it in the electric panel or in a dry place.



7.2.8 Restarting of Electric Panel

1. Before taking the panel into service, **ensure** that anti-condensation heater (if fitted) have been disconnected and removed.
2. Check that no foreign matter is present in the panel.
3. Remove all surface dust and dirt.
4. Test the insulation resistance between phases and earth.
5. If an insulation resistance lower than one mega ohm at **20°C (68°F)** is measured, the panel must be dried out until a minimum of one mega ohm is obtained.
6. Clean and mount the salinity sensor in the freshwater pipe.

7.2.9 Solenoid Valve

Solenoid valve is removed, flushed with warm fresh water and stored in a clean dry ozone free area.

Before replacing, the valve is flushed again with warm fresh water and the function of the valve is checked by energizing the coil.

8 Maintenance

8.0 Why you need to perform regular maintenance duties

Regular maintenance of the plant will improve performance and availability.

The maintenance schedule on the following pages will tell you how often service should be performed on the main components.

As the actual operating conditions of the plant are of major influence on the life time, the overhaul dates are not obligatory but only recommended intervals.

When the plant has been in operation for a longer period of time and experience has been established as to the actual performance, it will be possible to adapt the maintenance schedule.

For service on minor components please refer to component instructions.

8.1 Overhaul Intervals

Component	Operating Hours	Action
Production unit: Plate stack	As required	Clean in inhibited acid bath. Scrub with pure freshwater and brush.
Production unit: Complete	As required	Clean with pure freshwater and brush
Combined ejector/ cooling water pump with motor	8000 h	Measure seal ring and impeller. Examine mechanical shaft seal, cooling water pipe passage. Meg- ger-test electric motor. Clean pump thoroughly before reassem- bly.
Freshwater pump with motor	8000 h	Measure seal ring and impeller. Examine mechanical shaft seal, cooling water pipe passage. Meg- ger-test electric motor. Clean pump thoroughly before reassem- bly.
Combined air/brine ejector	8000 h	Measure nozzles and diffuser and compare to measurements in technical specification.
MV-valves	4000 h	Disassembly and inspect for dam- age.
Manometers	8000 h	Check with control manometer. Replace if necessary
Salinometer	See separate instruc- tions	See separate instructions

8.2 Maintenance of Plate surface

Clean Plate surface as follows:

NOTE!

Measure and note the tightening measure



1. Remove tightening bolts
2. Open plate stack
3. Remove plate stack

NOTE!

Be careful not to damage the gasket during manual cleaning.

NOTE!

If some of the gaskets come loose on removing plate stack, please see section 8.3.3

4. Submerge plates completely in a hot, inhibited acid bath at **maximum 50°C (122°F)**. For further instructions see “Chemical dosing of scale control chemicals”.

WARNING!

Always follow carefully the supplier’s instructions when using inhibited acids.
Remember to neutralize according to suppliers instructions.

5. Scrub plates with a soft brush and plain hot water at maximum **50°C (122°F)**.
6. Examine plates and gaskets for possible damage, and remove damaged plates and/or replace damaged gaskets.

NOTE!

If a defective plate is found, remove the plate together with one of the adjacent plates.

NOTE!

The assembly measurements must be reduced with 4.9 mm per plate, if plates are removed from plate stack.

CAUTION!

The end plate and start plate cannot be removed but must always be replaced, with a corresponding plate.

7. Reassemble the plate stack in accordance with attached assembly scheme.
8. Tighten plate stack to measurements stated in technical specification.
9. Vacuum test the freshwater generator before start up.
10. The evaporator section is pressure tested by letting hot water circulate through the section with bypass valve for hot water in normal running position.

NOTE!

If a defective plate is found, remove the plate together with one of the adjacent plates.

NOTE!

The assembly measurements must be reduced with **4.9 mm per plate**, if plates are removed from plate stack.

11. Reassemble the plate stack in accordance with attached assembly scheme.
12. Tighten plate stack to measurements stated in technical specification.
13. Vacuum test the freshwater generator before start up.
14. The condenser section is pressure tested by starting the ejector pump and letting sea water circulate through the condenser section.

NOTE!

If the gaskets is correct positioned the rubber indicators will be visible on every second plates on the right respectively left hand side.
If the plates are correctly assembled, the edges form a “honeycomb” pattern.

CAUTION!

Before starting the combined ejector/cooling water pump, the feed water must be sealed off.

8.3 Renewal of Plate Heat Exchanger Gaskets

8.3.1 Removal of Old Gaskets

Pull the old gaskets out of groove.

If the gasket cannot come off directly, heat the back of the gasket groove with a hot-air blower or butane gas burner.

Pay attention not to overheat the plates.

You will obtain a suitable temperature, if the flame is held **10 to 15 cm** behind the plate.

WARNING!

DO NOT use acetylene gas

8.3.2 Cleaning

Charred or loose glue and rubber remains must be removed, e.g. using a rotating stainless steel brush. The width should be adapted (\varnothing 40-50 mm, width 8-10 mm).

Thin layers of glue, which are difficult to remove, may remain.

Clean the gasket groove with a clean cloth, dipped in a solvent (acetone, methyl ethyl ketone, trichlorethylene etc.).

WARNING!

Be careful when handling these solvents, as they may be hazardous to your health. Observe suppliers' instructions.

Gaskets, that have loosened, can be glued on. Clean gasket groove carefully with a sharp tool. Then clean the loose part of the gasket with emery cloth or sandpaper. Finally clean groove and gasket with a solvent, and glue.

8.3.3 Preparation of new Gaskets

Dry new gaskets with a clean cloth that has been slightly moistened with a solvent.

8.3.4 Fitting new Gaskets

1. Apply a thin layer of glue to both gasket and groove.
2. Let the glue dry for **10-15 minutes**.
3. Fit new gasket into groove.



4. Gaskets may sometimes be slightly short or long.
5. Short gaskets should be stretched before being fitted into the groove.
6. Long gaskets should be fitted into the grooves at the plate ends first and then gradually be pushed into the groove towards the middle.
7. If necessary, tape gasket into groove.
8. **Assemble plate pack according to attached assembly scheme.**

9 Vacuum test

9.0 Vacuum testing of unit

If there are leaks in the system, it will be necessary to carry out a vacuum test in order to identify the leak:

1. Please follow the starting instructions.
2. Stop the ejector pump.
3. The vacuum drop must not be more than 2% within 10min

10 Chemical Dosing of Scale Control Chemicals

10.0 Prevention of Scaling

During evaporation of seawater there is always a risk of scaling on the heating surfaces. Scale will lead to a reduction of the K-values (Heat Transfer Value) on the heating surface and decrease the freshwater production. This will demand extensive cleaning.

Without correct operation of the Freshwater generator as well as chemical treatment of the feed water before it enters the AQUA unit, solid salts will form scales. The degree of deposit of scales (solid salts) depends on the concentration of calcium, magnesium, bicarbonates and sulphate in the seawater. At certain temperatures calcium carbonates, magnesium hydroxides and calcium sulphate will solidify and deposit on any surface they are in contact with over a sufficiently long period of time.

Scaling may occur. In order to effectively prevent scaling the operators must be aware of the various factors influencing scale formations

10.1 Feed Water Ratio

The feed water ratio is an extremely important factor. It is defined by the relationship between the feed water amount fed into the plant and the produced amount of freshwater.

$$\text{Feed Water Ratio} = \frac{M_f}{M_d}$$

M_f = total flow of feed water

M_d = total flow of freshwater

If the feed water ratio is reduced, the concentration will rise in the plant subsequently resulting in scale formations.

NOTE!

The AQUA is designed to a feed water ratio at 3.25.

Two things may shift the feed water ratio: **first** of all direct adjustment of the feed water system, and **secondly** exceeding the maximum freshwater production laid out for the plant.

The operators must observe the following rules at all times.

CAUTION!

DO NOT adjust spring loaded valve at the feed water system.
The feed water pressure at PI-ES-01 shall be minimum **3.0 (42.7 Psig)**
and maximum **4.0 Barg (56.9 Psig)**

10.2 Evaporating Temperature

Another factor influencing scale formation is the evaporating temperature. Temperatures higher than laid out by Alfa Laval Copenhagen will increase the scaling risk.

10.3 Operational Notes

10.3.1 Normal Operation Conditions

It is important that operating personnel become familiar with normal operating conditions so that deviations from the norm can be recognised quickly and dealt with promptly. The Table in Technical Data lists the approximate readings that should be obtained during normal operation of the unit. Most of these indications will be found on the central instrument.

10.3.2 Maintaining Distillate Output

The normal feed water treatment will keep the scale of evaporator to a minimum; though not prevent it completely, over time scale will accumulate. The length of this period depends both of the operation of the plant as well as the quality of the seawater. If the temperature of the incoming feed water is held constant at the normal value, the production of the unit will gradually decrease as scale accumulates on the plate surfaces. Eventually the scale will have to be removed by acid cleaning.

The rate of scale deposition depends on many factors, including:

- Chemical composition of the feed water
- Degree of attention to feed water treatment



It is therefore good practice to shut down the unit periodically for several hours to inspect the plate surfaces for scale. Experience will dictate the time interval between inspections. Never depend upon visual inspection alone, but rather, the unit should be opened and samples of scale taken for measurement of thickness, in accordance with cleaning the unit.

Scaling on plates leads to an increase of the total plant temperature difference. The increased temperature difference will lead to a higher evaporation temperature which will increase the risk of scale formation.

Scaling may occur. In order to effectively prevent scaling the operators must be aware of the various factors influencing scale formations.

10.4 Chemical Dosage

In order to control scale formations on the heating surfaces and continuously ensure long operation periods without cleaning the Freshwater generator, it is absolutely necessary to dose scale control chemicals to the feed water.

Calcium carbonate and magnesium hydroxides are soft or alkaline scales and can relatively easy be dissolved with acid solutions. They are primarily formed at temperatures above 45°C. Since the AQUA typically is operated at temperatures above 45°C, scale becomes a real issue, which needs to be dealt with by adding anti scalant chemicals.

It is also very important that the scale inhibitor used is effective at the evaporation temperature and at the same time effective at a feed water ratio factor 3.25.

The operators must follow the instructions for chemical dosing very carefully.

CAUTION!

If the freshwater generator is operated at boiling temperatures above **45°C (113°F)** without chemicals, frequent cleaning of the evaporator will be necessary.

NOTE!

We recommend that you do not operate the freshwater generator without recommended chemical dosage at boiling temperatures above **45°C (113 °F)**. Even at lower temperatures it can be recommended.

10.4.1 Scale Inhibitor Dosage Equipment for Feed Water

Mix thoroughly to ensure a homogenous blend when adding chemicals to water.

Use a fully soluble scale inhibitor, e.g. on polymer basis. The following product can be recommended:

Alpacon Altreat 400

Should other antiscaling chemicals be used, the user will be fully responsible concerning its efficiency in scale control and its compatibility with the plant and equipment. Should this selection of chemical cause any damage to any part of the plant or result in insufficient control of the formation of scale in the plant, then such cases will not be covered under Alfa Laval's warranty obligations.

Alfa Laval refrains from discussing or commenting on other brands of antiscaling chemical, as we find the responsibility for the applicability and use of a certain brand chemical should be the chemical supplier's.

10.4.2 Safety Precautions with the use of Chemicals

WARNING!

The operators must follow the instructions for chemical dosing given by the chemical supplier carefully.

USE eye protection and gloves. Avoid direct skin contact, eye contact or contact with clothes.

CLEAN empty containers before disposal.

If chemicals are spilled on clothes, rinse with water and dispose off clothes.

If chemicals are spilled on the floor, rinse with water and suck remaining chemicals off with sand. Clean the spot immediately afterwards.

Scale inhibitor is hazardous, if consumed in a concentrated solution. If consumed by mistake.

IMMEDIATELY SEEK MEDICAL ATTENTION.

If eyes get in contact with the chemicals, rinse for at least 20 minutes.

IMMEDIATELY SEEK MEDICAL ATTENTION.

WARNING!

Read carefully the safety data sheet before using any chemicals.

10.4.3 Alpacon Altreat 400

Alfa Laval recommends Alpacon Altreat 400, which is an Alfa Laval scale inhibitor product, for dosing to the feed water.

Technical specification

Appearance	Light brown liquid
Density at 20°C	Approx. 1,25g/cm ³
Viscosity at 23°C	600 mm ² /s
Flash point	>100 °C

pH-value at 20°C Approx 8
 Miscibility with water In all proportions

Ordering information

Article number:

985 00056-82 Alpacon Altreat 400 - 25 litre
 985 00056-81 Alpacon Altreat 400 – 200 litre

10.5 Preparation of chemical solution

10.5.1 Anti Scalant type Alpacon Altreat 400

The Alpacon Altreat 400 can be used concentrated or as a solution.

It is necessary to use a solution to the AQUA units as the dosing rate shall be at as high as practical to secure an even distribution.

The solution is prepared in the mixing tank by dissolving the Alpacon Altreat 400 additive in fresh water or distillate. The maximum effective life of the solution is one week. Preparation of quantities of solution for longer periods is therefore not recommended.

10.5.2 Dosing flow calculation

Dosing flow [l/day] = Effective volume [litre] / Filling interval [days]

Tank		Filling		
Volume litre	Effective litre	Interval days	Dosing l/day	Dosing l/hour
60	48	1	48	2,0
60	48	2	24	1,0
60	48	3	16	0,67

Example:

Chemical dosing tank volume = 60 litre

Effective volume (minus spare volume) = 48 litre

Filling interval = 3 days

=> Dosing flow = 16 l/day

10.5.3 Calculating Chemical solution

Feed water [m³/day] = Capacity [m³/day] × Feed water ratio

$$\text{Chemical dosing [l/day]} = \frac{\text{Feed water [m}^3\text{/day]} \times \text{chemical dosing rate [kg/m}^3\text{]}}{\text{Chemical density [kg/l]}}$$

Production Capacity m ³ /day	Feed water Flow m ³ /day	Chemical		Dosing 48 l/day		Dosing 24 l/day		Dosing 16 l/day	
		(dosage 8 g/m ³) kg/day	(density 1,25 kg/l) l/day	Chemicals litre	Water litre	Chemicals litre l/day	Water litre l/day	Chemicals litre l/day	Water litre l/day
5	16,3	0,130	0,104	0,104	47,9	0,104	23,9	0,104	15,9
10	32,5	0,260	0,208	0,208	47,8	0,208	23,8	0,208	15,8
15	48,8	0,390	0,312	0,312	47,7	0,312	23,7	0,312	15,7
20	65,0	0,520	0,416	0,416	47,6	0,416	23,6	0,416	15,6
25	81,3	0,650	0,520	0,52	47,5	0,52	23,5	0,52	15,5
30	97,5	0,780	0,624	0,624	47,4	0,624	23,4	0,624	15,4
35	113,8	0,910	0,728	0,728	47,3	0,728	23,3	0,728	15,3
40	130,0	1,040	0,832	0,832	47,2	0,832	23,2	0,832	15,2
45	146,3	1,170	0,936	0,936	47,1	0,936	23,1	0,936	15,1
50	162,5	1,300	1,040	1,04	47,0	1,04	23,0	1,04	15,0
55	178,8	1,430	1,144	1,144	46,9	1,144	22,9	1,144	14,9
60	195,0	1,560	1,248	1,248	46,8	1,248	22,8	1,248	14,8

Example:

Capacity = 20 m³/day

Feed water ratio = 3,25

Chemical dosing rate = 0,008 kg/m³

Chemical density = 1,25 kg/l

=> Chemical dosing = 0,416 l/day

If dosing flow is 16 l/day => Mix is 0,416 litre chemical to (16 - 0,416) litre Water

Obs. Multiply to get the needed Chemical solution volume.

Example:

Dosing flow is 16 l/day

Chemical dosing = 0,416 l/day

Tank volume to be filled = 45 litre

'=>

Water amount = (16 - 0,416) × 45 / 16 = 43,8

Chemical amount = 0,416 × 45 / 16 = 1,17

10.6 Dosing Instructions – Anti Scalant

The dosing flow shall be adjusted to calculated dosing flow. Use a bucket to determine the chemical dosing flow.

NOTE!

The dosing pump is started at the same time as the ejector pump.
Stroke rate shall be set to 100%
Use the stroke length knob to adjust flow.

NOTE!

The dosing pump is started at the same time as the ejector pump.
Stroke rate shall be set to 100%
Use the stroke length knob to adjust flow.

Dosing pump



Stroke length knob

11 Operation and maintenance instructions for Freshwater Pump type 1525/1532/2040

11.1 Product description

The pump is a single-stage centrifugal pump, direct-coupled to the electric motor shaft by means of a hollow shaft and hollow point screws. The pump is equipped with mechanical shaft seal with rubber bellows.

11.2 Technical data

- Pump casing in bronze
- Impeller in bronze
- Shaft in stainless steel
- Pump capacity appears on the nameplate of the pump.
- Motor power and voltage is indicated in the technical specification
- Power consumption is indicated in the technical data sheet for pumps and motors
- Number of revolutions is indicated in the technical data sheet for pumps and motors

The total weight is the sum of pump and motor weight:

Pump Type	Weight [kg]	
PVVF1525	5.5	
PVVF1532	7.5	
PVVF2040	9.0	
ABB Motor Type	Weight [kg]	Sound pressure
		dB(A) at 3000/1500 rpm
MT 71	5.5	59 / 45
MT 80	10.0	60 / 49

11.2.1 Noise level

The noise level of pump without motor is lower than 70 dB (A). The noise level of pump + motor is about 2 dB (A) higher than the noise level of the motor. The noise level of the motor is about 1-2 dB (A) higher at 3600 rpm. The above guiding noise levels are based on a tolerance of ± 3 dB (A). Max. water temperature: +70°C.

11.3 Installation / start-up

Before installation of the pump read these operation and maintenance instructions carefully. Installation and running must further be in accordance with local regulations and common practice. High tensions must not be transferred from piping system to pump. Make sure that the pump rotates in the direction of the arrow. The pump must be liquid-filled and bled before start-up as the shaft seal will otherwise be damaged.

11.4 Application

The pump is suitable for the pumping of pure seawater and fresh water.

The pump must not be used in ATEX zones.

11.5 Service

Before service the mains voltage must be disconnected. Make sure that the mains voltage cannot unintentionally be cut in. The pump might be so hot that handling may cause burns.

11.5.1 Pump overhaul

The following instructions must be carefully observed whenever it becomes necessary to overhaul or repair the freshwater pump.



Please refer to drawing for item references in the text.

Pos. No. Designation

1. Pump casing	2. Impeller	3. Gasket
4. Rear cover	6. Shaft	9. Motor
10. Screw	11. Hollow point screw	14. Screw
17. Sealing ring	18. Pipe plug	19. Sunk key
20. Screw	22. Shaft seal	23. Screw cap
30. Allen screw and disc	31. Guard	

1. Remove the bolts **pos. 14** in the pump casing **pos. 1**.
2. Motor with pump cover **pos. 4**, impeller **pos. 2** can now be removed from the pump casing **pos. 1**.
3. Remove the screw **pos. 20** (right-hand thread).
4. Remove impeller. Normally the impeller can be dismantled without the use of puller tools.
5. Remove the sunk key **pos. 19**.
6. The mechanical shaft seal **pos. 22** can now be removed.
7. Check the ceramic ring, the carbon ring and the springs in the shaft seal. If necessary, replace the shaft seal.
8. To facilitate the removal of the ceramic seat of the shaft seal it is recommended to dismantle the pump cover **pos. 4** from the motor flange.
9. After replacing the ceramic seat mount the pump cover **pos. 4** on the motor flange.

10. Before mounting the remaining part of the shaft seal apply glycerine to the pump shaft.

11.5.2 Clearance

11. Before assembling the pump, check the clearance between impeller and sealing ring.

12. Max. clearance impeller/sealing ring 0.5 mm on the diameter

13. Assemble the pump in the reverse order of dismantling.

CAUTION!

Only dismantle the pump shaft if pump shaft or motor bearings are to be replaced.

In this case carefully observe “Dismantling pump shaft”.

11.5.3 Dismantling Pump Shaft

Dismantle the pump as described above.

Remove the pointed screws **pos. 11** and normally the pump shaft can easily be removed from the motor shaft.

In case the dismantling causes problems, use the puller tools

If the pump shaft does not come loose, use the special dismantling tools shown below.

The tool is not Alfa Laval supply.



The tool consists of a pipe (A), a disc (B) with hole for the screw (C) and a nut (D), washer (E).

Please note that the length L must be longer than the length l.

Place pipe (A) around the shaft. Fasten the screw (C) with nut (D) and washer (E) into the threaded hole (M 5) on the shaft end.

Loosen shaft by tightening the nut (D) while holding on to the screw (C).

CAUTION!

DO NOT grind the motor shaft.

1. Clean the motor shaft and mount the new pump shaft on the motor shaft.
2. Make sure that the pump shaft fits the motor shaft without any obstructions, before final shaft fitting as follows:

3. Tighten pointed screws 11 as shown on picture below:

NOTE!

The torque shall be 5 Nm (0.5 kpm) and the maximum wobble 0,06 mm

4. Check the wobble of the pump shaft with a dial indicator.
5. Reassemble the pump as described above in reverse order.

11.6 Maintenance

The motor bearings, which are the only bearings in the pump, are lubricated for life and must, therefore, not be re-lubricated. Check the shaft seal at regular intervals.

11.7 Transport / storage

The small pumps can be lifted by hand. The big pumps have to be lifted by placing a rope round the pump so that it is in balance. The rope must not touch sharp edges. Store the pump in a dry area.

11.8 Spare parts

Spare parts must be ordered on the basis of the freshwater pump assembly drawing and parts lists attached with this manual.

12 Salinometer

12.0 Salinometer type DS-21

Front view

12.1 Specification of Salinometer type DS-21

Function:	The salinometer measures and supervises the salinity (salt content) of fresh water produced by distillation of sea water
Mains supply:	90-115 or 190-230 V, 50-60 Hz
Mains current:	Mains supply must be secured against over current externally. Max. 100mA
Power consumption:	Max. 3.5 W
Range of Salinity:	0 - 20ppm of sea salt (0 – 10 ppm 0,1 ppm/step) (10 – 20 ppm 0,2 ppm/step)
Accuracy:	+/- 10% on displayed value
Alarm Level:	Adjustable 1 - 20ppm (1 – 10 ppm 1 ppm/step) (10 – 20 ppm 2 ppm/step)
Alarm:	Alarm indicating a bad connection to the electrode
Cable Connections:	Terminal 1 - 4: Mains supply Terminal 5 - 7: Relay contacts for solenoids Terminal 8 – 10: Relay contacts for ALARM Terminal 11 – 15: Electrode unit Terminal 17: 4-20mA Current loop Terminal 18: Current ref, Ground

Alarms to devices connected to the secondary relay can be cancelled by means of a push button "ALARM ON/OFF" on the front panel.

Display:	LED Bar
Relay contacts:	8A / 24V AC

12.2 Installation of Salinometer type DS-21

1. Make sure, that the mains supply is secured against over current by a fuse (max.100mA). There are NO fuses in the salinometer.
2. The salinometer is adopted to operate from 90 to 115V AC 50-60 Hz or 200 to 230 V AC 50-60 Hz.



3. Lay the necessary cables and connect them to the female connector.

4. Plug the female connector in the male connector, and test the instrument as described.

12.3 User instruction for Salinometer type DS-21

1. Check that the LED "Electrode Disconnected" not indicates a bad connection to the electrode.
2. Adjust the alarm level to the required level.
3. Be sure that "ALARM ON/OFF" is in the right position.

The salinometer is now ready for use.

If the salinity exceeds the alarm level, the instrument signals alarm:

- a) The alarm LEDs are flashing.
- b) The externally connected alarm devices (solenoid valve(s), buzzer, external alarm system(s) etc. are functioning. The externally alarms can be cancelled by pushing the "ALARM ON/OFF" button, but not the solenoid valve.

When the alarms are operative a green LED appears.

12.4 Maintenance of Salinometer type DS-21

Always keep the salinometer dry and clean. The accuracy of the salinometer is very dependent on the electrodes are kept clean.

The electrodes should be taken out and cleaned at **least once a week**. Use only a **clean and soft rag**. When cleaning the electrodes it is **IMPORTANT** that the electrodes are not polluted by oil or other chemicals.



Any pollution result immediately in an inaccurate measurement of the salinometer.

If the surface of the electrode is damaged it needs to be replaced.

13 Trouble-Shooting

13.0 Test Sheet

Before taking any action, please fill in a test sheet to find possible causes of malfunctions.

Test sheets can be found in the back of this section.

13.1 Trouble Shooting Table

Problem	Cause	Action
Drop in production.	Partially blocked feed water orifice and/or sludge deposits on hot water side.	Dismantle plate stack and clean evaporator section and orifice.
	Sludge on the heat exchanger plates on the sea water side.	Dismantle plate stack and clean condenser section.
	Inlet channel in evaporator/condenser plate stack blocked, e.g. with rust scales, gasket fragments etc.	Dismantle plate stack, and clean.
	Too low ejector pump pressure.	See instructions for “Low Sea Cooling water/Ejector pump flow / pressure”, below.
	Leakages.	Carry out a vacuum test.
	Foreign bodies in ejector nozzles.	Inspect nozzles, and clean. Replace nozzles, if damaged.
	Too high back pressure on ejector outlet side. Max 0.6 Barg (8.7 Psig).	Check overboard pipe and valves for blocking / function ability.
	Non-return valve in air extraction pipe defect.	Replace non-return valve.
	Hot water temperature too low.	Increase to specified temperature
	Defective water clock.	Examine water clock. Let the produced water flow through water clock into a 10 l pail, and check production with a stop watch. Clean strainer if dirty

Low Sea Cooling water/Ejector pump flow / pressure. Minimum pressure 3.0 Barg (43.5 Psig). At inlet side of ejector.	Too low ejector pump pressure.	Clean, or replace pressure gauge.
	Impeller / seal ring defective.	Check pump maximum clearance See “Maintenance of Ejector Pump”.
	Suction strainer blocked.	Clean suction strainer.
	Valves on suction or pressure pipe defect.	Examine and overhaul defective valves.
	Leakage from suction pipe to pump.	Repair.
	Clocked up condenser.	Dismantle plate stack and clean.
	Pump rotating in wrong direction.	Interchange phases.
Sight glass overflow.	Suction pipe leakage.	Check suction pipe especially unions and connections. Repair.
	To high freshwater back pressure	Reduce back pressure
	Mechanical seal in freshwater pump defect.	Replace mechanical seal.
	Impeller / seal ring in freshwater extraction pump defect.	Check pump. Maximum clearance See “Maintenance of Freshwater-Pump”.
	Pump rotating in wrong direction.	Interchange phases.
	Valves to freshwater tank closed.	Check all valves.
	Inlet filter for water clock blocked.	Clean filter.
Salinity too high	Too high production	Reduce production by reducing hot water flow
	Insufficient brine extraction.	See separate instructions for insufficient brine extraction, below.
	Very cold seawater	<ul style="list-style-type: none"> • Open air screw (VA-E1-01) in small steps to increase boiling temperature. • Reduce hot water flow • Reduce to min. sea water pressure 3,0 Barg (42,7 Psig) at ejector inlet (PI-ES-01)
	To high hot water flow	Reduce hot water flow

	To low boiling temperature	<ul style="list-style-type: none"> • Open air screw (VA-E1-01) in small steps to increase boiling temperature. • Reduce hot water flow • Reduce to min. sea water pressure 3,0 Barg (42,7 Psig) at ejector inlet (PI-ES-01)
	Wrong placement or scale in brine separation gaskets	Open clean / reglue
	Electrode unit defective or dirty.	Examine electrode unit for cracks. Check that it is fitted correctly. Clean, if necessary.
	Leakage in condenser section.	Leak test condenser section. Max. 4.0 Barg (58 Psig). If there is a defective plate, check gaskets for foreign objects, if none remove together with adjacent plate assemble plate stack according to new plate number with reduced assembly measurements. Check plate gaskets are securely attached to the plates and replace, if necessary.
Insufficient brine extraction.	Ejector pump pressure too low.	See special instructions for “Low Sea Cooling water/Ejector pump flow / pressure”, above.
	Foreign bodies in ejector nozzles.	Check nozzles, and clean. Replace damaged nozzles.
	Too high back pressure downstream of ejector.	Examine overboard pipe and valves.
	Wrong dimension of feedwater orifice.	Examine orifice dimension - check technical specification.
	Non-return flap in brine suction pipe of ejector defect.	Examine flap and repair, or replace.

<p>Frequent refill of freshwater expansion tank due to loss of hot water.</p>	<p>Leakage in evaporator section.</p>	<p>Leak test evaporator section. Max. 4.0 Barg (58 Psig). If there is a defective plate, check gaskets for foreign objects, if none remove together with adjacent plate assemble plate stack according to new plate number with reduced assembly measurements. Check plate gaskets are securely attached to the plates and replace, if necessary.</p>
<p>Abnormal amperage consumption of ejector pump motor.</p>	<p>Ejector nozzles defective.</p>	<p>Replace nozzles.</p>
	<p>Wrong dimension of feedwater inlet orifice.</p>	<p>Check dimensions on spare parts list, and replace if necessary.</p>
	<p>Bearings in motor defective.</p>	<p>Examine with stethoscope, and replace bearings, if defective.</p>
	<p>Contactors defective.</p>	<p>Examine and replace contactor set, if defective.</p>
	<p>Breaking of phases.</p>	<p>Max. 5% difference in amperage between phases.</p>

Test Sheet for single stage Fresh Water Generator type Aqua HW									
Vessel:			Date:			Location:			
Freshwater Generator no.:			Type:			Capacity:			
No. of plates:			Date for last cleaning:						
TEST									
Date:									
Time from:									
To:									
Difference			min.						
Fresh water									
Water clock to:			FI-FR-01	This page intentionally left blank					
From:			FI-FR-01	m ³					
Difference:			Calc.	m ³					
Total output:			Calc.	m ³ /24h					
Evaporator section									
Hot water inlet:			TI	°C					
Hot water outlet			TI	°C					
Difference			Calc.	°C					
Hot water flow rate			Calc.	m ³ /24h					
Feed water temperature			TI-ES-01	°C					
Process									
Boiling temperature			TI-E1-01	°C					
Vacuum			PI-E1-01	°C					
Condenser section									
Sea water inlet			TI	°C					
Sea water outlet			TI-ES-01	°C					
Difference			Calc.	°C					
Outlet pressure			PI-ES-01	Bar					
Brine / Air Ejector									
Inlet pressure			PI-ES-O1	Bar					
Back pressure			PI	Bar					
Ejector pump									
Inlet pressure			PI	Bar					
Discharge pressure			PI	Bar					
Freshwater pump									
Discharge pressure			PI-FR-01	Bar					
Salinometer									
Salinity			QT-FR-01	ppm					
Chemical dosage									
yes / no									
Chemical type / dosage									
Comments									
<p>*) Hot water flow [m³/h] = 24,6 x Freshwater production [m³/24h] / Hot Water difference temperature [°C]</p> <p>*) Sea water flow [m³/h] = 23,5 x Freshwater production [m³/24h] / Sea Water difference temperature [°C]</p>									
Document number: 985 22699 rev03			<hr style="width: 100%; border: 0; border-top: 1px solid black;"/>						
			Signature						

14 Spare Parts -

14.0 Ordering Spare Parts

When ordering spare parts please always state:

1. Serial number.
2. Spare parts drawing number.
3. Position number.
4. Article number.

In order to identify article numbers, please refer to FWG Order Specification and other drawings.

When ordering parts for pumps proceed as follows:

1. Find article number in the list of drawings.
2. Check spare part drawing and item list with corresponding article number to identify the item to be ordered.

14.1 Alfa Laval Service

The Alfa Laval group is represented in all major ports of the world.

DO NOT hesitate to contact your Alfa Laval representative if you have any questions, problems or require spare parts.

www.alfalaval.com



15 FWG Order Specification - Drawings and Parts lists



985 21683 General description AQUA

Application

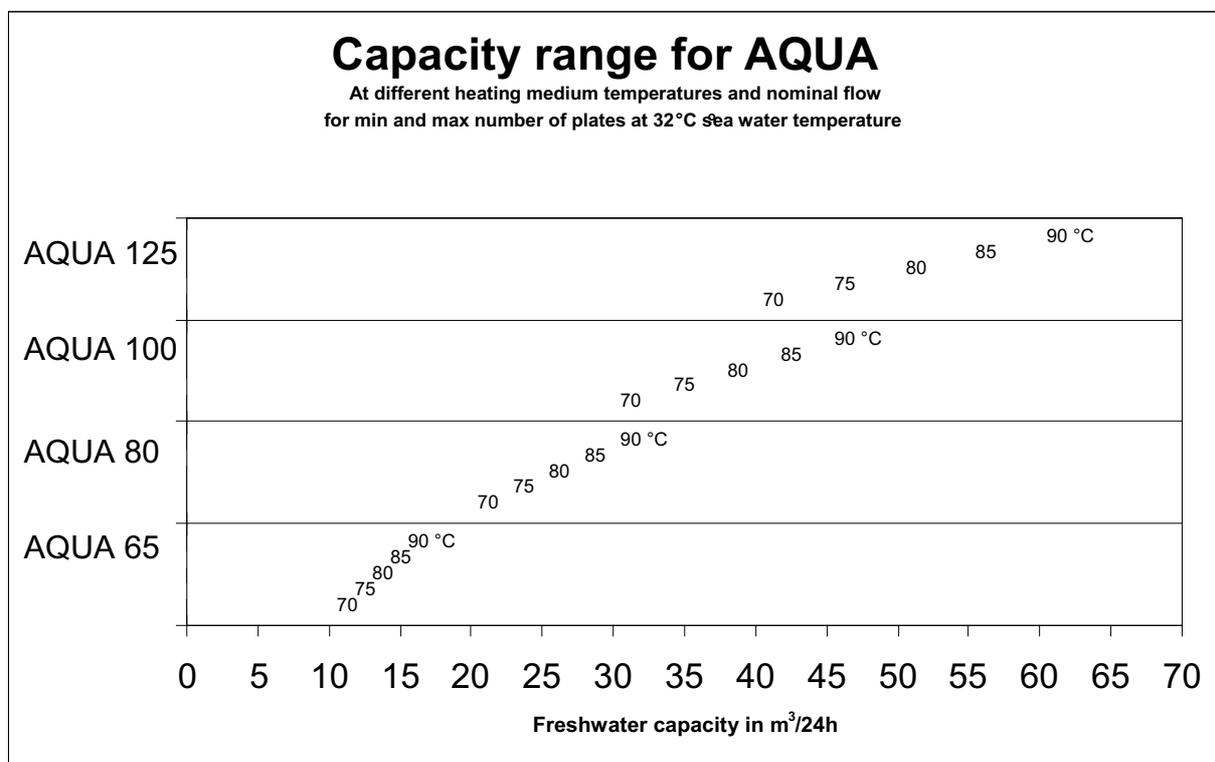
Conversion of seawater into fresh water by vacuum distillation for the supply of high quality fresh water for domestic and process utilization. For installation on ships, rigs and remote onshore locations.

The AQUA is designed for automatic operation with continuous control of fresh water quality. Heating media is waste heat, jacket water, steam or HWL.

At all time the Alfa Laval AQUA fresh water generator secure pure fresh water onboard and replacement of bunker water.

Capacity

The AQUA covers a capacity range from 4 to 60 m³/24hr, depending on the heating medium temperature, flow and seawater temperature. The capacities shown below are at 32°C seawater temperature.



985 21683-R00

Illustrations, indications of material, dimensions and weights etc. herein, do not constitute any commitment on our part. We reserve the right to change such specification when necessary.

9.2 Production Information
9.2.11 Freshwater Generator AQUA

Working principle

Picture 1

The feed water to be evaporated is taken from the sea cooling water outlet of the condenser. It enters the evaporator where it evaporates at about 40–60°C as it passes between the plates heated by the heating medium. The evaporating temperature corresponds to a vacuum of 85–95%, maintained by the brine/air ejector. The vapours generated pass through a separation section where any drops of seawater entrained are removed and fall due to gravity to the brine sump at the bottom of the titanium plate stack. The clean fresh water vapours continue to the condenser section, where they condense into fresh water as they pass between the cold plates cooled by the sea cooling water.

Picture 2

Picture 3

Basic equipment

Titanium plate heat exchanger

Sea- and feed water pipes in CuNi and stainless steel.

The freshwater generator is equipped for hot water heating and with a combined condenser and ejector water system. Furthermore the freshwater generator is equipped with dump valve including return pipe, water clock, automatic feed water regulator, combined brine/air ejector, instruments, fresh water pump with electric motor, internal piping and frame parts.

985 21683-R00

Illustrations, indications of material, dimensions and weights etc. herein, do not constitute any commitment on our part. We reserve the right to change such specification when necessary.

9.2 Production Information
9.2.11 Freshwater Generator AQUA

Power supply - options

Main power supply:	Control voltage:
<ul style="list-style-type: none">• 3x220V 50 Hz• 3x400V 50 Hz• 3x690V 50 Hz• 3x220V 60 Hz• 3x440V 60 Hz• 3x690V 60 Hz	<ul style="list-style-type: none">• 110V• 230V

Additional equipment necessary for operation

- Ejector pump including electrical motor
- Electrical motor for fresh water pump
- Control panel with motor starter and salinometer or manual motor starters and salinometer
- Feed water treatment equipment

Optional design

- Flange on fresh water outlet
- Steam heating system type HWS
- Filling line for feed water treatment
- Adaptors for front or side connections
- Control panel build on the unit
- Manometer set for ejector pump
- By-pass on water clock

Optional equipment

- Salinometer type DS21
- Remote control box with lock
- Class test certificates
- Fresh water treatment equipment

Spare parts

- Spare parts kit for one year of operation
- Spare parts kit for two years of operation
- Spare parts kit for five years of operation
- Steel box for spare parts





985 23067 Technical data: AQUA 80, 0.5 mm plates

Power consumption

Ejector- and fresh water pump:

<u>Number of plates</u>	<u>50 Hz</u>	<u>60Hz</u>
36 – 38	5.3 kW	6.0 kW
40 – 44	5.5 kW	6.2 kW
46 – 50	5.7 kW	6.4 kW
52 – 56	5.9 kW	6.7 kW
58 – 62	6.1 kW	6.9 kW
64 – 68	6.2 kW	7.2 kW
70 – 84	6.4 kW	7.5 kW

Pressure

	<u>bar(g)</u>	<u>psi</u>
Max. hot water pressure	5.0	72.5
Max. back pressure to fresh water tank (50 Hz)	1.5	21.8
Max. back pressure to fresh water tank (60 Hz)	2.5	36.3
Max. seawater inlet pressure	4.0	58.0
Min. seawater pressure to ejector	3.0	43.5
Max. back pressure at ejector outlet	0.6	8.7
Max. back pressure for safety valve in steam equipment	1.0	14.5
Max. steam inlet pressure in steam equipment	7.0	101.5
Normal operation pressure for steam equipment (standard)	2 – 4	29 – 58
Alternative operation pressure for steam equipment	6 – 7	87.0 – 101.5
Min. back pressure to condensate well for steam equipment	0.6	8.7
Max. back pressure to condensate well for steam equipment	0.8	11.6

Materials

Evaporator/condenser plate	Titanium
Frame plate	Cast iron
Pressure plate	Cast iron
Frame parts	Aluminum & stainless steel
Stud bolts	Steel – galvanized
Pipe for brine discharge	Cast iron – hot dip galvanized
Pipe for feed water	Duplex steel
Pipe for seawater	CuNi 90/10
Pipe for freshwater	Bronze & CuNi 90/10
Combined brine/air ejector housing	Bronze
Combined brine/air ejector nozzles	Duplex steel & bronze

Illustrations, indications of material, dimensions and weights etc. herein, do not constitute any commitment on our part. We reserve the right to change such specification when necessary. 1



Steam equipment, type HWS:

Pipes	Steel – hot dip galvanized
Steam injector housing	Cast iron – painted
Steam injector nozzle	Bronze

Temperature & flow

Seawater temperature:	0 – 32 °C	Hot water temperature:	55 – 95 °C
Seawater flow:	11 – 25 m ³ /h	Hot water flow:	22 – 52 m ³ /h

Installation

The sea water supplied to the unit has to pass a filter (Yard supply) in the sea water line before the ejector pump.	Filter mesh size	2 mm
--	------------------	------

Shipping data

Freshwater generator, complete with ejector pump, electrical panel and dosing equipment

AQUA 80-HW

Weight	1270 kg
Dimensions LxBxH	2220 x 1300 x 1580 mm ³
Volume	4.6 m ³

AQUA 80-HWS

Weight	1390 kg
Dimensions	2220 x 1300 x 1810 mm ³
Volume	5.2 m ³



Pumps and motors
AQUA 80

Document no.: 985 21689 R01
Technical data

50 Hz

Pump function	36-38			40-44			46-50			52-56			58-62		
	Fresh water	Ejector		Fresh water	Ejector		Fresh water	Ejector		Fresh water	Ejector		Fresh water	Ejector	
No. of plates	36-38			40-44			46-50			52-56			58-62		
Pump type	CNL 65-65/160														
Motor size	132S														
Norm. flow	12.0			13.6			15.7			17.8			19.4		
Pressure, min.	3.8			3.8			3.8			3.8			3.8		
Impeller size	ø175														
Rotating speed	2880			2880			2880			2880			2880		
3 x 380-415 V, 50 Hz															
Rated output power	1.1			1.1			1.1			1.1			1.1		
Consumed power	0.6			0.6			0.6			0.6			0.6		
Current (full load)	2.5			2.5			2.5			2.5			2.5		
Current (start)	15.0			15.0			15.0			15.0			15.0		
3 x 660-720V, 50 Hz															
Rated output power	1.1			1.1			1.1			1.1			1.1		
Consumed power	0.6			0.6			0.6			0.6			0.6		
Current (full load)	1.5			1.5			1.5			1.5			1.5		
Current (start)	8.7			8.7			8.7			8.7			8.7		

60 Hz

Pump function	36-38			40-44			46-50			52-56			58-62		
	Fresh water	Ejector		Fresh water	Ejector		Fresh water	Ejector		Fresh water	Ejector		Fresh water	Ejector	
No. of plates	36-38			40-44			46-50			52-56			58-62		
Pump type	CNL 65-65/160														
Motor size	132S														
Norm. flow	12.0			13.6			15.7			17.8			19.4		
Pressure, min.	3.8			3.8			3.8			3.8			3.8		
Impeller size	ø152														
Rotating speed	3500			3500			3500			3500			3500		
3 x 440-480V, 60 Hz															
Rated output power	1.3			1.3			1.3			1.3			1.3		
Consumed power	1.1			1.1			1.1			1.1			1.1		
Current (full load)	2.6			2.6			2.6			2.6			2.6		
Current (start)	15.5			15.5			15.5			15.5			15.5		
3 x 660-720V, 60 Hz															
Rated output power	1.3			1.3			1.3			1.3			1.3		
Consumed power	1.1			1.1			1.1			1.1			1.1		
Current (full load)	1.7			1.7			1.7			1.7			1.7		
Current (start)	10.2			10.2			10.2			10.2			10.2		

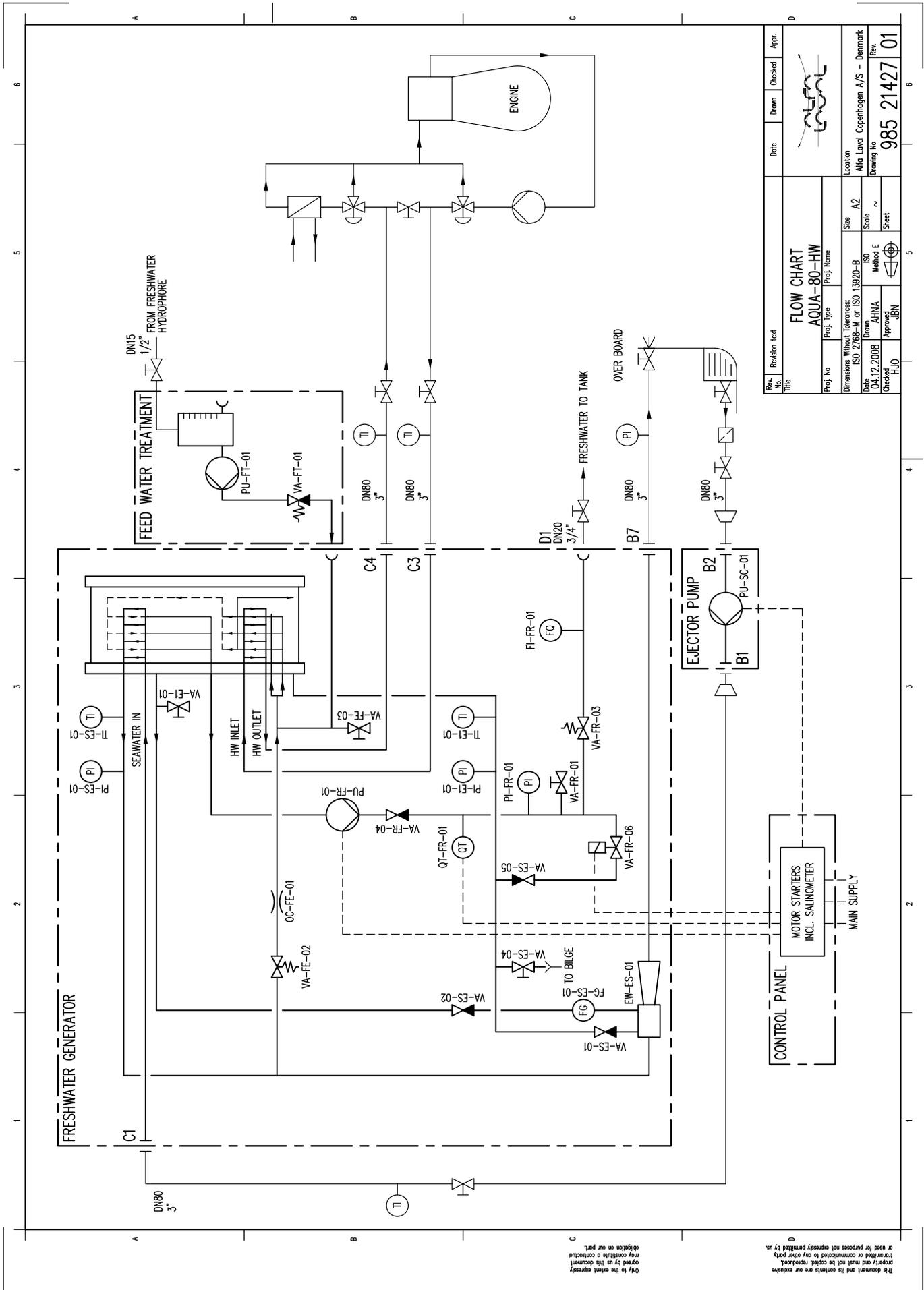


50 Hz

Pump function	64-68			70-76			78-84		
	Fresh water	Ejector	Ejector	Fresh water	Ejector	Ejector	Fresh water	Ejector	Ejector
3 x 380-415 V, 50 Hz									
Pump type	PVVF-1532	CNL 65-65/160	CNL 65-65/160	PVVF-1532	CNL 65-65/160	CNL 65-65/160	PVVF-1532	CNL 65-65/160	CNL 65-65/160
Motor size	80B	132M	132M	80B	132M	132M	80B	132M	132M
Nom. flow	1.0	21.5	21.5	1.0	24.2	24.2	1.0	26.8	26.8
Pressure, min.	2.6	3.8	3.8	2.6	3.8	3.8	2.6	3.8	3.8
Impeller size	ø142	ø175	ø175	ø142	ø175	ø175	ø142	ø175	ø175
Rotating speed	2730	2880	2880	2730	2880	2880	2730	2880	2880
3 x 660-720V, 50 Hz									
Rated output power	1.1	9.5	9.5	1.1	9.5	9.5	1.1	9.5	9.5
Consumed power	0.6	5.5	5.5	0.6	5.8	5.8	0.6	5.8	5.8
Current (full load)	2.5	17.3	17.3	2.5	17.3	17.3	2.5	17.3	17.3
Current (start)	15.0	129.9	129.9	15.0	129.9	129.9	15.0	129.9	129.9
3 x 660-720V, 50 Hz									
Rated output power	1.1	9.5	9.5	1.1	9.5	9.5	1.1	9.5	9.5
Consumed power	0.6	5.5	5.5	0.6	5.8	5.8	0.6	5.8	5.8
Current (full load)	1.5	10.0	10.0	1.5	10.0	10.0	1.5	10.0	10.0
Current (start)	8.7	75.3	75.3	8.7	75.3	75.3	8.7	75.3	75.3

60 Hz

Pump function	64-68			70-76			78-84		
	Fresh water	Ejector	Ejector	Fresh water	Ejector	Ejector	Fresh water	Ejector	Ejector
3 x 440-480V, 60 Hz									
Pump type	PVVF-1532	CNL 65-65/160	CNL 65-65/160	PVVF-1532	CNL 65-65/160	CNL 65-65/160	PVVF-1532	CNL 65-65/160	CNL 65-65/160
Motor size	80B	132S	132S	80B	132S	132S	80B	132M	132M
Nom. flow	1.0	21.5	21.5	1.0	24.2	24.2	1.0	26.8	26.8
Pressure, min.	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Impeller size	ø142	ø152	ø152	ø142	ø152	ø152	ø142	ø152	ø152
Rotating speed	3324	3500	3500	3324	3500	3500	3324	3500	3500
3 x 440-480V, 60 Hz									
Rated output power	1.3	6.6	6.6	1.3	6.6	6.6	1.3	11	11
Consumed power	1.1	6.0	6.0	1.1	6.4	6.4	1.1	6.4	6.4
Current (full load)	2.6	11.0	11.0	2.6	11.0	11.0	2.6	17.4	17.4
Current (start)	15.5	76.8	76.8	15.5	76.8	76.8	15.5	130.7	130.7
3 x 660-720V, 60 Hz									
Rated output power	1.3	6.6	6.6	1.3	6.6	6.6	1.3	11	11
Consumed power	1.1	6.0	6.0	1.1	6.4	6.4	1.1	6.4	6.4
Current (full load)	1.7	7.3	7.3	1.7	7.3	7.3	1.7	11.6	11.6
Current (start)	10.2	51.1	51.1	10.2	51.1	51.1	10.2	87.0	87.0



Rev. No.	Revision text	Date	Drawn	Checked	Appr.
01					

FLOW CHART		Location	
AQUA-80-HW		Alfa Laval Copenhagen A/S - Denmark	
Proj. No.	Proj. Type	Size	A2
Dimensions Without Tolerances	ISO 2768-M or ISO 13920-B	Scale	~
Doc. No.	Draw. Method E	Sheet	~
04-12-2008	ISO 15926-2	985 21427	01
Sheet No.	Approved	Drawing No.	
1/10	JBN	985 21427	
		Rev.	
		01	

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985 21693 Equipment specification AQUA 80

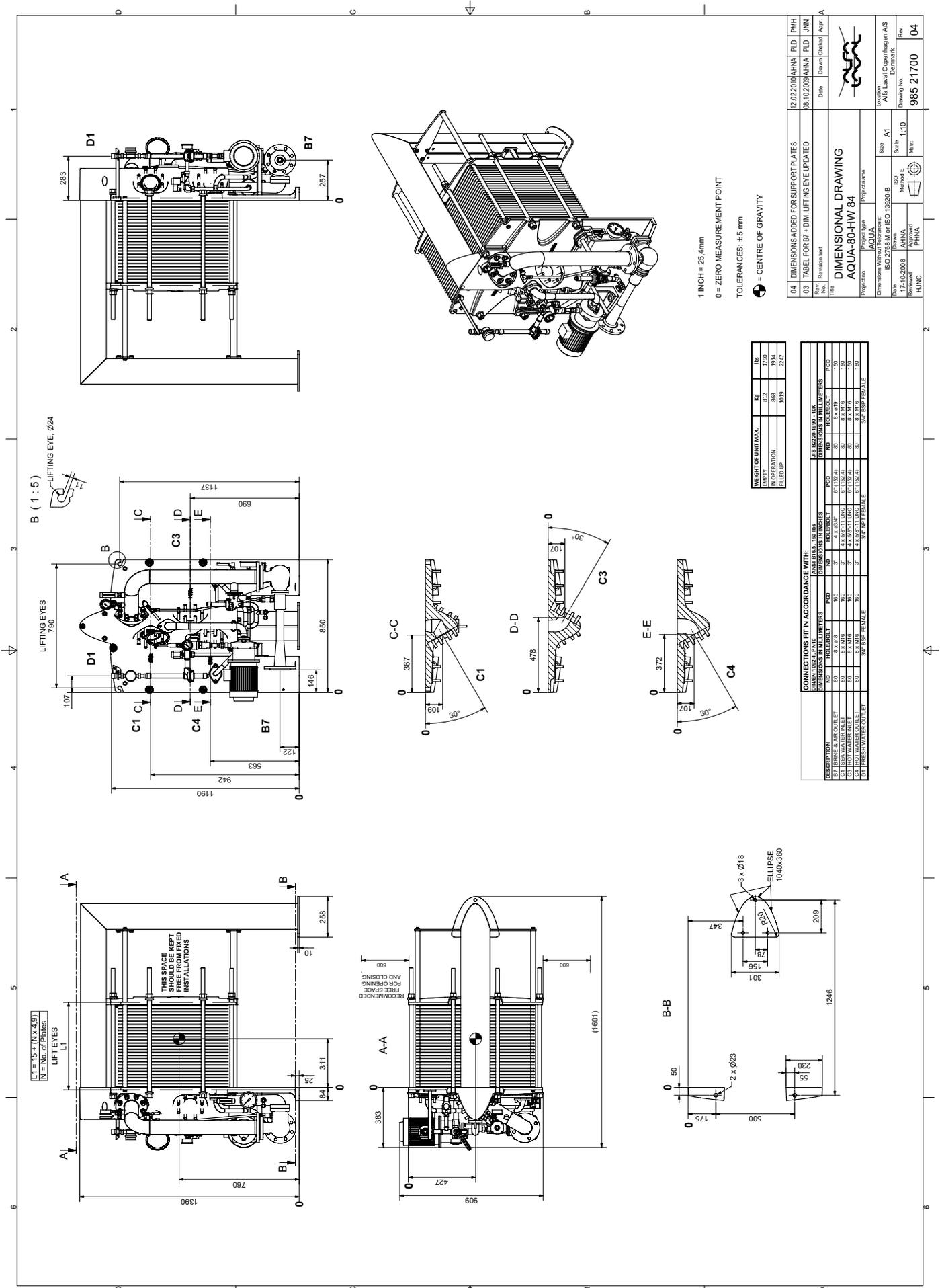
Tag no.	Description	Article no.	Connection
EW-ES-01	Ejector	See spec.	-
FG-ES-01	Flow sight glass	984 35686-00	1/2" BSP
FI-FR-01	Watermeter	985 42600-09	1/2" BSP
OC-FE-01	Orifice	See spec.	-
PI-E1-01	Mano / vacuum gauge	985 62601-00	3/8" BSP
PI-ES-01	Pressure gauge	985 62500-02	1/4" BSP
PI-FR-01	Pressure gauge (50 Hz)	985 62501-01	1/4" BSP
PI-FR-01	Pressure gauge (60 Hz)	985 62501-02	1/4" BSP
PU-FR-01	Freshwater pump	985 21510-01	-
MO-FR-01	Motor for freshwater pump	See spec.	-
PU-SC-01	Ejector pump	See spec.	-
MO-SC-01	Motor for ejector pump	See spec.	-
QT-FR-01	Electrode sensor	985 21475-01	1/2" BSP
TI-E1-01	Thermometer w. pocket	985 20578-05	1/2" BSP
TI-ES-01	Thermometer w. pocket	985 20577-05	1/2" BSP
VA-E1-01	Air screw	984 40939-03	1/4" BSP
VA-ES-01	Non return valve	See spec.	-
VA-ES-02	Non return valve	984 35686-00	1/2" BSP
VA-ES-04	Ball valve	984 35649-00	1/2" BSP
VA-ES-05	Non return valve	984 35671-00	1/2" BSP
VA-FE-02	Spring loaded valve	See spec.	-
VA-FE-03	Ball valve	984 35649-00	1/2" BSP
VA-FR-01	Ball valve	984 35649-00	1/2" BSP
VA-FR-03	Spring loaded valve	985 21472-01	3/4"
VA-FR-04	Non return valve	984 35671-00	1/2" BSP
VA-FR-06	Solenoid valve	See spec.	1/2" BSP
VA-FR-13	Ball valve (*)	984 35649-00	1/2" BSP
VA-FR-14	Ball valve (*)	984 35649-00	1/2" BSP
VA-FR-15	Ball valve (*)	984 35649-00	1/2" BSP

(*) optional equipment: water clock by-pass

Steam arrangement

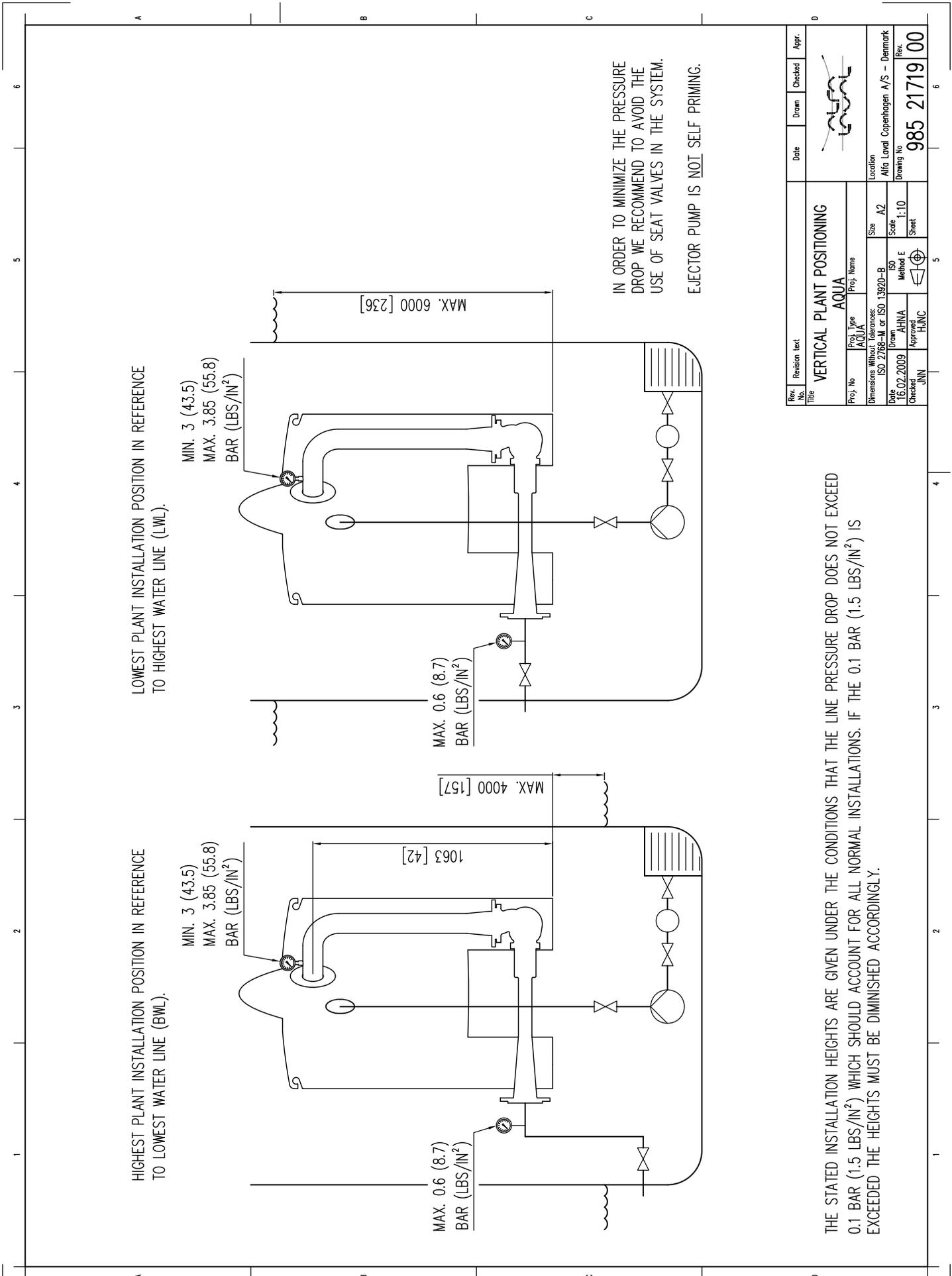
IS-SS-01	Steam injector	See spec.	-
PI-SS-01	Mano / vacuum gauge	985 62600-01	3/8" BSP
TI-SS-01	Thermometer w. pocket	985 20577-05	1/2" BSP
TI-SS-02	Thermometer w. pocket	985 20577-05	1/2" BSP
VA-SS-01	Butterfly valve	985 21325-23	DN 80
VA-SS-02	Safety valve	See spec.	-
VA-SS-03	Ball valve	984 35649-00	1/2" BSP
VA-SS-04	Seated valve	985 56110-04	3/4" BSP
VA-SS-05	Butterfly valve	985 21325-23	DN 80
VA-SS-06	Ball valve	984 35649-00	1/2" BSP





04 DIMENSIONS ADDED FOR SUPPORT PLATES		12/02/2010	JMM	PLD	PMH
Rev.	Revision text	Date	Drawn	Checked	Appr.
03	TABEL FOR B7 - DIM. LIFTING EYE UPDATED	08/10/2009	JMM	PLD	JMM
DIMENSIONAL DRAWING					
AQUA-80-HW 84					
Project no.	Project type	Project name	Scale	Sheet	Rev.
AQUA			1:10	A1	04
Dimension system	Drawn	ISO 2768-M or ISO 13020-B	Method	AS	
177-10-2008	AHMA			Danmark	
177-10-2008	PHNA			985 21700	
177-10-2008	PHNA			04	





LOWEST PLANT INSTALLATION POSITION IN REFERENCE TO HIGHEST WATER LINE (LWL).

MIN. 3 (43.5)
MAX. 3.85 (55.8)
BAR (LBS/IN²)

MAX. 0.6 (8.7)
BAR (LBS/IN²)

MAX. 6000 [236]

HIGHEST PLANT INSTALLATION POSITION IN REFERENCE TO LOWEST WATER LINE (BWL).

MIN. 3 (43.5)
MAX. 3.85 (55.8)
BAR (LBS/IN²)

MAX. 0.6 (8.7)
BAR (LBS/IN²)

1063 [42]

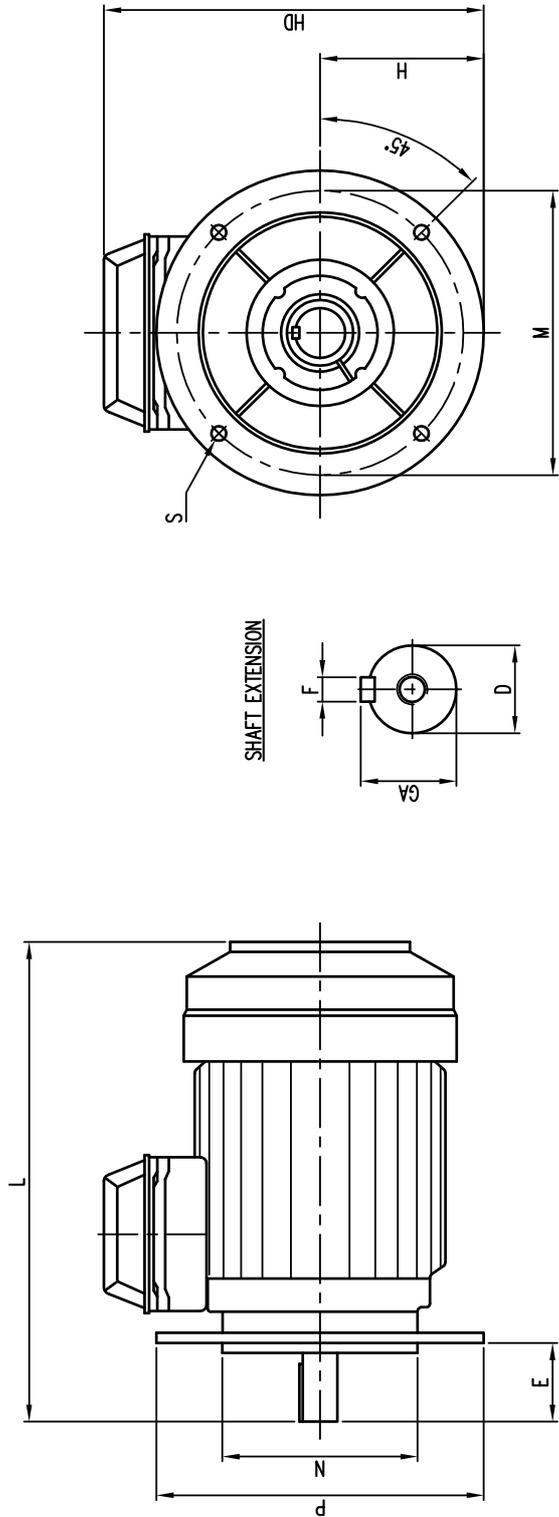
MAX. 4000 [157]

IN ORDER TO MINIMIZE THE PRESSURE DROP WE RECOMMEND TO AVOID THE USE OF SEAT VALVES IN THE SYSTEM.
EJECTOR PUMP IS NOT SELF PRIMING.

Rev. No.	Revision text	Date	Drawn	Checked	Appr.
VERTICAL PLANT POSITIONING					
Title		AQUA			
Proj. No.	Proj. Name	Location	Size	Rev.	
AQUA	AQUA	Alfa Laval Copenhagen A/S - Denmark	A2	985 21719 00	
Dimensions Without Tolerances:		ISO 2768-M or ISO 13920-B	Scale	Sheet	
Date	Drawn	ISO Method E	1:10	985 21719 00	
16.02.2009	AHNA	Approved			
Checked	JUN	Approved	HUNC		

THE STATED INSTALLATION HEIGHTS ARE GIVEN UNDER THE CONDITIONS THAT THE LINE PRESSURE DROP DOES NOT EXCEED 0.1 BAR (1.5 LBS/IN²) WHICH SHOULD ACCOUNT FOR ALL NORMAL INSTALLATIONS. IF THE 0.1 BAR (1.5 LBS/IN²) IS EXCEEDED THE HEIGHTS MUST BE DIMINISHED ACCORDINGLY.





SHAFT EXTENSION

FLANGE-MOUNTED MOTOR B5

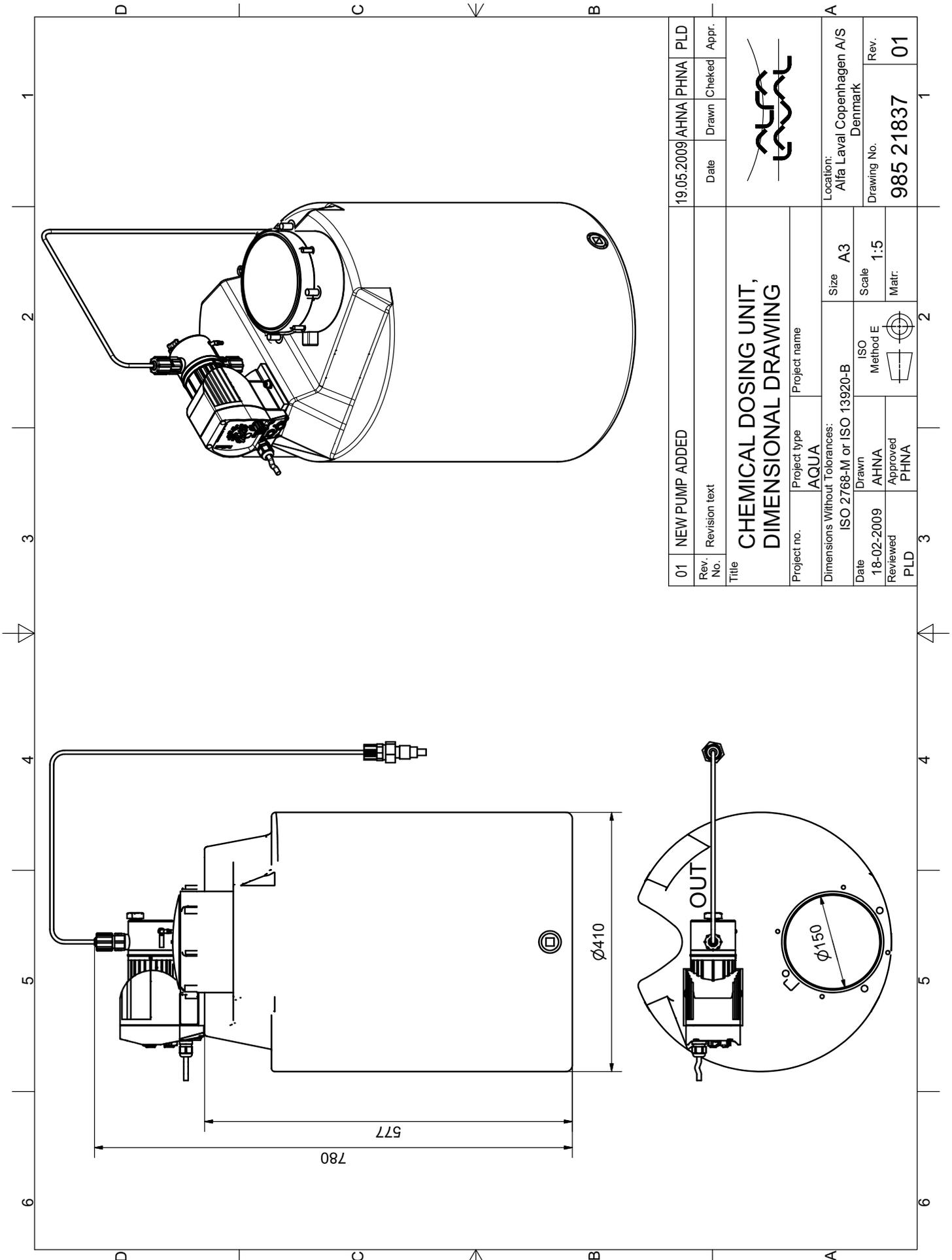
D	GA	F	E	L	M	N	P	S	HD	H
19	21.5	6	40	295	165	130	200	12	225	100

MANUFAC.	TYPE/POLE	OUTPUT (kW)	VOLTAGE (V)	FREQUENCY (Hz)	SPEED (RPM)	WEIGHT (kg)	NORMAL CURRENT (A)	START CURRENT (A)	LUBRICATION	PROTECTION	COOLING	INSULATION CLASS	BEARING D-END	BEARING N-END	CABLE GLANDS
SENCY	80B/2	1.3	440-480	60	3324	10.2	2.6	15.5	FOR LIFE	IP 55	IEC 600 34-6	F	6204 ZZ C3 984 20653-00	6204 ZZ C3 984 20653-00	7-12 mm

Rev. No.	Revision text	Date	Drawn	Checked	Appr.
OUTLINE DRAWING FOR MOTOR 80B					
Proj. No	Proj. Type	Proj. Name		Size	A3
Dimensions Without Tolerances:			ISO 2768-M or ISO 13920-B		
Date	Drawn	ISO Method E	Scale	~	
04.07.2007	DKN	Method E	Sheet	~	
Checked	Approved	Location			
PLD	PLD	Alfa Laval Copenhagen A/S - Denmark			
Drawing No			Rev.		
985 21028			00		

THREE PHASE INDUCTION MOTOR FOR MARINE ENVIRONMENT
TOTALLY ENCLOSED FAN COOLED SPLASH PROOF





01	NEW PUMP ADDED	19.05.2009	AHNA	PHNA	PLD
Rev. No.	Revision text	Date	Drawn	Checked	Appr.
<p>CHEMICAL DOSING UNIT, DIMENSIONAL DRAWING</p>					
Project no.	Project type	Project name			
	AQUA				
Dimensions Without Tolerances:					
Date	Drawn	ISO 2768-M or ISO 13920-B	Size	A3	
18-02-2009	AHNA	ISO Method E	Scale	1:5	
Reviewed	Approved		Matr.		
PLD	PHNA				
Location:			Alfa Laval Copenhagen A/S		
Drawing No.			985 21837		
Rev.			01		





General

Control panel option A for the AQUA freshwater generator includes start/stop of pumps and salinity supervision. The panel is internally connected, and needs only to be connected to main power and to the electrical components on the freshwater generator.

Standard design

Standard design consists of a box with the following build in components:

- Main switch, which locks panel if power is on
- Push button for freshwater, ejector and ejector pump
 - Start (green)
 - Stop (red)
- Signal lamp for freshwater and ejector pump running (green)
- Signal lamp for source on (white)
- Thermal relay and contractor for:
 - Freshwater pump
 - Ejector pump
- Operating transformer
- Salinometer
- Ammeter for ejector pump
- Running hour meter for ejector pump
- Mini circuit breaker to protect freshwater pump
- Nameplate (inside panel)
- Painting: RAL 7035

Electrical design

Supply voltage:

3x400V 50Hz
3x690V 50Hz
3x230V 60Hz
3x440V 60Hz
3x690V 60Hz

Control voltage:

110 V or 230 V

Permissible tolerances:

Voltage: +10/-15%
Frequency: $\pm 2\%$

Internal wire:

Type flame retardant
Class 70°C

Illustrations, indications of material, dimensions and weights etc. herein, do not constitute any commitment on our part. We reserve the right to change such specification when necessary.

External connections:

Remote alarm, thermal overload freshwater pump – NC
Remote alarm, thermal overload freshwater pump – NO
Remote alarm, thermal overload ejector pump – NC
Remote alarm, thermal overload ejector pump – NO
Remote start/stop freshwater pump
Remote start/stop ejector pump
Contact set, freshwater pump running - NC
Contact set, freshwater pump running – NO
Contact set, ejector pump running – NC
Contact set, ejector pump running – NO

External connections (salinometer):

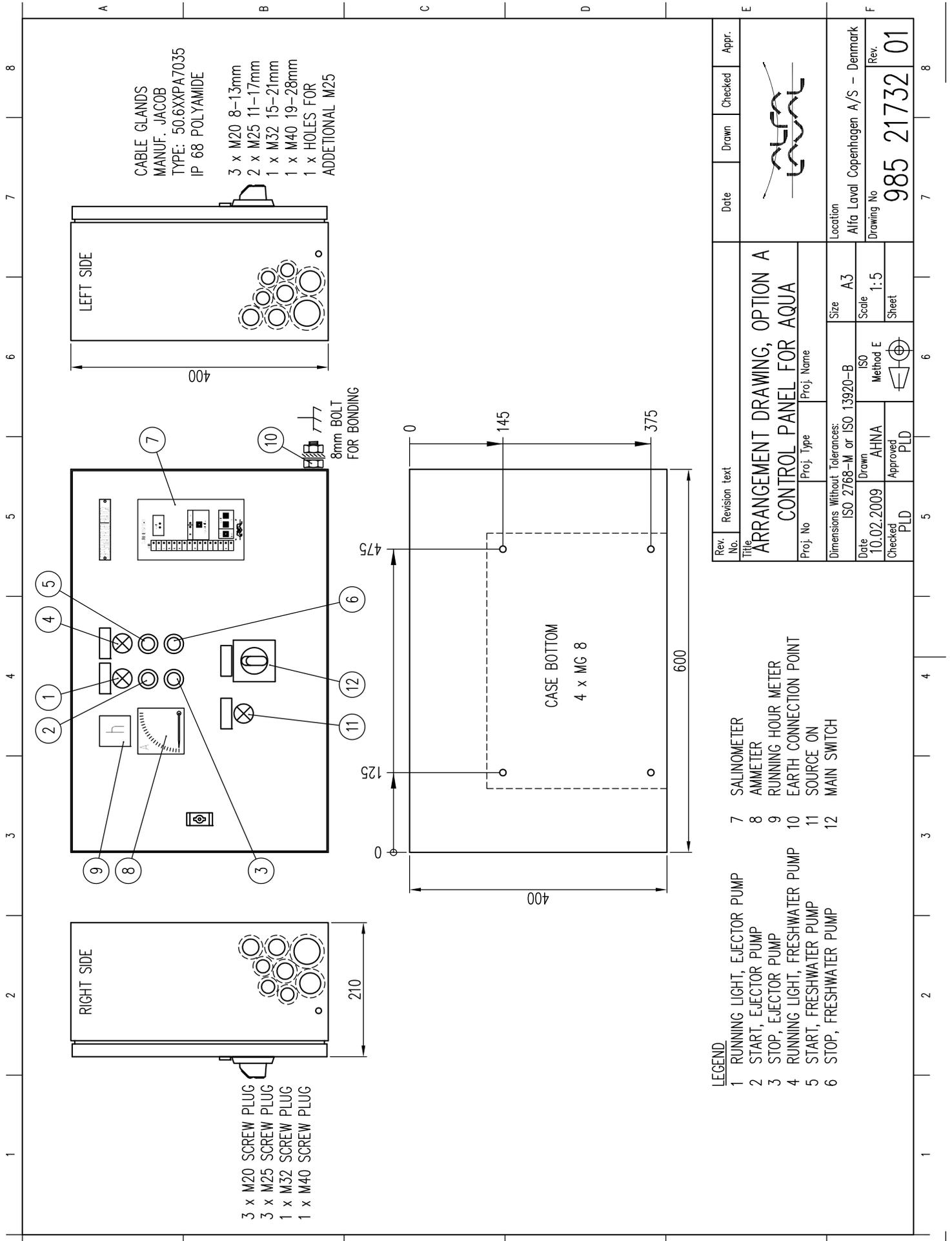
External meter
Electrode unit
External alarm contact – NC
External alarm contact – NO
Solenoid valve – NC
Solenoid valve – NO

Physical design

Dimensions:	600 x 400 x 210 mm
Weight:	App. 27 kg
Max. ambient temperature:	50 °C
Min. protection degree:	IP54

Optional design

Remote control box with lock

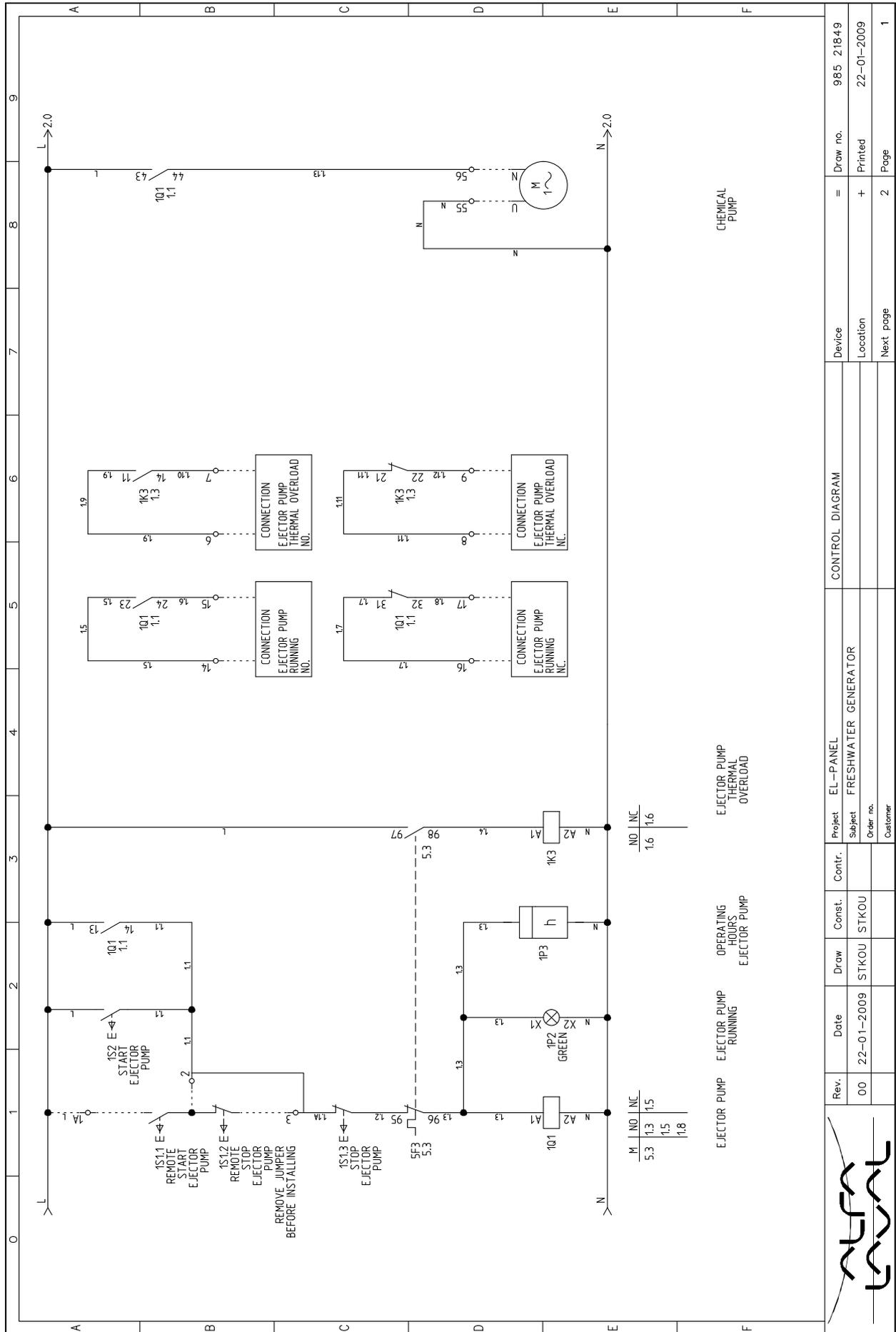


Rev. No.	Revision text	Date	Drawn	Checked	Appr.
	ARRANGEMENT DRAWING, OPTION A CONTROL PANEL FOR AQUA				
	Proj. No	Proj. Type	Proj. Name		
	Dimensions Without Tolerances: ISO 2768-M or ISO 13920-B	Size	A3		
	Date 10.02.2009	Drawn AHNA	ISO Method E	Scale 1:5	
	Checked PLD	Approved PLD	Method E	Sheet	
		Location	Alfa Loyal Copenhagen A/S - Denmark		
		Drawing No	985 21732		
		Rev.	01		

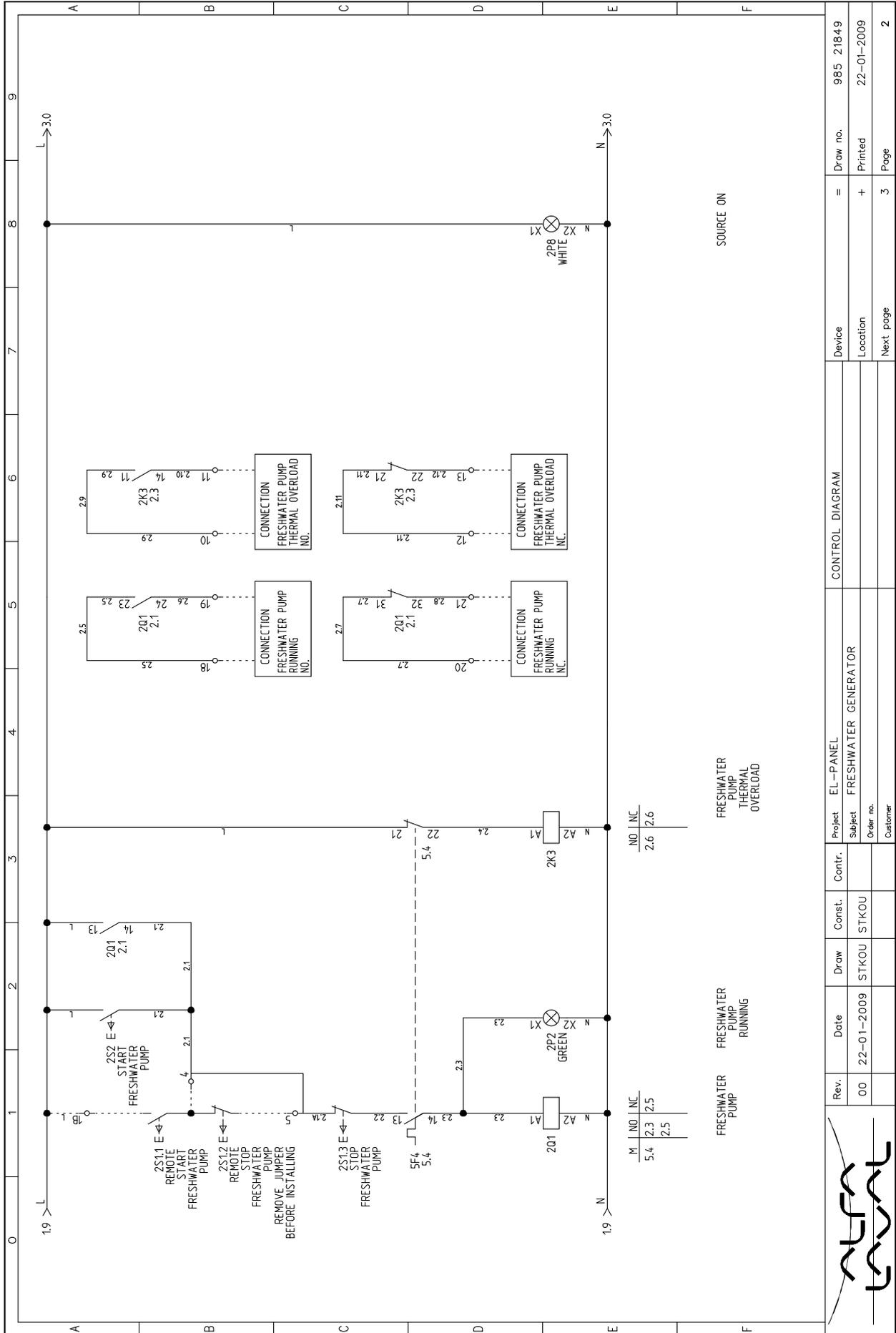
Rev. No.	Revision text	Date	Drawn	Checked	Appr.
	ARRANGEMENT DRAWING, OPTION A CONTROL PANEL FOR AQUA				
	Proj. No	Proj. Type	Proj. Name		
	Dimensions Without Tolerances: ISO 2768-M or ISO 13920-B	Size	A3		
	Date 10.02.2009	Drawn AHNA	ISO Method E	Scale 1:5	
	Checked PLD	Approved PLD	Method E	Sheet	
		Location	Alfa Loyal Copenhagen A/S - Denmark		
		Drawing No	985 21732		
		Rev.	01		

- LEGEND**
- 1 RUNNING LIGHT, EJECTOR PUMP
 - 2 START, EJECTOR PUMP
 - 3 STOP, EJECTOR PUMP
 - 4 RUNNING LIGHT, FRESHWATER PUMP
 - 5 START, FRESHWATER PUMP
 - 6 STOP, FRESHWATER PUMP
 - 7 SALINOMETER
 - 8 AMMETER
 - 9 RUNNING HOUR METER
 - 10 EARTH CONNECTION POINT
 - 11 SOURCE ON
 - 12 MAIN SWITCH

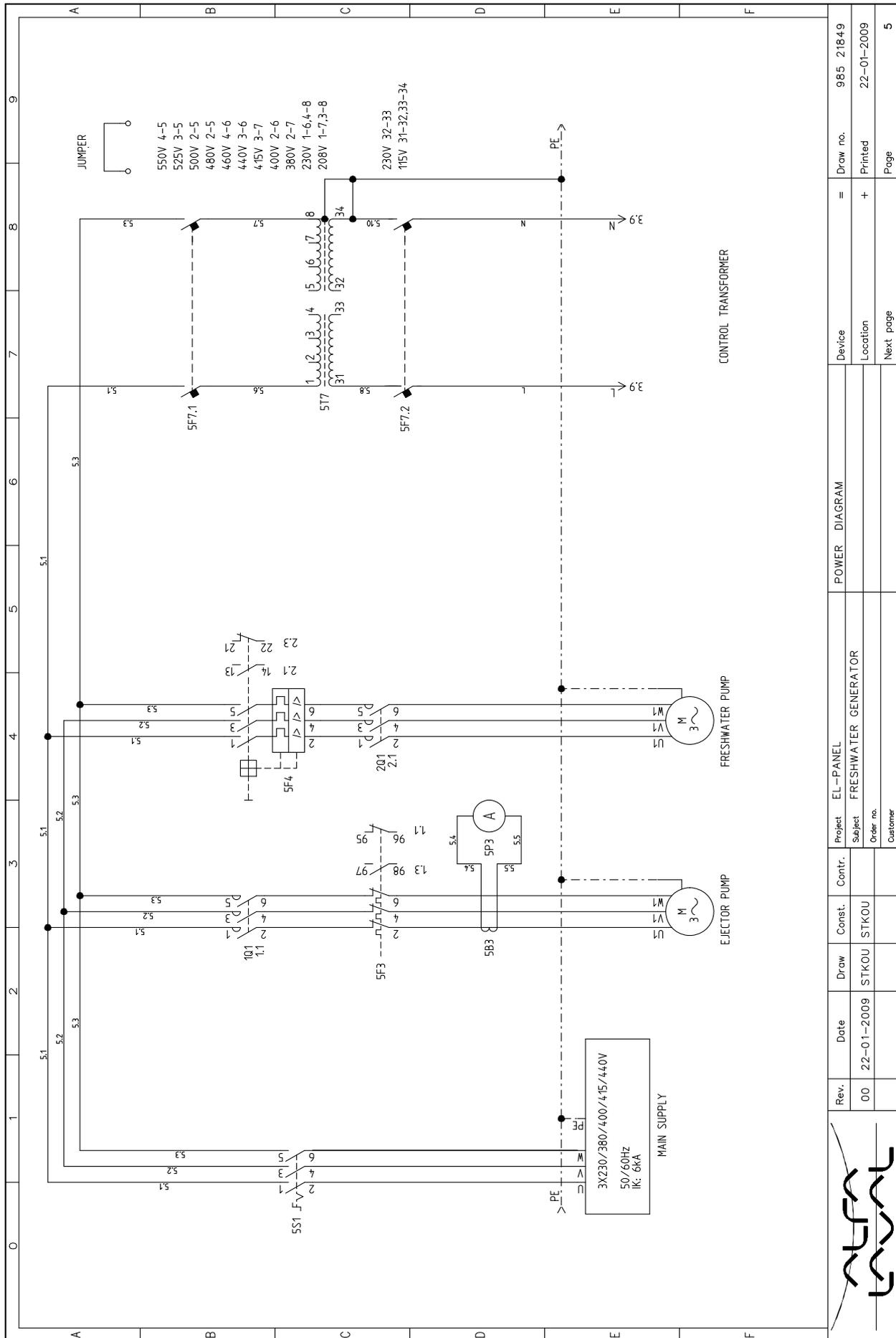


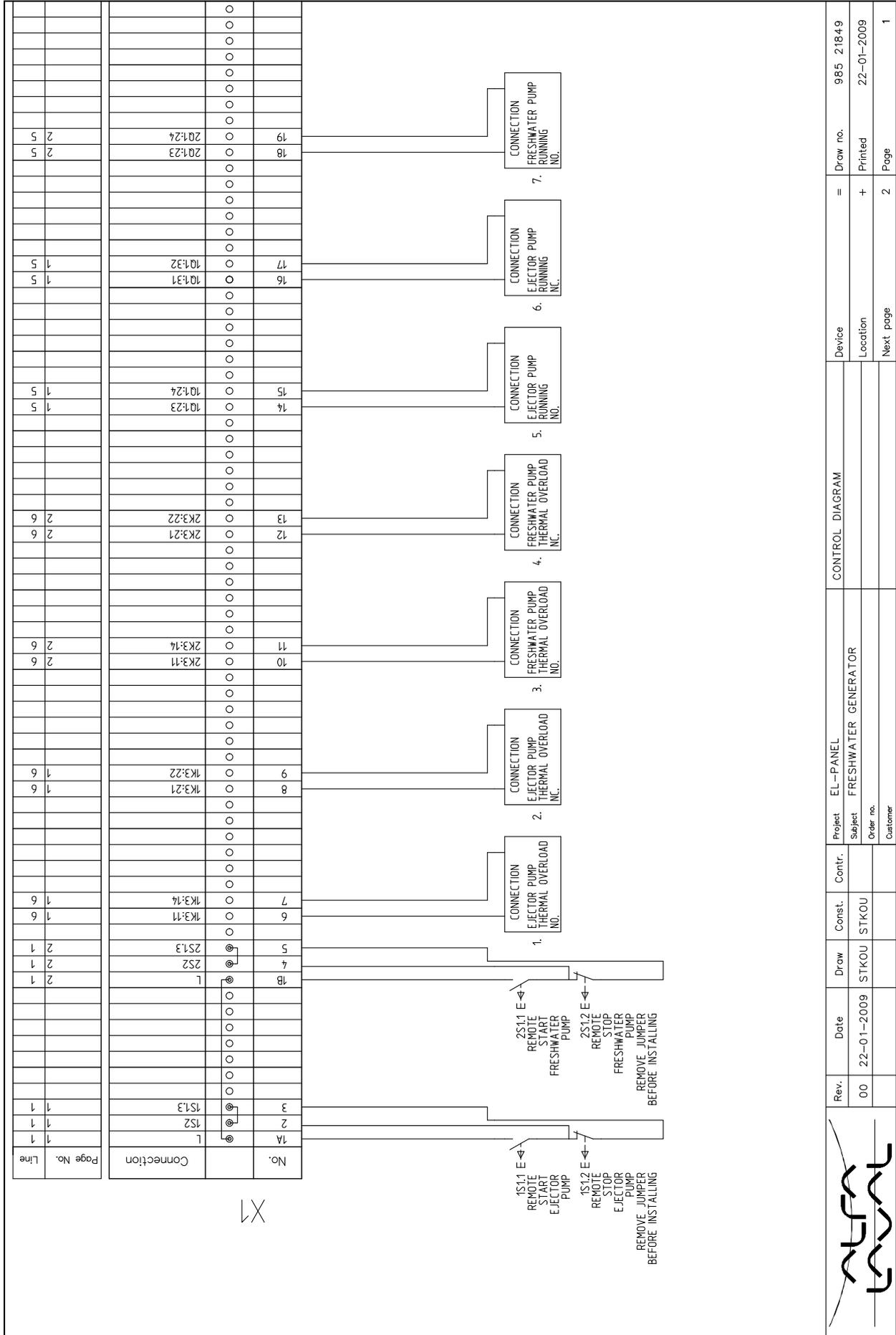


Rev.	00	Date	22-01-2009	Draw	STKOU	Const.	STKOU	Contr.		Project	EL-PANEL	CONTROL DIAGRAM			Device	=	Draw no.	985 21849
										Subject	FRESHWATER GENERATOR				Location	+	Printed	22-01-2009
										Order no.					Next page	2	Page	1
										Customer								

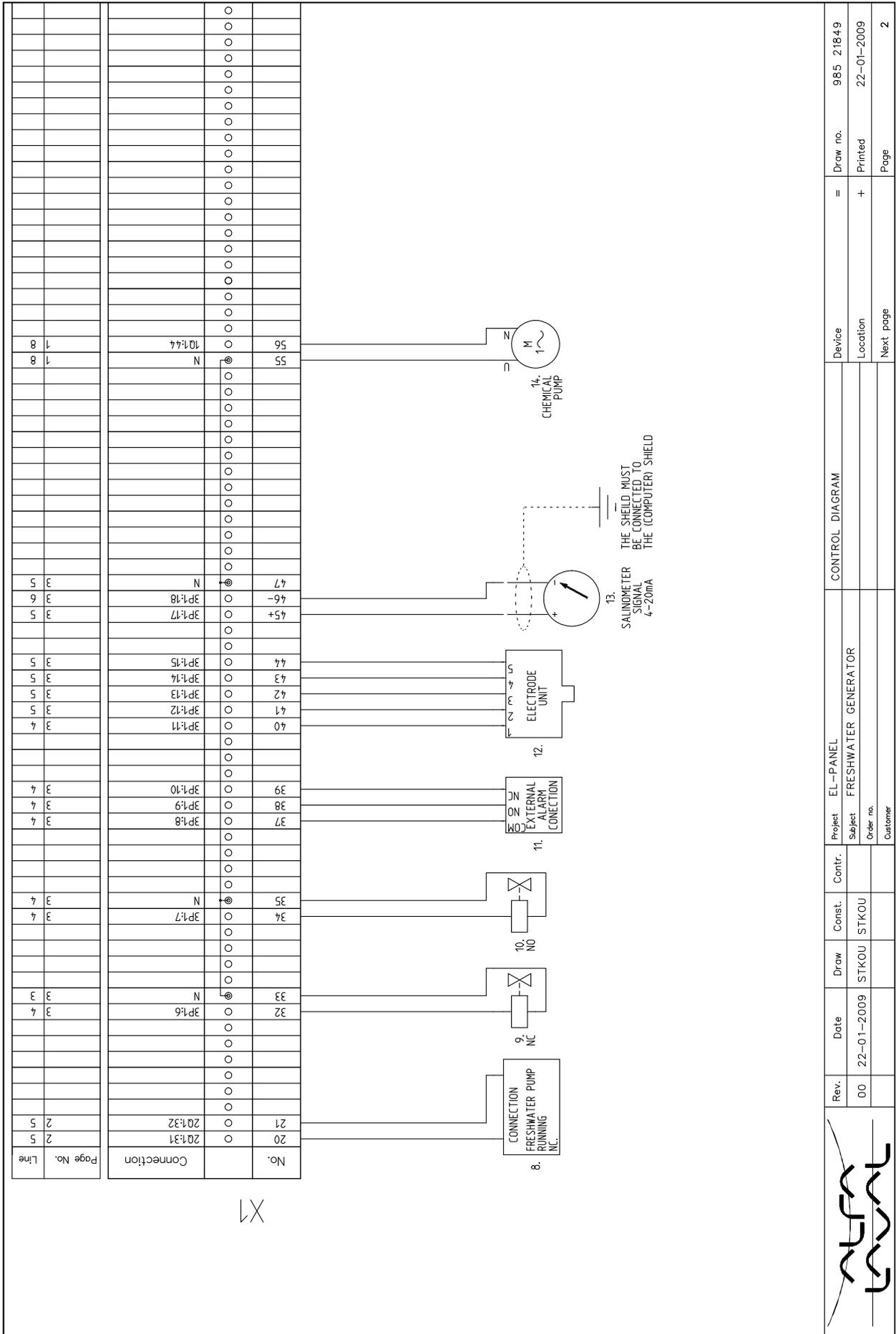


Rev.	00	Date	22-01-2009	Draw	STKOU	Const.	STKOU	Contr.		Project	EL-PANEL	CONTROL DIAGRAM			Device	985 21849	
										Subject	FRESHWATER GENERATOR			Location	22-01-2009		
										Order no.				Next page	3	Page	2
										Customer							

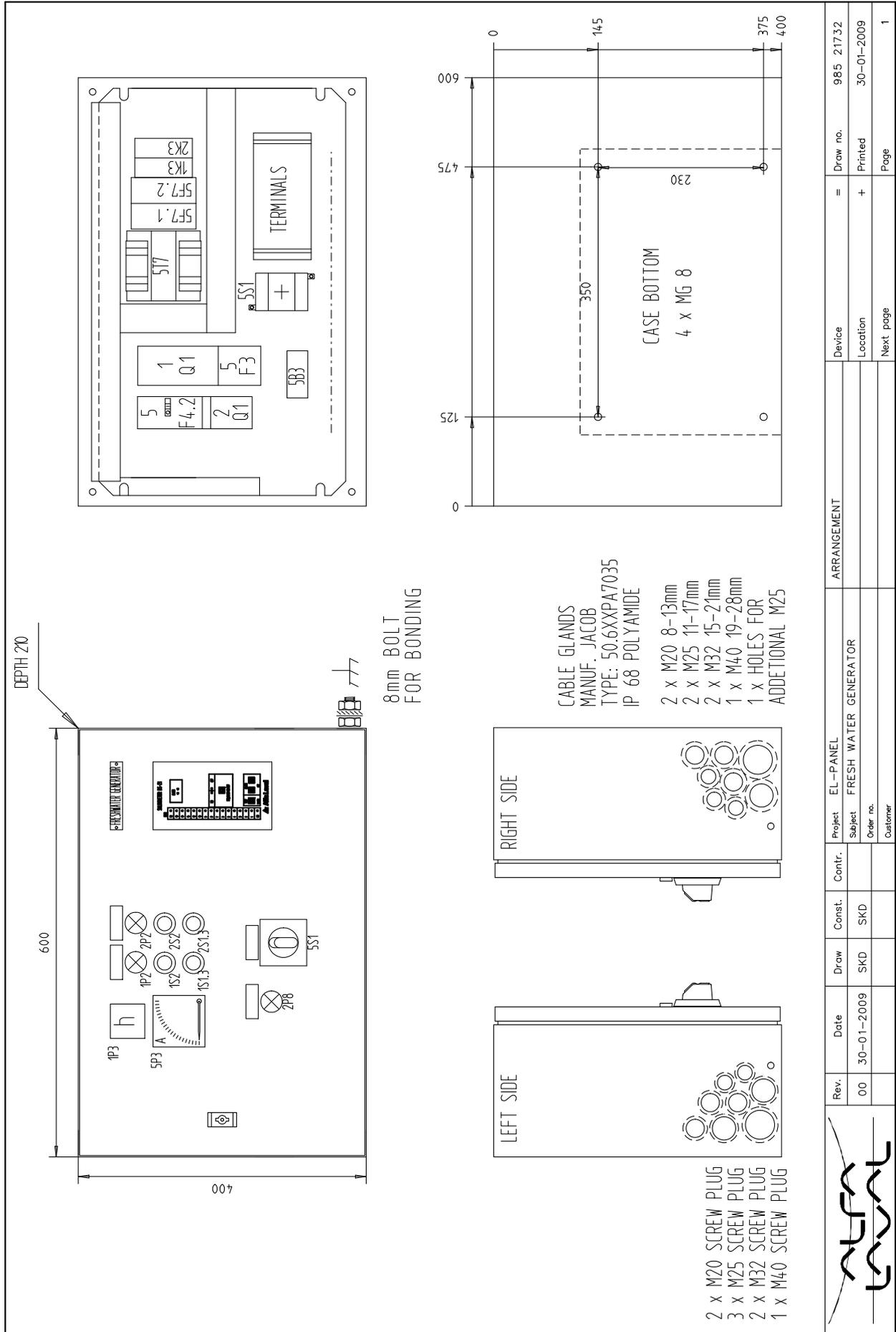




Rev.	Date	Draw	Const.	Contr.	Project	Device	Draw no.
00	22-01-2009	STKOU	STKOU		FRESHWATER GENERATOR	CONTROL DIAGRAM	985 21849
					Subject	Location	Printed
					Order no.		22-01-2009
					Customer	Next page	Page
							2
							1



Rev.	Date	Draw	Const.	Contr.	Project	EL-PANEL	CONTROL DIAGRAM	Device	Draw no.	985 21849
00	22-01-2009	STKOU	STKOU		FRESHWATER GENERATOR			Location	Printed	22-01-2009
					Order no.			Next page	Page	2







Instruction Manual

Instructions manual for CNL pumps size 160 and 200
Alfa Laval Freshwater Generators

Instructions for *installation*,
operation, *maintenance* and *repair* of
CNL pumps size 160 and 200.

Alfa Laval Copenhagen A/S



Alfa Laval reserves the right to make changes at any time without prior notice.
Any comments regarding possible errors and omissions or suggestions for improvement of this publication would be gratefully appreciated.

Copies of this publication can be ordered from your local Alfa Laval Company.

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Denmark

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1 General

Should you need further clarification regarding this manual, do not hesitate to contact your local Alfa Laval representative - or call Alfa Laval Copenhagen A/S directly.

Telephone +45 (for Denmark) 39 53 60 00

Telefax +45 (for Denmark) 39 53 65 66

1.1 Introduction

This instruction manual contains relevant information on installing, operating and maintaining the pump.

The pump is configured for the specific customer requirements. The specific pump type is described in the enclosed documentation

The personnel in charge of installing, operating and maintaining the pump must be properly qualified and trained to carry out the operations described in this manual. Alfa Laval recommends that you read this manual before you install and operate the pump as this will minimize any risk of incorrect handling. Alfa Laval cannot be held responsible for unauthorized use of the pump.

Alfa Laval does not provide any guarantee if working conditions are inappropriate. If the working conditions differ from those given in the technical data sheet, please contact Alfa Laval before putting the pump into operation.

1.2 Identification

Details of the pump identification (type, article number ect.) can be found in the technical data sheet. The Pump no. can also be found on the name plate on the pump.

1.3 Directions & warning signs

Comply with all instructions located on the pump or motor, such as direction of rotation, arrows, instruction signs, directions or warning signs and remember to keep this information in readable condition.

1.4 Warning symbols

Important machine and safety-related instructions in this manual are illustrated with symbols. It is essential that these instructions are followed to avoid accidents and damages to machines and/or personnel.

STOP!

This symbol is for all safety instructions which must be followed to avoid accidental injuries and hazards to life. Observe these safety instructions carefully and proceed with great care.

ELECTRIC POWER!

This symbol signals possible danger due to presence of electric power. Only proceed if the operator is experienced with the pump and procedures.

CAUTION!

This symbol is used for instructions of particular importance and signals a risk of damage to the pump or its components. Proceed only if the parts or the pump have been assembled according to instructions.

1.5 General safety

The following safety instructions apply for both pumps and motors supplied by Alfa Laval.



Please observe:

- The safety regulations
- Accident prevention regulations
- Country specific safety regulations
- Guide lines and acknowledged technical rules cited in this operating manual.

Non-compliance with safety regulations will result in danger to personnel and damage to the unit, e.g:

- Danger to personnel through contact with voltages exceeding 42V.
- Failure to observe prescribed methods of transportation, assembly, maintenance and repair of pump or motor.

CAUTION!

When working on the unit, please observe all valid accident prevention regulations and generally acknowledged technical rules!

1.5.1 Electrical hazards

ELECTRIC POWER!

Do not carry out any installation or maintenance on the pump or motor while it is operating or before it has been disconnected. Pumps with motors must have appropriate connections. Amp ratings are given in the technical data sheet and the power supply must be adequate.

1.5.2 Temperature hazards

STOP!

Before any maintenance is carried out, be sure to empty the pump of liquid. If the pump has been pumping hot liquid, the pump should be cooled to the surrounding temperature.

As a precaution, the hot parts of the machine should always be covered to avoid accidental contact.

1.5.3 Chemical hazards

CAUTION!

The pump should always be cleaned before carrying out any maintenance or repairs. This will prevent chemical reactions if the pump has been pumping dangerous liquids.

1.5.4 Dry running

CAUTION!

If the pump is not supplied with a priming device, the pump must never be put into operation before it has been filled with liquid. If the pump is supplied with a priming device, dry running is permissible for a short period while the pump is primed.

1.5.5 Noise level

STOP!

Under normal conditions the pump and the motor will produce a noise level below 80 dB. The exact noise level depends on motor type, foundation and environment.

The operator must wear protective gear if the noise level becomes harmful.

2 Installation

2.1 Condition on delivery

The Pump is tested before delivery to ensure perfect running condition. A test run is made of the pump using water to check the performance data stated in the technical specifications.

2.2 Inspection on delivery

Check your shipment immediately upon arrival. Make sure that the parts and accessories received are in accordance with your order. In the event of damage, defects or deficiency, immediately report the problem to the Transport Company and Alfa Laval.

The packaging must be examined to make sure that it is in good condition to guarantee protection in storage.

The packaging may only be opened when:

- It is seriously damaged.
- The product is to be stored longer than originally planned.

In all other cases the packaging may only be opened at assembly. When the packaging has been removed, the product must be examined for any deficiencies or defects.

2.3 Storage instructions

CAUTION!

The standard packaging protects the pump against corrosion during transport and storage in dry conditions for at least 3 months. If the pump is not installed immediately after receipt, it must be protected against corrosion and frost and kept in a dry place.



2.3.1 Preservation procedure

1. Drain the pump through the bottom drain.
2. Flush the pump with hot fresh water (maximum 60 0C, 140 0F). Flushing can be done through the manometer connections.
3. Let the pump dry out.
4. Flush the pump with 'Mobil Arama 25' or similar quality.
5. Mount drain plug and manometer connections.
6. Turn the pump shaft once a week to avoid damaging the mechanical shaft seal.

2.3.2 Restarting of Pumps

1. Fill the pump with hot fresh water through the manometer connections.
2. Mount the manometer connections.
3. Turn the pump shaft by hand to check for any obstructions.
4. Open valves and check that the mechanical shaft seal is not leaking (if leaking starts the pump and let it run for 1 to 2 minutes, if still leaking the mechanical seal must be replaced).
5. Start the pump and watch the operation of the pump and electric motor for approx. 10 minutes.

2.3.3 Preservation Procedure for Electric Motors

- Factory fitted bearings use a lithium based grease with a recommended shelf life of two years. If stored for a longer period, grease may need to be replaced.
- Shielded bearings have a storage life of five years and a further two years operational life following the installation.
- To avoid static indentation during long term standstill, the area should be vibration free.
- Where exposure to some vibration is unavoidable, the shaft should be looked. Roller bearings may be fitted with a shaft locking device, which should be kept in place during long term standstill.
- Shaft should be rotated by hand, one quarter of revolution weekly.

ELECTRIC POWER!

Where anti-condensation heaters have been fitted, it is strongly recommended that they are energized.

In such case, prominent warnings of live terminals inside the terminal box must be posted **inside** and **outside** the motor terminal box.

Where anti-condensation heaters are not fitted, the use of desiccant is recommended.

2.3.4 Restarting of Electric Motors

Before taking a motor into service, ensure that anti-condensation heaters (if fitted) have been disconnected and isolate before starting the motor.

1. Check that no foreign matter is present.
2. Remove all surface dust and dirt.
3. Test the stator insulation resistance between phases and also to earth.
4. If an insulation resistance lower than one mega ohm at 20 oC (68 oF) is measured, the windings must be dried out until a minimum of one mega ohm is obtained.
5. Start the motor.
6. Watch the operation of the electric motor for approx. 10 minutes.

2.4 Foundation

CAUTION!

The pump must be fixed to a rigid foundation which is substantial enough to absorb vibrations and to take up stress from the hydraulic strain and loads from the pipelines.

The pump should be installed with sufficient accessibility for inspection and maintenance. The surface of the foundation where the pump is installed must be level and horizontal. Damage due to an inadequate or faulty foundation is not covered by the guarantee.

2.5 Environment conditions

CAUTION!

The pumps are intended for installing in dry rooms free from aggressive atmosphere in temperatures between + 10 and 50 0C. Installing the pump in other conditions is only allowed if this is stated in the technical data sheet.

2.6 Piping

CAUTION!

To keep pressure loss and flow resistance at a minimum, tight bends and substantial size reductions in the piping system should be avoided. Loss of pressure in the suction line must be kept at a minimum in order to avoid cavitations in the pump. Static suction height + loss of pressure in the suction line + NPSH value for the pump + steam pressure must not exceed 10 mWC at sea level. Long suction pipes that make air pockets possible should be avoided.

Suction and pressure lines must be connected to the flanges of the pump, free from strain, as any stresses are taken up at fixed points, and suitable compensators should therefore be installed in the pipe system. The flanges between which the pump is installed must be absolutely parallel.

2.7 Piping connections

CAUTION!

Before installing the pump, the entire piping must be pressure and leakages tested and flushed clean before it is connected to the suction and discharge side of the pump. If the pressure test takes place with the pump installed, the testing pressure must not exceed the testing pressure of the pump, which is stamped into the pump, usually in the suction flange. The pump's gaskets or flanges for the mechanical shaft seal might otherwise be damaged.

Check that all connections to the pump are in working order and that the various measuring equipment has been correctly connected. Take care that no parts obstruct easy access to the pump for inspection or replacement of important parts.

2.8 Electrical installation

ELECTRIC POWER!

Check that there is enough cable to allow the motor to be removed without disconnecting the wires. A switch (emergency stop) must be installed close to the pump.

2.9 Recommended accessories

As the pump, especially the mechanical shaft sealing, is designed to run with clean water without sludge, a suitable filter must be installed in the suction line.

3 Operation

3.1 Start-up procedures

CAUTION!

Ensure that the pump and motor are mounted according to instructions, all connections are correct and the necessary screens and guards are in order.

- Check the direction of rotation (marked with an arrow). The motor must turn in the direction in which the arrow is pointing. If the direction is wrong, the connections to the terminals of the electric motor should be changed.
- Check that the pump can be turned by hand.
- Check that the motor has been lubricated with grease. (If applicable)
- Make sure that the piping is clean and free from foreign objects. Liquid should flow regularly into the pump.
- Check that the pump and suction pipe are filled with liquid. Any air or gas must be carefully released before start-up.
- Check the pump for noise and vibrations immediately after starting. At the normal head it should have a very steady motion without unusual noise and vibrations after one minute.
- Check the seal housing for leakages.

3.2 Starting the pump

CAUTION!

When the pump is ready, it is started with the discharge valve closed. After starting, the discharge valve is slowly opened until the working point is reached. If the pump runs with closed valves for a period, it should be equipped either with temperature control equipment or recirculation. Running with the valves closed for a long period can damage the pump.

3.3 Stand-by

CAUTION!

If the pump is going to be on stand-by for a long period, it must be started or rotated at least once a week to avoid damage to the mechanical seals.

3.4 Pump vibrations

CAUTION!

During operation, be aware that significant vibrations have a major affect on the pump's performance. If vibrations are significant the pump should immediately be turned off to be able to locate possible errors.

4 Maintenance

4.1 Inspections

STOP!

Before any inspection and maintenance of the pump, the operator must ensure that the pump cannot be unintentionally started. The pump must be stopped, and all electronic contacts must be disconnected.

The system must be de-pressurized and the pump must be emptied of liquid and washed. If the pump has been pumping hazardous liquids, the liquid must be collected, and the pump should be flushed with clean water or another suitable liquid. It is important to ensure that the pump does not contain dangerous amounts of corrosive, toxic or similar substances when maintenance is taking place.

4.1.1 Three-month inspection

- Check suction and discharge pressure.
- Check for unusual noise, vibrations and leakages.
- Inspect the motor.
- The mechanical seal must be inspected for leaks. The seal must not leak either during stand-by or during operation.

If any faults are found during inspection, they must immediately be corrected, since any defects can be of major importance for the functioning of the pump and its useful life.

4.1.2 Twelve-month inspection

Take the pump apart - See “Disassembly and assembly instructions”. The rotating parts are checked and repaired if necessary. Normal clearance between the impeller and

casing wear ring is 0,45-0,50 mm. Maximum clearance is 0,8-1,0 mm. depending on the size and capacity. See - “Centrifugal pump wear ring clearances”

4.1.3 Lubrication

The pump type CNL is without bearings and needs no lubrication. The motor bearings are greased in accordance with the motor instructions.

4.2 Disassembly and assembly

4.2.1 Disassembly

1. Ensure that the pump is emptied of liquid
2. Unscrew bolts connecting pump casing and cover. Lift the disconnected part of the pump comprising motor, bracket and pump cover.
3. The impeller will follow the removed part, enabling direct access.
4. Gentle disconnection is recommended to prevent any damage on the mechanical seal.

NOTE!

Unless pump shaft and engine shaft are assembled with a flanged coupling, do not remove the pump shaft from the motor shaft unless the pump shaft or the motor has to be replaced.

4.2.2 Assembly

- Before reassembling clean the inside of the pump casing and paint with appropriate coating.
- In order to make disconnection of the pump easier at a later stage, lubrication of all bolts and assembling surfaces with “Never Seez” lubricant is recommended.
- Assemble motor, coupling and pump shaft. **Note!** Adjustment of the shaft will take place later.
- Assemble the motor stool item 6 with the motor.
- Pump cover item 2 with the seat ring of the mechanical seal, has to be fitted gently on the shaft and tightened to the motor stool item 6 by screws.
- The O-ring has to be fitted to the cover
- Adjust the distance (B) between the bottom of the shaft flange and the cover.

	IEC size	B (mm)
CNL -/160	90-160	4
CNL -/200	90-180	4
CNL -/200	200	14

- The rotating part of the mechanical shaft seal is placed carefully on the shaft.
- The casing wear ring and the impeller have to be fitted and tightened by screws.
- The rotating assembly can be fitted to the pump casing and tightened by screws.
- Before any start-up, the shaft has to be turned by hand in order to check for any blockages.
- The pump has to be primed in order to prevent any dry running.

4.3 Fitting instructions for mechanical seals

A mechanical seal is a very high-precision product and should be treated with the utmost care before and during fitting. Do not unpack until ready for use. The rotating wear ring and the seat have been lapped to a high degree of accuracy.



Mechanical seals used for CNL pumps

Type 1

Type 2

4.3.1 Fitting instructions

1. Remove the protective packaging from the seal, check for damage, and wipe clean.
2. Make sure that the pump is ready and switched off.
3. The shaft should be clean and free of burrs, and the machined place where the seat fits must be cleaned very carefully. Edges should be rounded so that they are not sharp or penetrating.
4. Check that the shaft diameter corresponds with the dimension of the seal within a tolerance of 0.05 mm.
5. The bore in the housing and the seat must be lubricated. Use only liquid soap, soapy water or glycerine with ethylene-propylene elastomer. The elastomer must also be lubricated on the inside where it slides on the shaft. Lubricants containing silicone must never be used.
6. Press the seat into position with your fingers. If the space is tight, use a bush when pressing the seat into position. Take care not to damage the surface of the seat. For example, use a piece of plastic for protection between the bush and the seat. After pressing the seat into position, make sure that it is fully in place by measuring the depth with a depth calliper.
7. The compressed length after fitting must correspond to the working length of the size of seal in question given in the table of measurements.
8. Be aware of changes that can occur when bearing arrangements and gaskets etc. are replaced.
9. Before the pump is started it must be filled with liquid and the air allowed escaping. Air should be bled frequently during the period after starting.

NOTE!

When fitting shaft seals, the instructions should be read carefully, especially when the medium is dangerous (poisonous, hot, flammable etc.)

4.4 Centrifugal pump wear ring clearance

In connection with the inspection, the impeller 5 and wear rings 10 are measured in order to secure that the clearance is not larger than stated in the diagram below.

CAUTION!

The pump shaft may only be dismantled, if pump shaft or bearings, in the electric motor have to be replaced.

Wear ring Ø	Clearance maximum	Clearance minimum
100 mm	0.5 mm	0.15 mm
150 mm	0.6 mm	0.2 mm
200 mm	0.7 mm	0.25 mm
250 mm	0.8 mm	0.28 mm
300 mm	0.85 mm	0.3 mm
350 mm	0.9 mm	0.3 mm



If the clearance is too big, replace wear rings as follows:

1. Unscrew **countersunk screws 25**.
2. Pull out wear (seal) rings.
3. Fit new wear rings and tighten countersunk screws.

5 Spare Parts

5.1 Ordering

When ordering spare parts or requesting our assistance, please advise the following:

- Pump type
- Item numbers and descriptions of parts to be ordered (Check spare part drawing and corresponding parts list with item numbers to identify the parts to be ordered)

5.2 Alfa Laval Service

The **Alfa Laval** group is represented in all major ports of the world.

DO NOT hesitate to contact your **Alfa Laval representative** if you have any questions, problems or require spare parts.

If you do the repairs yourself, you are requested to follow the instructions regarding assembly and disassembly or to contact our service department.

5.3 Returning parts

Before returning parts to Alfa Laval, please note that all liquids must be removed and parts should be cleaned and neutralized.

The sender is liable for damage suffered by the pump or other goods caused by leaking of liquid during transport.

5.4 Decommissioning

Do not dump old or used parts. Metal parts should be recycled as scrap.

When decommissioning the pump, it should be neutralized and cleaned, and any hazardous liquids, should be removed and sent to a recycling facility.

None of the materials in the pump can be considered hazardous, but we urge you to act with care and to take the steps needed when decommissioning the pump or its parts.

5.5 Type CNL - table of materials

Table of materials with the total content calculated as percentage by weight.

	Material	%
Pump casing	See. Parts list	54
Casing cover	See. Parts list	10
Base	Cast iron	11,5
Shaft	AISI 316	2,5
Impeller	See. Parts list	7
Motor base	Cast iron	10
O-ring	Viton	0,2
Mechanical seal	Carbon/ceramics	0,3
Casing wear ring	See. Parts list	1
Accessories	Stainless steel	1
Coupling	Cast iron	2,5

5.6 Spare parts drawing for CNL 160 and 200 with flanged coupling

6 Trouble Shooting

6.1 Trouble Shooting Table

The diagram below describes the most common faults which can occur during operation of the pump unit. Should additional information be required, please contact Alfa Laval.

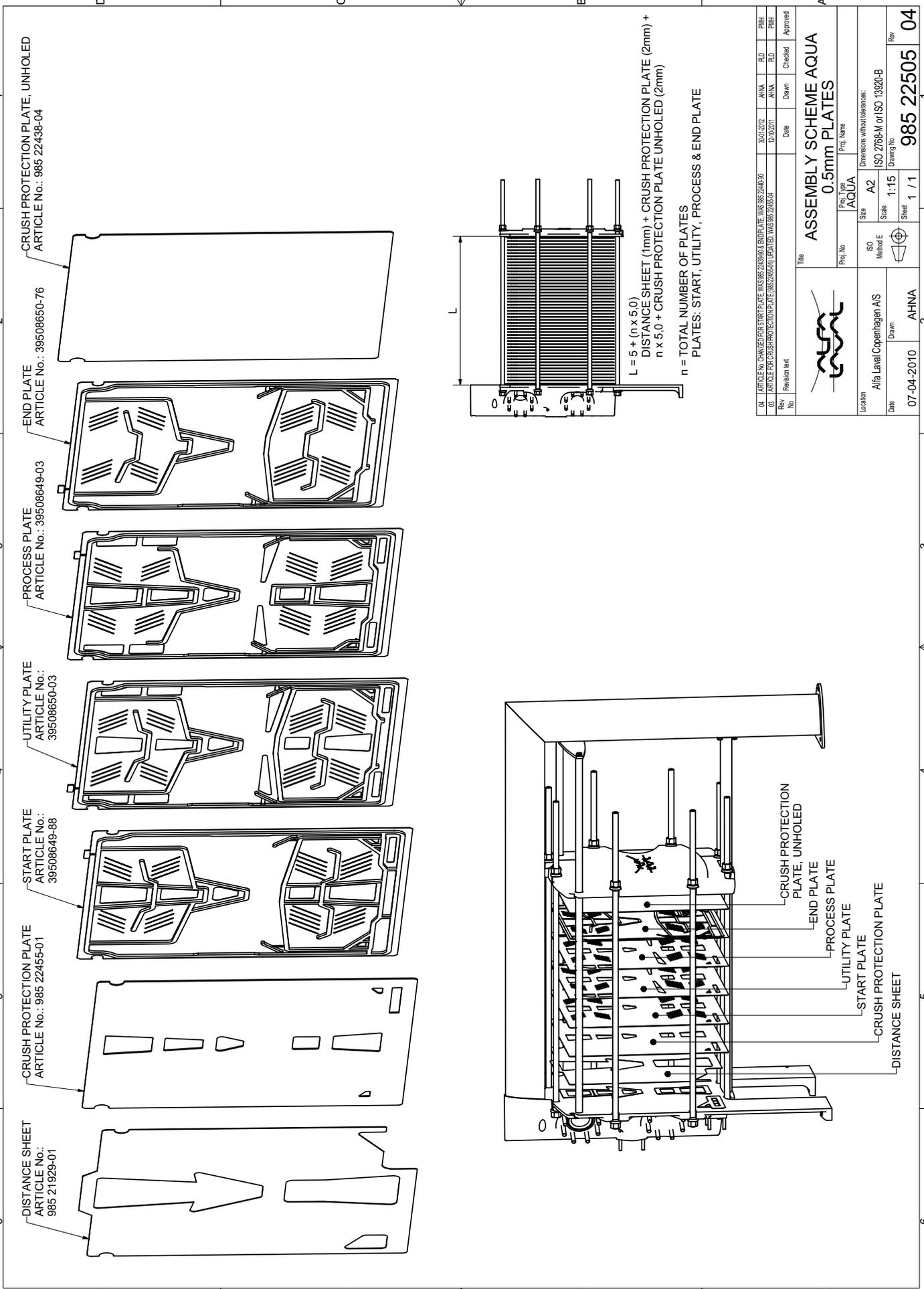
<p>Pump and motor cannot be actuated:</p>	<ul style="list-style-type: none"> • Impeller or shaft blocked. • Motor fault.
<p>Motor running but no pumping effect:</p>	<ul style="list-style-type: none"> • Motor rotation is not transmitted through coupling. • Discharge valve closed. • Non-return valve or other valves are closed. • Suction line closed. • Air in pump casing. • Suction line leaking. • Shaft seal leaking. • Bottom valve defective. • Suction lift too high. • Priming pump defective.

<p>Insufficient capacity:</p>	<ul style="list-style-type: none"> • Wrong direction of rotation. • Number of revolutions too low. • Counter-pressure too high. • Suction line or impeller partly clogged. • Air in pump casing. • Air in pumping medium. • Suction lift too high (inlet pressure too low). • Cavitations. • Suction line leaking. • Shaft seal leaking. • Pump worn out.
<p>Pump pressure too high:</p>	<ul style="list-style-type: none"> • Number of revolutions too high. • Impeller oversized. • Too many pressure stages. • Specific gravity of pumping medium too high. • Viscosity of pumping medium too low. • Inlet pressure too high. • Manometer defective.
<p>Capacity too large:</p>	<ul style="list-style-type: none"> • Number of revolutions too high. • Impeller diameter too big. • Counter-pressure too low.
<p>Discharge head too low:</p>	<ul style="list-style-type: none"> • Number of revolutions too low. • Impeller diameter too small. • Too few pressure stages. • Specific gravity of pumping medium too low. • Viscosity of pumping medium to high. • Manometer defective.

Power consumption too large:	<ul style="list-style-type: none"> • Motor too small. • Motor fault. • Capacity too large. • Counter-pressure too low. • Stuffing-box tightened too much. • Shaft ends out of alignment. • Electricity supply incorrect.
Pump output decreases or stops:	<ul style="list-style-type: none"> • Suction line leaking. • Shaft seal leaking. • Increasing suction lift. • Filter clogged. • Cavitations.
Irregular running:	<ul style="list-style-type: none"> • Bearings defective. • Motor fault.
Increasing noise level:	<ul style="list-style-type: none"> • Cavitations beginning. • Air in pumping medium. • Capacity too large. • Clamping to base loosened. • Base bolts loosened. • Influences from pipe connections or base.
Leaks:	<ul style="list-style-type: none"> • Cracks in pump casing. • Faulty assembly of pump. • Pipe connections leaking. • Shaft seal leaking.

<p>Bearing temperature too high:</p>	<ul style="list-style-type: none"> • Faulty lubrication or wrong lubricant. • Defective pump alignment. • Influences from pipeline. • Coupling distance wrong. • Shaft bent. • Foreign bodies or impurities in bearings.
<p>Pump wears out quickly:</p>	<ul style="list-style-type: none"> • Wrong pump in relation to liquid. • Cavitations. • Stuffing-box tightened too much. • Shaft bent. • Defective alignment. • Influences through pipe line.
<p>Strong vibrations:</p>	<ul style="list-style-type: none"> • Impurities in pump. • Worn or loose bearings. • Operating the pump at a critical speed. • Unbalanced motor or rotating components. • Loose hold-down bolts or loose or damaged parts.

7 Drawings and Part Lists

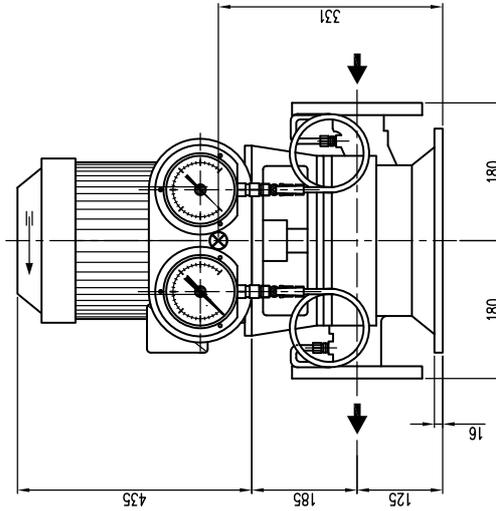
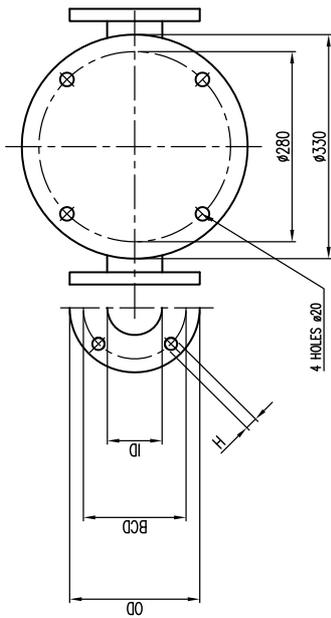


04	ARTICLE NO. CHANGED FOR START PLATE WAS 985 22455-01 (END PLATE WAS 985 22445-01)	30/01/2012	AHNA	RD	PHH
03	ARTICLE FOR CRUSH PROTECTION PLATE (985 22455-01) (START PLATE WAS 985 22455-01)	12/01/2011	AHNA	RD	PHH
Rev No	Revision text	Date	Drawn	Checked	Approved
ASSEMBLY SCHEME AQUA					
0.5mm PLATES					
Title		Proj. Name			
Proj. No		Proj. Type			
AQUA		AQUA			
Location		Dimensions without tolerances:			
Alfa Laval Copenhagen AIS		Size			
Drawn		A2			
Date		Scale			
07-04-2010		ISO 2768-M or ISO 13920-B			
AHNA		Drawing No			
985 22505		Sheet			
04		1 / 1			









PUMP TYPE	CNL 65-65/160	CNL 65-65/160	CNL 65-65/160	CNL 65-65/160
VOLTAGE	3 x 380-415	3 x 440-480	3 x 660-720	3 x 660-720
FREQUENCY	50	60	50	60
NOMINAL FLOW	20.9-28.2	20.9-28.2	20.9-28.2	20.9-28.2
TOTAL HEAD	38	38	38	38
AMPERE	17.3	17.4	10.0	11.6
IMPELLER SIZE	ø 175	ø 152	ø 175	ø 152
MOTOR TYPE	132M	132M	132M	132M
RATED OUTPUT POWER	9.5	11.0	9.5	11.0
CONSUMED POWER	5.5-6.3	6.0-6.7	5.5-6.3	6.0-6.7
ROTATING SPEED	2930	3516	2930	3516
EFFICIENCY	88.0	88.0	88.0	88.0
WEIGHT (INCL. MOTOR)	115	115	115	115
COOLING SYSTEM	FAN COOLED	FAN COOLED	FAN COOLED	FAN COOLED
SHAFT SEAL	MECH. SEAL	MECH. SEAL	MECH. SEAL	MECH. SEAL

MOTOR ART. NO.	985 63010-03	985 63010-04	985 63010-00	985 63010-01
MOTOR ART. NO. (WITH SPACE HEATER)	985 63010-23	985 63010-24	985 63010-00	985 63010-01

PUMP ART. NO.	DIN	JIS / ANSI
WITH BRONZE IMPELLER	985 21660-80	985 21670-81
WITH AISI 316 IMPELLER	985 21660-90	985 21670-91

⊗ CENTRE OF GRAVITY

EJECTOR PUMP FOR: AQUA 64-92 PLATES

EJECTOR PUMP, MOTOR AND MANOMETER SET ARE OPTIONAL EQUIPMENT AND ARE ONLY SUPPLIED IF ORDERED

DIN	ANSI	JIS
OD	185	185
BCD	145	140
ID	65	65
H	4xø18	4xø19

Rev No	Revision text	Date	AHWA	LMB	Checked	LMB	Approved
03	TEXT FOR ID CHANGED. WAS 50, 50 & 50	14-08-2012					

Title		Proj. Name	
DIMENSIONAL DRAWING		EJECTOR PUMP INCL. DATASHEET	

Location	ISO Method E	Size	Dimensions without tolerances:
Alfa Laval Copenhagen A/S		A2	ISO 2768-M or ISO 13920-B
Date	Drawn	Sheet	Drawing No
08.09.2009	PLD	~	985 21651 03





985 22032 Technical data CNL 65-65/160

Description

Vertical centrifugal pump with a design in accordance with DIN 24255 and ISO 2858.
Close coupled in-line top pull out version.
As a standard the discharge and suction flanges are drilled alike.

Capacity

The CNL 65-65/160 ejector pump cover a capacity range of 5-50 m³/hr with a minimum lifting height at 38 MWC. Further details on capacity, pressure and performance can be found at the pump curves.

Materials and weight

Pump casing	Red Brass (RG10)
Impeller	NiAlBrz
Shaft	Stainless steel
Painting	Alfa Blue c310
Weight of pump	56 kg

Connections

Fits to:
DIN DN65, PN10
ANSI 150 lbs, DN65
JIS 10k, DN65

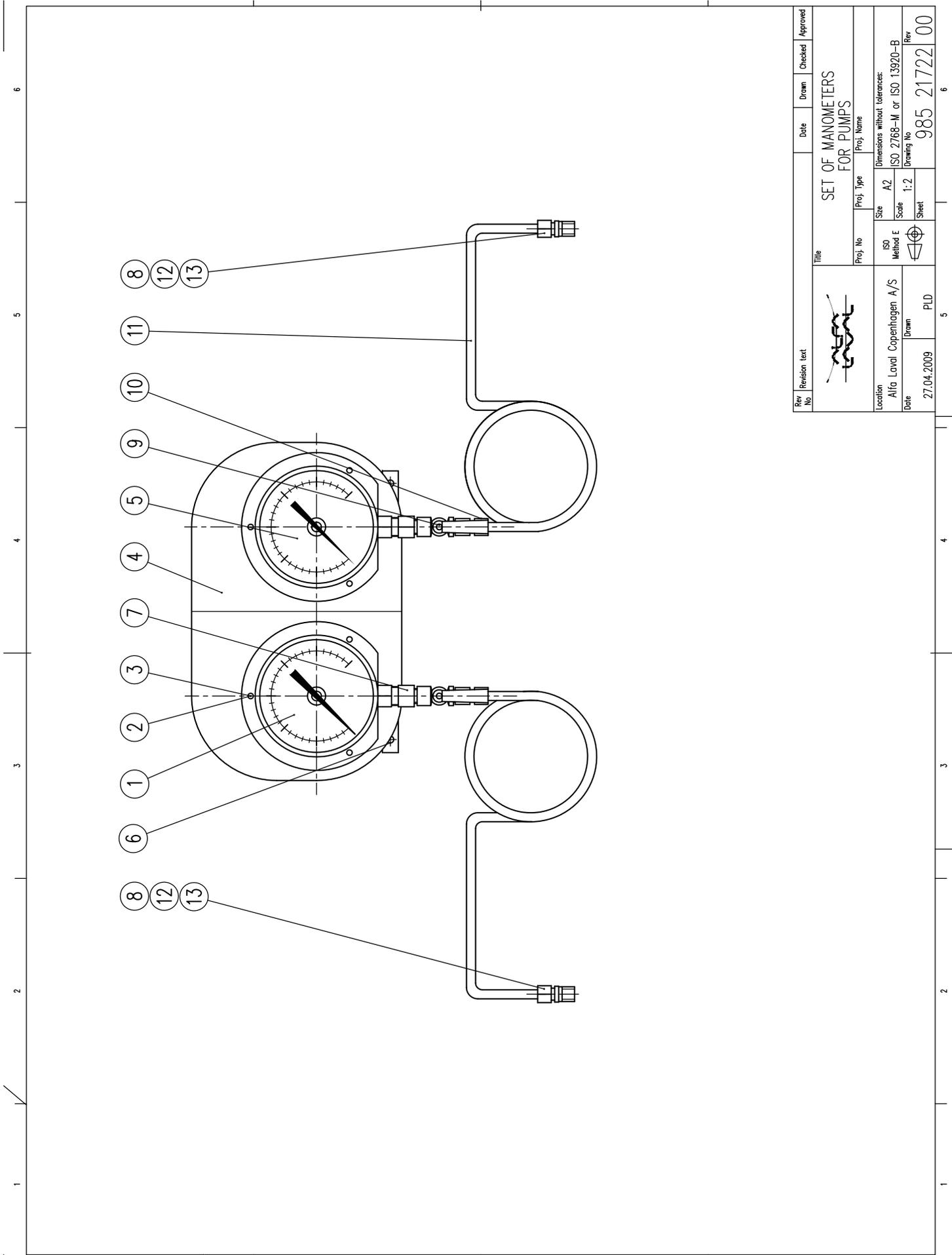
Options

Stainless steel impeller
Manometer set to monitor inlet and outlet pressure
Class test certificate

Warning

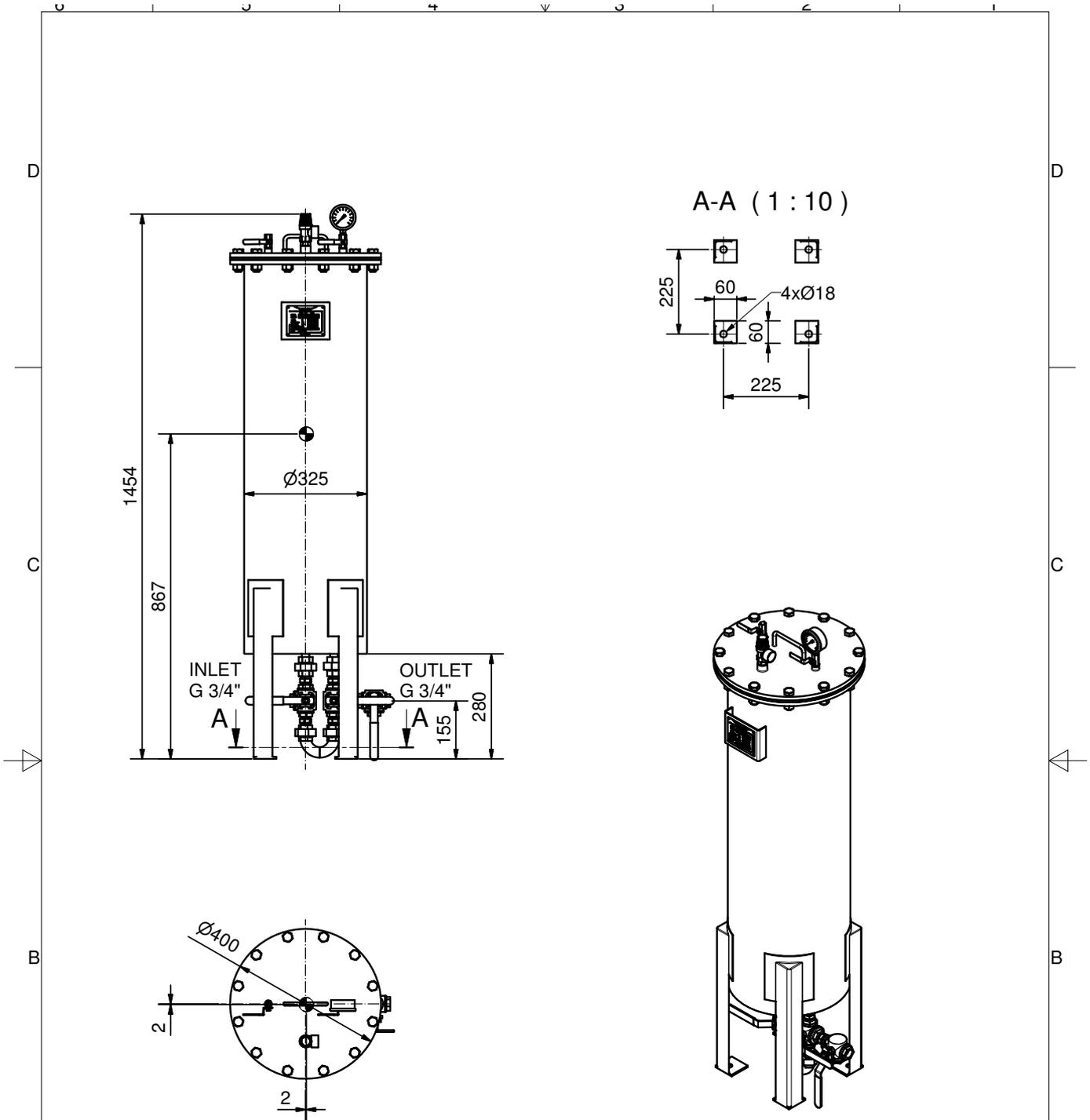
The pump is not self-priming and need a positive back pressure.





Rev No	Revision text	Date	Drawn	Checked	Approved
Title		SET OF MANOMETERS FOR PUMPS			
Proj. No	Proj. Name	Proj. Name			
ISO Method E	Size A2	Dimensions without tolerances: ISO 2768-M or ISO 13920-B			
Scale 1:2	Scale	Drawing No 985 21722 00			
Sheet	Sheet	Rev			
Location Alfa Laval Copenhagen A/S	Drawn PLD				
Date 27.04.2009					



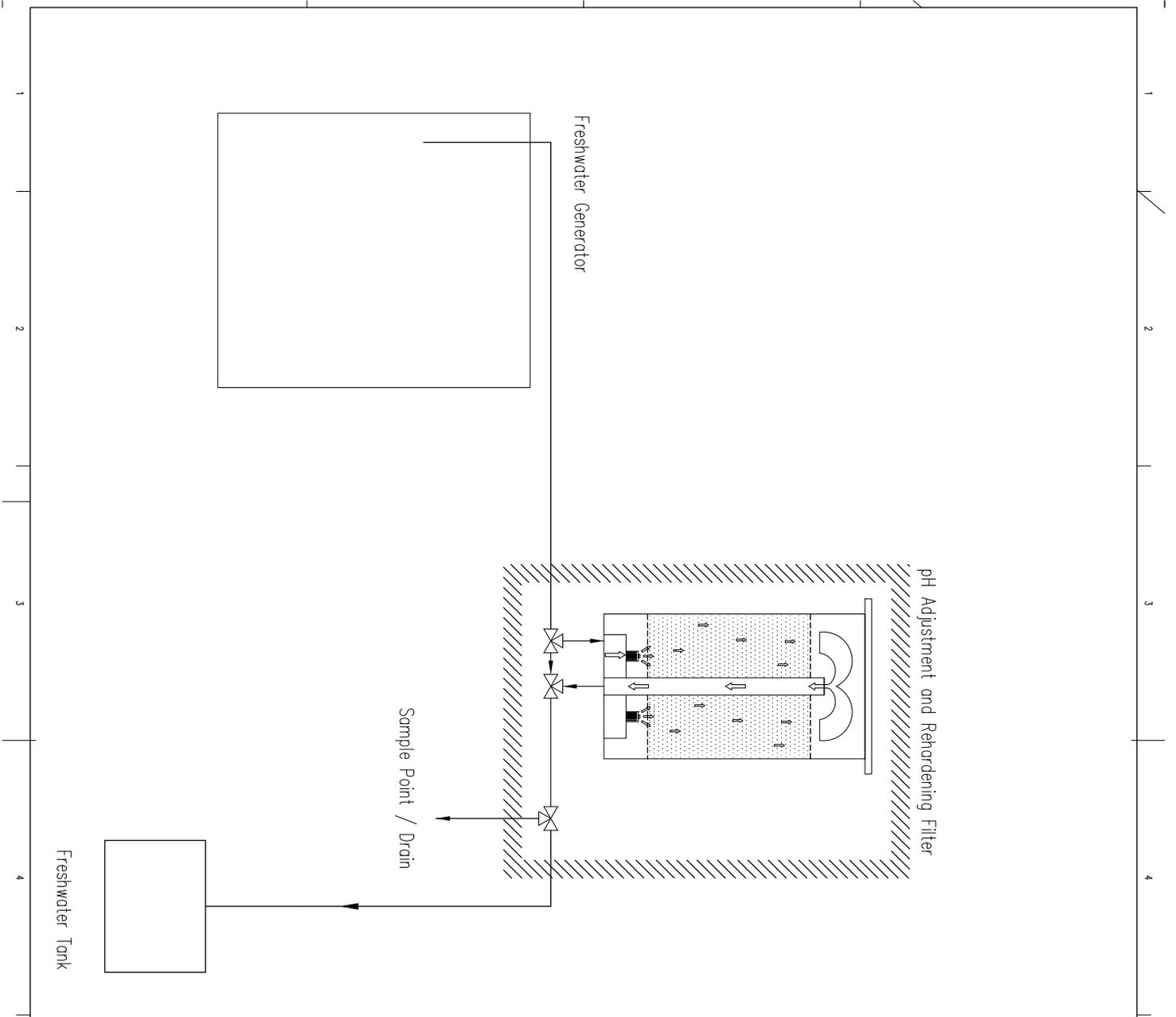


WEIGHT (Kg)	
EMPTY	OPERATING
40	130

= CENTER OF GRAVITY

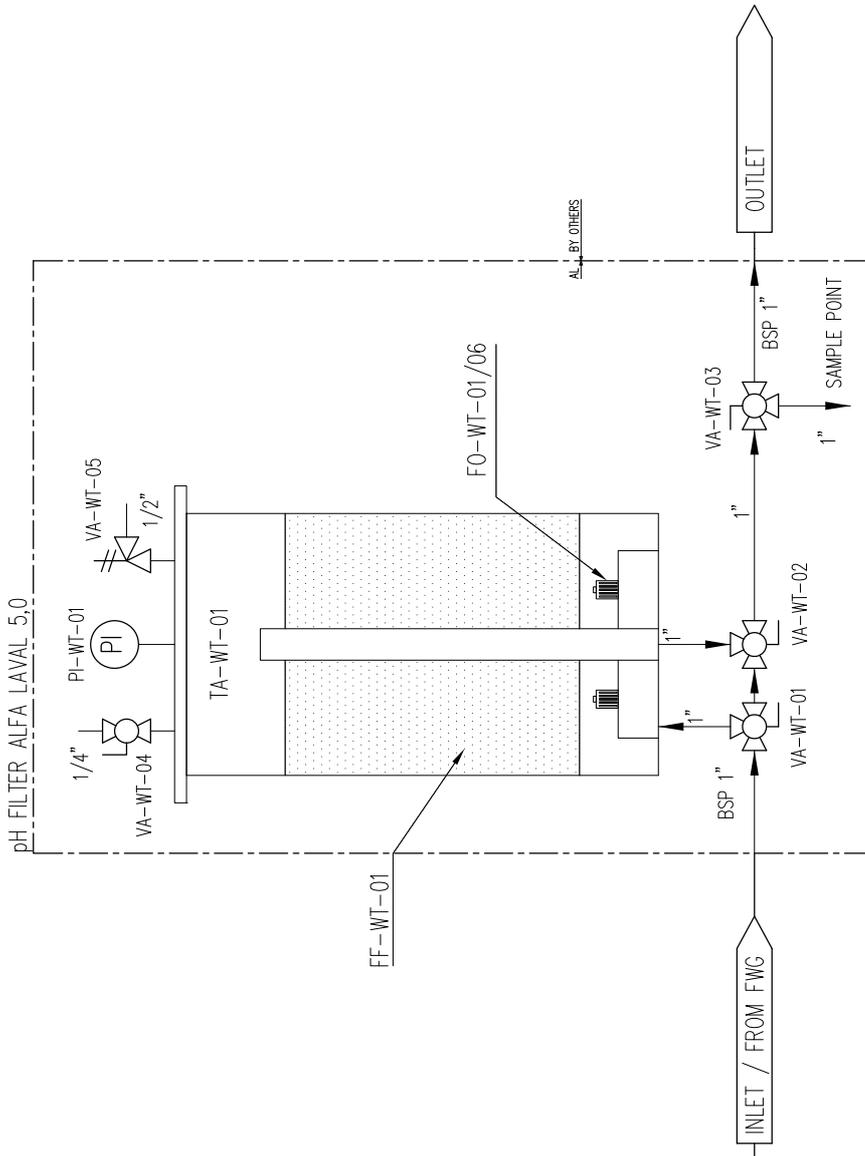
02	OUTLET TEXT CORRECTED	18-02-2011	DKSONSR	DKSOPHNA	DKSOANHA
01	TITLE CORRECTED + WEIGHT & DIMENSIONS ADDED	11-08-2010	AHNA	NSR	PMH
00	RELEASED FIRST TIME	09-08-2010	DKSONSR	DKSOPHNA	DKSOANHA
Rev No	Revision text	Date	Drawn	Checked	Approved
		Title pH ADJ. & REHARDENING FILTER TYPE: ALFA LAVAL pH 2,5			
		Proj. No	Proj. Type URF	Proj. Name	
Location Alfa Laval Copenhagen A/S		ISO Method E	Size A3	Dimensions without tolerances: ISO 2768-M or ISO 13920-B	
Date 09-08-2010	Drawn DKSONSR		Scale 1:10	Drawing No 985 22581	Rev 02
		Sheet 1			





00	Issued	15-03-2010	NSR	PLD	PMH
Rev No	Revision text	Date	Drawn	Checked	Approved
		Title Flow Chart - pH Adjustment and Rehardening Filter			
		Proj. No	Proj. Type	Prof. Name	
Location Alfa Laval Copenhagen A/S		ISO Method E 	Size A2	Dimensions without tolerances: ISO 2768-M or ISO 13920-B	
Date 15-03-2010	Drawn NSR	Scale 1:1	Sheet 1	Drawing No 985 22583	Rev 00





00	ISSUED	2010-03-05	DKSONSR	AHNA	PMH
Rev No	Revision text	Date	Drawn	Checked	Approved
		Title			
		P&ID pH FILTER ALFA LAVAL			
Location		Proj. No	Proj. Type	Proj. Name	
Alfa Laval Copenhagen A/S		5,0	-	5,0	
Date		ISO Method E	Size	Dimensions without tolerances:	
2010-03-05		Method E	A3	ISO 2768-M or ISO 13920-B	
Drawn		Scale	1:1	Drawing No	
NSR		Sheet	-	985 23835	
		Rev		00	



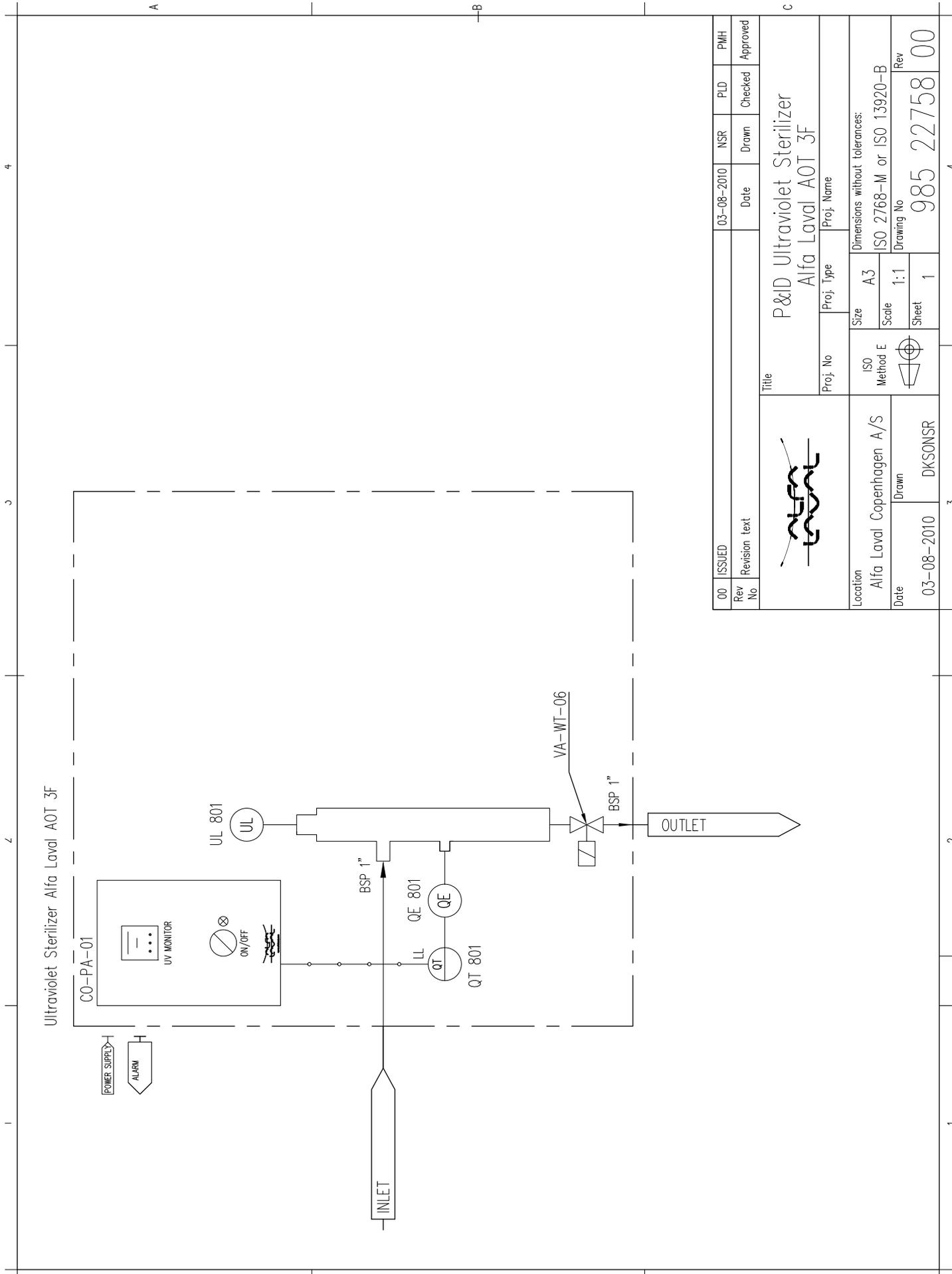


Document No. 985 22586

Equipment Specification pH Adjustment and Rehardening Filter

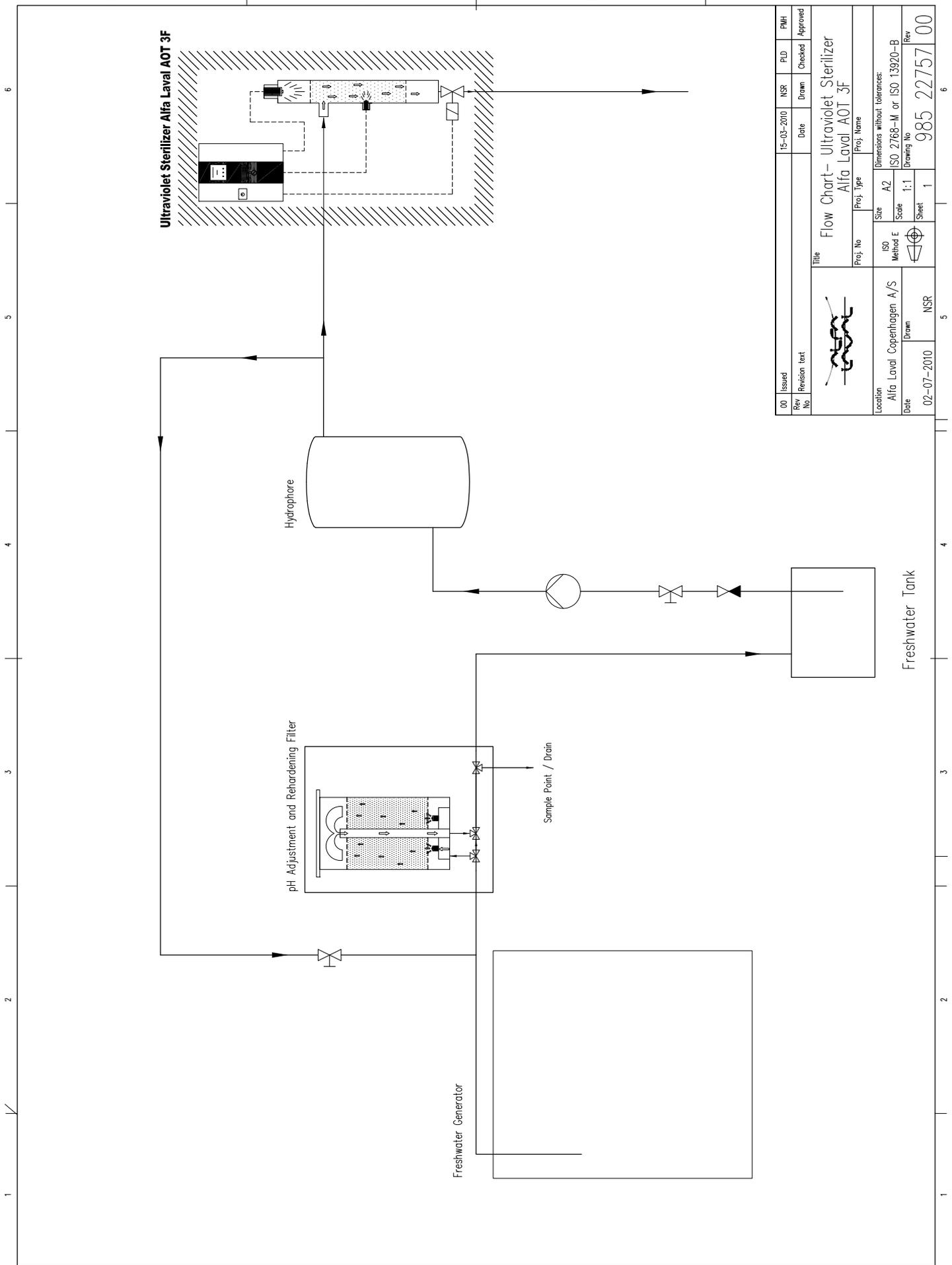
Tag No.	Description	Article No.	Connection		
PI-WT-01	Pressure Gauge w/ Ball vavle	985 22586-10	1/4" BSP		
VA-WT-01	3-Way Ball Valve	985 22586-11	3/4" BSP		
VA-WT-02	3-Way Ball Valve	985 22586-11	3/4" BSP		
VA-WT-03	3-Way Ball Valve	985 22586-11	3/4" BSP		
VA-WT-04	Ball Valve	985 22586-12	1/4" BSP		
VA-WT-05	Pressure Relief Valve	985 22586-13	1/2" BSP		
TA-WT-01	Filter Tank URF325-25	985 22586-14			
TA-WT-01	Filter Tank URF325-50	985 22586-15			
TA-WT-01	Filter Tank URF450-125	985 22586-16			
FO-WT-01/06	Filter nozzle with gland	985 22586-17			
Spare Parts pH Filter ALFA LAVAL 1,5			Recommended qty.		
			1 year	2 years	5 years
FF-WT-01	Granulated Rehardening Material	985 22586-30	1	3	9
-	Supporting Gravel Sand	985 22586-31	0	0	1
-	Flat Cover Gasket	985 22586-32	1	2	5
Spare Parts pH Filter ALFA LAVAL 2,5			Recommended qty.		
			1 year	2 years	5 years
FF-WT-01	Granulated Rehardening Material	985 22586-30	2	6	18
-	Supporting Gravel Sand	985 22586-31	0	0	1
-	Flat Cover Gasket	985 22586-32	1	2	5
Spare Parts pH Filter ALFA LAVAL 5,0			Recommended qty.		
			1 year	2 years	5 years
FF-WT-01	Granulated Rehardening Material	985 22586-30	5	15	45
-	Supporting Gravel Sand	985 22586-31	0	0	1
-	Flat Cover Gasket	985 22586-32	1	2	5





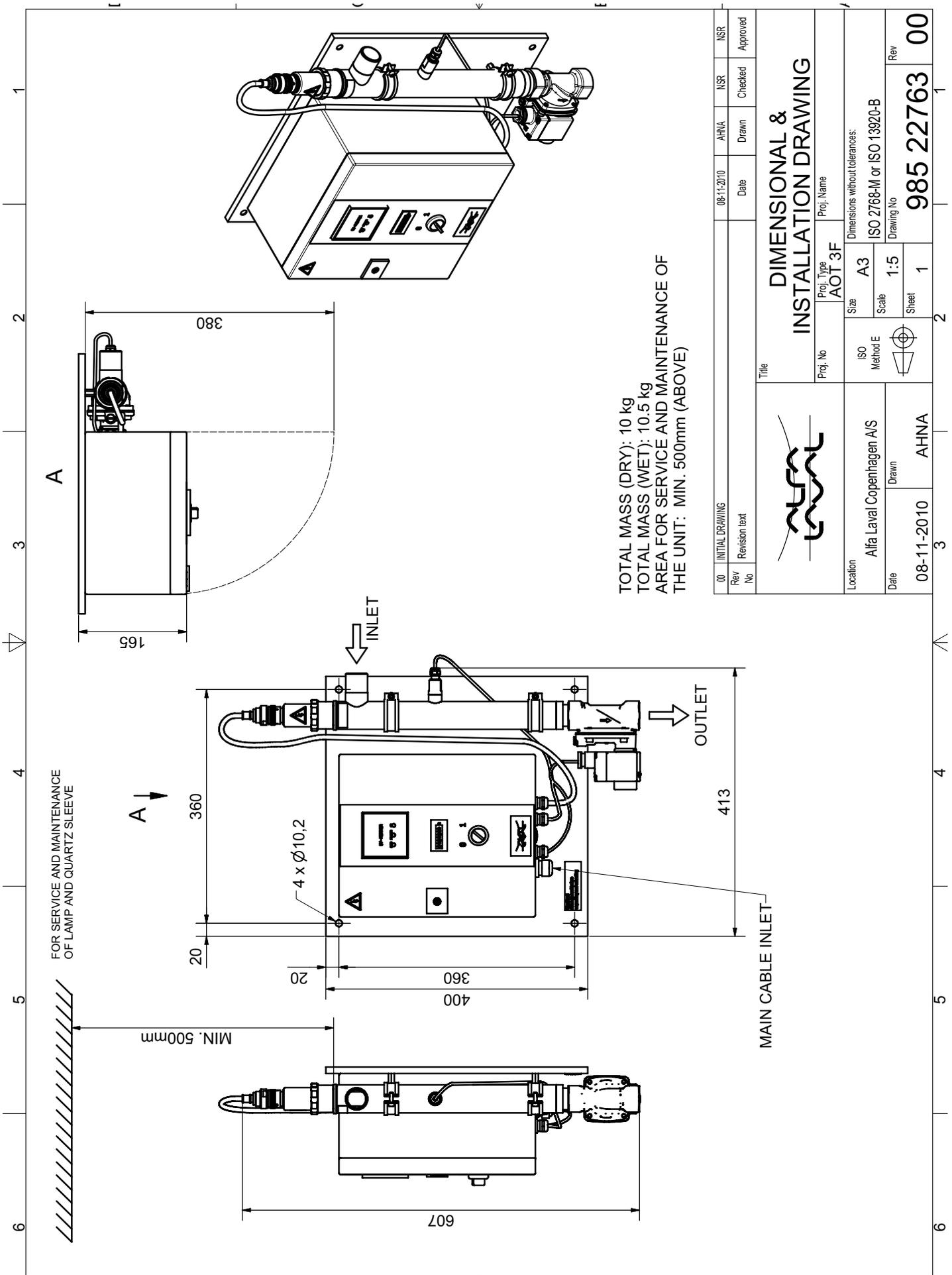
00	ISSUED		03-08-2010	NSR	Drawn	PLD	Checked	PMH	Approved
Rev No	Revision text								
		Title P&ID Ultraviolet Sterilizer Alfa Laval AOT 3F							
		Proj. No	Proj. Type	Proj. Name					
Location		ISO Method E	Size A3	Dimensions without tolerances:					
Alfa Laval Copenhagen A/S			Scale 1:1	ISO 2768-M or ISO 13920-B					
Date	Drawn		Sheet 1	Drawing No					
03-08-2010	DKSONSR		1	985 22758					
				Rev 00					





00	Issued	NSR	15-03-2010	NSR	PLD	PMH
	Revision text		Date	Drawn	Checked	Approved
Title Flow Chart - Ultraviolet Sterilizer Alfa Laval AOT 3F						
Location		ISO Method E		Dimensions without tolerances:		
Alfa Laval Copenhagen A/S		A2		ISO 2768-M or ISO 13970-B		
Date	Drawn	Scale	Sheet	Drawing No	Rev	
02-07-2010	NSR	1:1	1	985 22757	00	

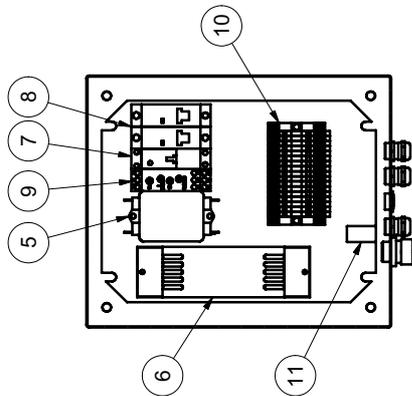
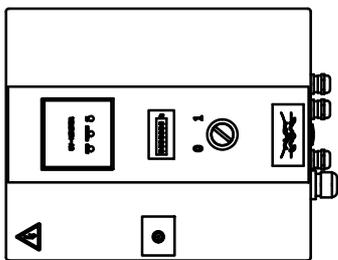
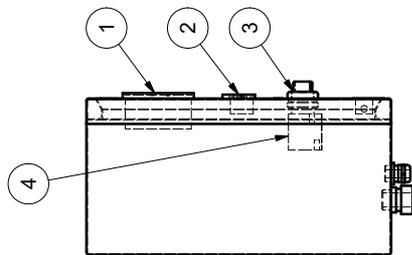
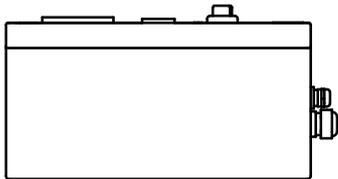
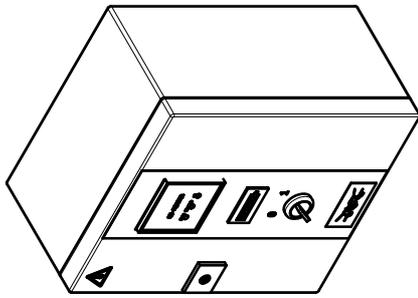




TOTAL MASS (DRY): 10 kg
 TOTAL MASS (WET): 10.5 kg
 AREA FOR SERVICE AND MAINTENANCE OF THE UNIT: MIN. 500mm (ABOVE)

00	INITIAL DRAWING	08-11-2010	AHNA	Drawn	NSR	Approved
Rev	Revision text	Date	Drawn	Checked	NSR	Approved
No						
		DIMENSIONAL & INSTALLATION DRAWING				
		Proj. No	Proj. Type	Proj. Name	Title	
Location		ISO Method E	Size	Dimensions without tolerances:		
Alfa Laval Copenhagen A/S			A3	ISO 2768-M or ISO 13920-B		
Date		Scale	1:5	Drawing No		
08-11-2010		Sheet	1	985 22763		
		Drawn	AHNA	Rev		
				00		





00	INITIAL DRAWING	08-11-2010	AHNA	NSR	NSR
Rev No	Revision text	Date	Drawn	Checked	Approved
		MAIN ELECTRICAL COMP. AOT 3F - ELECT. CABINET			
		Proj. No	Proj. Type	Proj. Name	
Location		Size	Dimensions without tolerances:		
Alfa Laval Copenhagen A/S		A3	ISO 2768-M or ISO 13920-B		
Date	Drawn	Scale	Sheet	Drawing No	Rev
08-11-2010	AHNA	1:5	1	985 22764	00





Part List for 985 22764
AOT 3F Electrical Cabinet

Pos	Qty	Description	Article No.	Remarks
	1	Complete electrical Cabinet	985 22764-80	
1	1	UV Monitor	985 22764-01	
2	1	Elapsed time counter 50/60 Hz	985 22764-02 / 985 22764-12	
3	1	ON/OFF Handle	985 22764-03	
4	1	Connection Block	985 22764-04	
5	1	Power Line Filter	985 22764-05	
6	1	Electronic Ballast	985 22764-06	
7	1	Relay	985 22764-07	
8	1	Line Safety Switch	985 22764-08	
9	1	Time Relay	985 22764-09	
10	15	Connection block / terminal (incl. End protection)	985 22764-10	
11	1	Ferrite	985 22764-11	Not mounted at delivery

