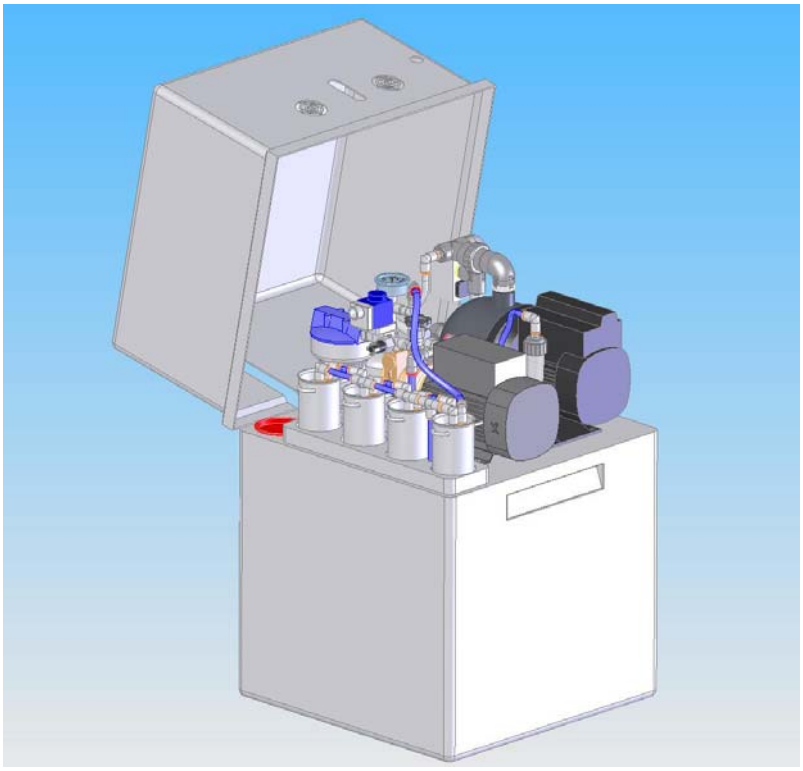
ASSEMBLY AND

MAINTENANCE MANUAL
FOR

HOH RO 100 SERIES
REVERSE OSMOSIS PLANT



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1. IN GENERAL

This assembly and service manual applies to HOH RO 111-114 total desalination plants.
This assembly and service manual contains **important** information about the correct installation and operation of the RO plant which is why the following is very **important.**

1. **Enclosed "Start-up control" shall be completed during start-up and then be filed together with the operating journal.**
2. **Operating journal shall be updated as described under: Various enclosures.**
3. **There must be a floor drain in the immediate vicinity of the plant.**
4. **The RO plant removes 95-98 % of all salts, so you have to install a post-treatment unit, e.g. a mixed bed or similar, if a better water quality is requested.**
5. **Our warranty no longer applies if the plant is not started up by an authorised HOH service technician.**

This instruction should be read carefully before installing and starting up the plant. Correct installation and operation will also form the basis of a possible factory warranty.
Your RO 100 is a compact design with reservoir tank and RO plant built together in order to take up a little space as possible.
The RO 100 plant with its compact and finished design is easy to install, since all installations are pre-assembled and tested in our factory.
Your RO 100 plant is equipped with casters and constructed in a stainless steel frame. That means that the plant can be placed e.g. underneath a table and then pulled out for a service check.
Your RO 100 plant is equipped with a powerful reservoir pump which supplies water at a pressure flow as the normal waterworks pressure/flow.
Your RO 100 plant is designed for a minimum of service and for long and unproblematic operation. However, this is on condition of correct installation and maintenance.
Always read this manual carefully before commissioning.

2. EXPLANATION OF WORDS

There will be a few technical explanations in this instruction which we explain below.

Permeate: The treated, totally desalinated water which is produced by the RO plant and supplied to the reservoir tank.

Concentrate: Is the water that is led to outlet. This water contains the salts and minerals that have been removed from the water.

Raw water: Is the water which is led directly to the RO plant and which must be desalinated in the RO plant.

TDS: The amount of totally dissolved salts in measured in the unit mg/l.

Conductivity: Is the designation of salt concentration of the water and it is measured in the unit µS/cm. The lower the figure, the better the water quality.

Membranes: Is the filter of the plant which by high pressure and flow is capable of desalinating the raw water.

RO: The abbreviation for Reverse Osmosis.

Reservoir-pump: is the pump which transports the treated water from the plant reservoir to the consumer.

Level sensor: Is a sensor which gives a signal when the RO plant must either be started or stopped, and it stops the reservoir pump in case of dry-running of the reservoir tank.

Softening plant: Is a pre-filter which softens the water, that means it removes hardness from the water.

3. PLACING OF PLANT

The plant must be placed in a non-freezing environment on a even foundation so that the water in the reservoir does not overflow when the tank is full. the foundation must be able to stand a load of approx. 100 kg which is the plant weight when full.
The plant is furnished with casters, so if you wish to be able to move the plant, you should keep the foundation even and solid.
The outside measures of the plant are (WxDxH): 580x580x850 mm, but when placing the plant you should take into account that the cover shall be demounted

during maintenance work. Either you must calculate with an additional 370 mm in height to be able to lift the cover, or it should be possible to roll the plant out for servicing (e.g. place it under a table or equal).
You should also make room on the back of the plant for the water installation; especially you should take into account the outlet hose from the plant. **The hose may never be bent!**
Placing of the plant must be done in a way so that the air intake on the front never gets covered.
There must also be room in front of the plant, so that it is possible to freely read the flow, and the suction of the high-pressure pump can take place without obstruction. Also it should be possible to pull out the plant in connection with maintenance.
In case of a stoppage, the reservoir may overflow. Therefore there should always be a drain in the immediate vicinity of the plant so that the overflowing water does not cause damage.
If there is no floor drain near the plant, installing the plant is at your own risk.

4. WATER QUALITY

The raw water, which is to be treated in the RO 51 unit, must be softened drinking water quality with maximum 500 mg/l TDS.
The raw water may maximum contain:

* Fe: 0.05 mg/l
* Mg: 0.02 mg/l
* Free chlorine: 0.1 mg/l
* Turbidity, maximum: 1.0 NTU
* Silt index: 3.0
* KMnO4 max: 10 mg/l

Max. temperature: 25 °C. The plant is adjusted at 10 °C in our factory. If there are doubts about the raw water composition, a water analysis must be made.
The plant must be connected to a raw-water pressure of minimum 2 bar and maximum 7 bar. The quality of the treated water will be less than 20 µS/cm at 10 °C.

5. WATER CONNECTIONS

Note! All water connections must be in compliance with local regulations.

5.1 Connection of raw water/inlet water:

On the inlet side you must fit a ball valve so that the water may be cut off during maintenance of the plant.
Install a ½" flexible pressure hose on the pre-filter of the plant (A-figure 2). The opposite end shall be connected to the raw-water supply.
The best operating result is obtained by connecting to minimum ¾" raw-water pipe. That reduces the drop in pressure to the plant. With a too small raw-water connection, there will be a risk of outage on the plant due to lacking water pressure, e.g. when rinsing out the membranes at start-up of the plant.

5.2 Connection of outlet water (treated water)

Fit the supplied ¾" flexible pressure hose to the reservoir pump (B-figure 2). The opposite end shall be connected to the consumer of the treated water or pipe connection which is led to ½ consumer of the treated water.
Note! Totally desalinated water may speed up corrosion. Therefore, always use corrosion-proof piping for the treated water, e.g. stainless steel or PVC.

5.3 Connection of outlet hose

Start by dismounting the "bent" blue hose which is fitted on the outlet valve (B-figure 3).
Install the supplied 10 mm plastic hose to outlet valve (B-figure 3). It is **important** that the hose is pressed all the way down. The opposite end shall be connected to outlet. The hose may not be led down into the outlet water, though, since the water may risk getting sucked back into the plant during standstill. **Note!** The outlet hose may never be bent or in any other way obstructed, as this would damage the plant membrane.

5.4 Connection of overflow hose

On the back of the plant, on the overflow nozzle (C-figure 2), you shall connect a ½" plastic hose to the floor drain or another subjacent drain. This overflow is a safety overflow in case an error occurs on the level sensor of the plant and the reservoir tank as a consequence gets filled to overflowing.

6. ELECTRICAL CONNECTIONS

Note! The electrical connections must be made in compliance with local regulations.
The electrical connection to the RO 100 unit must be as follows:

* Voltage: 230 Volt-50 Hz
* Fuse: 10 Amp
* Max. power consumption: 1.5 kW
* The plant must be connected to phase + 0 + E.

All internal connections in the plant like e.g. pump control and level control are pre-assembled in our factory. This means that only the supplied wire which is connected to the control box (C-figure 3) must be connected to a power switch/circuit breaker.

Colour code of power cable:

Blue wire:	0
Brown wire:	Phase
Yellow/green wire:	Earth

If for some reason you need to change the factory-mounted

power cable, please cf. paragraph: Various enclosures "electric diagrams"

7. START-UP OF PLANT

Check prior to start-up that all water and electrical connections are made as described in previous paragraphs and in compliance with local regulations.
Open the raw-water supply.
Check that all water connections are tight.
Pull the permeate hose (A-figure 3) out of the reservoir tank and lead it away from the tank to a drain.
Open the outlet valve (B-figure 3)
Now switch on the 230 Volt 50 Hz power supply. Also switch on the main switch located on the control box (C-figure 3).
The plant is now operating.
Now the plant shall operate and flush to outlet for 20-30 minutes before adjusting the outlet valve once more.
When the flushing is finished, adjust the outlet valve (B-figure 3) again. Read below paragraph carefully before starting up the plant.

7.1 Adjustment of outlet amount

Important! Read the entire paragraph 7.1 and 7.2 before adjustment is commenced.
Outlet amount must be adjusted, and the suitable outlet amount on your plant depends on the raw-water quality. A too high water recovery will damage the plant membranes. On condition that the raw water complies with the quality requirements, the plant can operate with a recovery rate of 40 %. With softened feed water, you may obtain a recovery of 70-80 % dependent on the amount of organic material in the water.
Finally, the plant recovery affects the conductivity of the permeate. That means that if a retention greater than 98 % is requested, the plant recovery can be adjusted at a lower level. Please note that the plant retention rate of 98 % applies by 75 % recovery. Contact HOH Water Technology A/S the supplier of your plant to decide which outlet amount is suitable for your water.

Type of plant	Permeate capacity l/h	Outlet amount l/h (Recovery)			
		Ground water	Surface water	Softened water	2nd pass
		40 %	50 %	75 %	85 %
111	50	75	50	17	9
112	100	150	100	33	18
113	150	225	150	50	27
114	200	300	200	67	35

An easy way of checking the outlet amount of the plant is:

$$\text{Outletamount } (l/h) = \frac{100 \; x \; permeatecapacity \; (l/h)}{recovery(\%)} - \text{permeate capacity (l/h)}$$

Ex.: RO 113 with 40% recovery

$$outletamount \; l/h = \frac{100x150}{40} - 150 = 225 \; l/h$$

When the requested amount of outlet water has been obtained, tighten the lock nuts on the outlet valve (B-figure 3) so that it is locked. It is important to check the outlet amount after the lock nuts have been tightened to make sure that the valve has not moved. Both lock nuts must be tightened.
Important! The outlet valve must be locked on the prescribed outlet amounts. If the needle valve is closed so that the outlet amount is reduced, then the plant membranes will become damaged.

7.2 Adjustment of recirculation amount

Then the recirculation amount (D-figure 3) must be adjusted by loosening lock nut on the recirculation valve. Adjust the permeate amount at maximum 50-200 l/h for RO-111 – 114 respectively, at a temp. of 10-25°C.
If the temp. is below 10 °C, the capacity will be 3 % below normal capacity for every degree under 10 °C.
If e.g. the raw-water temp. is 8 °C, for an RO-114 it means that the permeate capacity is 6 % below the normal 200 l/h, i.e. 188 l/h. At the same time make sure that the pressure on the manometer (E-figure 3) does not exceed 12 bar + inlet pressure from the water supply, however maximum 16.5 bar.
The normal pressure indicated on the manometer in order to obtain normal permeate capacity will be approx. 12-15.5 bar.
When the requested pressure and permeate capacities have been obtained, check again if the outlet amount has been adjusted correctly.
(We recommend that you loosen both lock nuts while the valves are fine-adjusted).
When both valves have been adjusted, they shall be locked with the lock nuts. Please take care not to move the valve when you tighten the lock nut.
NB! When the valves have been locked, the plant shall be started and stopped 4-5 times, and then the flow shall be checked again; the valves are re-adjusted if necessary.
Now check that the quality of the treated water on the permeate hose (A-figure 3); the conductivity shall be below 20 µS/cm (conductivity meter is available as accessory). If the water quality is below 20µS/cm it is OK and the hose can be led back to the hole in the reservoir tank.

The270 litre reservoir tank now will be filled up with treated water <20 µS/cm.
Write the operating data in the enclosed operating journal (see paragraph – Operating journal).

7.3 Deaeration of reservoir pump

The reservoir pump (G-figure 3) shall now be deaerated.
This is done by filling in treated water in the filling hole (N-figure 3) located at the top of the pump head.
Dismount the filling cap and fill in the treated water until it flows over (approx. 3-4 litres), and then refit the filling cap.
The pump has now been deaerated. The pump pressure switch and hydrophore are preset from oru factory and shall not be adjusted.
Note! The reservoir pump (G-figure 3) will not start until the reservoir tank has been completely full. Check that the on/off switch of the reservoir pump is in position ON! (not all pump motors have this on/off switch).
Check that the motor is running in the right direction.
Wait for the reservoir tank to fill up complete (approx. 20 min).
Check that the level sensor (H-figure 3) automatically interrupts the plant when the reservoir tank is full.
NB: Do not touch the level sensor.
Create a large consumption of treated water.
Check if the reservoir pump (G-figure 3) automatic starter.
Let the pump operate a while with a very large flow in order to get possible air out the pump housing.
Check if the pump supplies water and pressure. If the pump does not supply water and pressure, then try deaerating the pump once more as described earlier.
When the reservoir pump is working, shut off the consumption of treated water.
Wait for the reservoir pump to stop automatically.
Note! (on HOH reservoir plants):
The reservoir pump stops 20/30 seconds after the consumption has stopped due to the built-in time delay in the control box.
Re-create a consumption of treated water and this time let the reservoir pump (G-figure 3) empty out approx. 100 litres of the reservoir tank content.
Check that the plant automatically starts up and produces treated water.
This can be read on the plant flow meter (F-figure 3).
The plant has now been started and is ready for use.

8. AUTOMATIC FUNCTION

The RO 100 plant is equipped with a control box with following functions integrated:

- Level sensor for start/stop of high-pressure pump. Alarm low level.
- Solenoid valve inlet raw water.
- Pressure switch for start/stop of reservoir pump (stop 4.2 bar, start 3.7 bar)
- Pressure switch alarm for low inlet pressure <0.5 bar.
- Option extra level switch Alarm high level.

Level control in reservoir tank.
Stop and start of high-pressure pump.
Opening and closing of solenoid valve.
Safety stop of reservoir pump in case of dry-running of tank.
Pressure-switch control of raw-water pressure.
The pressure switch interrupts the plant by too low raw-water pressure < 0.5 bar delayed for 15 seconds. Red lamp in control box indicates a outage of the plant.
Pressure-switch control of the reservoir pump.
Stop and start of reservoir pump – stop at 4.2 bar – start at 3.7 bar.
Stop of pump is delayed by 20/30 seconds.

9. MAINTENANCE AND TROUBLE-SHOOTING

9.1 Maintenance

The RO plant is produced and designed for a minimum of servicing and maintenance. However, there are some functions which should be checked regularly. (The interval is described in paragraph: Service Intervals).
Folowing must be checked regularly:
The capacity of the treated water can be checked on flow meter (F-figure 3).
If the capacity has dropped by more than 10 % of the capacity on the day of start-up, see paragraph: Trouble-shooting.
The quality of the treated water shall be checked with a conductivity meter on the permeate hose (A-figure 3) while the plant is operating.
If the quality of the treated water is ≥ 20 µS/cm, see paragraph: Trouble-shooting.
Check that the pressure on manometer (E-figure 3) is 12-16.5 bar when the plant is in operation. If the pressure is lower than 12 bar, see paragraph: Trouble-shooting.

9.2 Trouble-shooting

This paragraph deals with the problems that may occur on the plant.

9.2.1 Plant capacity has dropped

This capacity can be read on the flow meter (F-figure 3) while the RO plant is operating.

Check:
The operating pressure which must be 12-16.5 bar while the plant is operating; it can be checked on the manometer (E-figure 3). If the operating pressure is below 12 bar, replace pre-filter (M figure 3) with new 5"-5 µ micron filter cartridge. The Micron filter shall also be replaced if it is very dirty. Check also if the raw-water pressure is the same as by start-up. If it is below 2 bar, look for the error in the water supply.
Check:
The raw-water temperature; if the raw-water temperature has dropped compared to the day of start-up (winter/summer), the capacity will also drop, and it will increase at a higher temperature. For every °C± the plant capacity will either drop or rise by approx. 3%
That means if the temp. has dropped by 4 °C compared to start-up time, the capacity can drop by approx. 12 %. This is quite normal and does not require a service check.
Rinse the membranes for 20 min with the recirculation valve (D-figure 3) completely closed and outlet valve (B-figure 3) completely open. After rinsing, adjsut these valves again as described in paragraph: Start-up of Plant.
Check if:
there is a bend on the outlet hose (C-figure 2). If the plant capacity cannot be improved by these solutions, the membranes are clogged and must be cleaned; See paragraph: Cleaning – Replacement of membranes.

9.2.2 The quality of the treated water is higher than 20 µS/cm

Check if:
there is a bend on the outlet hose (C-figure 2).
Correct the error by replacing the hose.
Check if:
the plant has been out of operation for long, i.e. 1 week or longer.
Correct the error by letting the plant operate for 1-2 hours and then keep it operating minimum every 3rd day. Remember to adjust outlet/re-circulation valve after finished flush; See paragraph: Start-up of Plant.
Check if:
there are leaks on the raw-water side. If so, raw-water comes in connection with the treated water in the reservoir tank.
Repair this fault by sealing possible leaks, empty the reservoir tank of water and let the plant fill in new, clean and treated water <20 µS/cm.
If none of these errors are present, the plant membrane is defective and must be cleaned/replaced, see paragraph: Cleaning/Replacement of Membrane.

9.2.3 Alarm low inlet pressure

This can be checked on the control box (E-figure 1)-(C-figure 3).

- Power: fixed light
- Alarm: fixed light
- Inlet: flashes slowly

The plant will restart automatically 3 times and then generate a permanent alarm.

- Power: fixed light
- Inlet: flashes slowly
- Alarm: fixed light

Check if:
the pre-filter (M-figure 3) is choked.
Correct the error by shutting off the raw water and release the pressure on the pre-filter. Then replace the pre-filter by a new 5"-5 µ micron filter. Cut off the power supply of the plant for 20 seconds. Reconnect power.
Check if:
the raw-water pressure is present.
Correct the error in the raw-water supply. When the raw-water pressure has been re-established, cut off the power supply for 20 seconds. Reconnect the power.
If none of above-mentioned errors are found, it may be the pressure switch located on teh pre-filter (M-figure 3) that is defective, or the PCB in the control box is defective.

9.2.4 Alarm transport pump

- Power: Fixed light
- Alarm: Fixed light
- Transport pump: flashes slowly

Check if:
the transport pump is requesting water.
Create a water consumption on the outlet of the transport pump – if the pump is running, find the error elsewhere; plant and pump control are in order.

9.2.5 Level low

- Power: fixed light
- Level: flashes slowly.

The reservoir tank has run dry. Let the tank fill up completely, then the transport pump starts up again automatically.
Note! If the reservoir tank has been totally drained, the transport pump will only re-start when the reservoir tank is completely full. This is controlled by the level sensor (H-figure 3).
Check if:
the pressure switch on the transport pump is defective.
Short the pressure switch by making a bridge between the two plugs. If the pump is only running when this bridge is connected and there is a "call" for water, then the pressure switch is defective and must be replaced.
Check if:
the on/off switch of the reservoir pump is set at OFF. If none of these errors are found, the PCB

or the reservoir pump is defective and must be replaced. If this does not help, the capacity may be too small.

9.2.6 Level high

- Power: fixed light
- Level: flashes slowly
- Alarm: fixed light

Check if:
the inlet solenoid valve is closed and tight. If the permeate hose (A-figure 3) drips constantly when the plant is not operating, the solenoid valve is defective and must be replaced.
Check if:
the level sensor (H-figure 3) is prevented from interrupting the plant (stuck).
Remove possible blockage from the level sensor.

9.2.7 The plant is not running

Check if:
The main power is connected.
Check if:
The main switch on the control box is connected – I.
Check if:
The plant needs to operate? – Full reservoir tank or no "call" for water!
If none of above-mentioned errors are found, the high-pressure pump or the control PCB may be defective; Check these.

9.2.8 Reservoir pump stops and starts

The reservoir pump stops and starts at 10-15-second intervals without consumption of treated water.
Check if:
there is a leak on the piping from plant outlet to consumption of treated water, or a defect at consumer, e.g. would a defective/leaky valve create a small water consumption which makes the reservoir pump start and stop constantly.
Check if:
the non-return valve in the suction sensor of the reservoir pump, located at the bottom of the reservoir tank, maybe is leaky/defective. If so, it must be replaced.
Check if:
The reservoir pump hydrophore lacks air. The hydrophore must always be pre-pressurized at 2.9 bar.

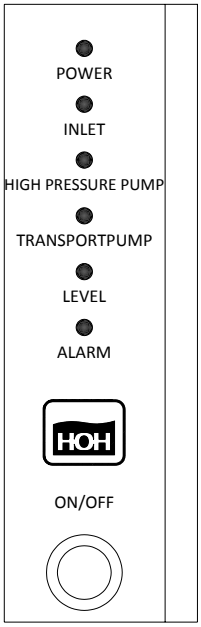
9.2.9 Hard water is measured at the soft-water tap

Check if:
there is salt in the softening plant salt tank.
Fill in salt tablets and start regeneration.
Check if:
The softening plant is adjusted at the current hardness of the raw water (see paragraph: Start-up of Plant).
If none of above-mentioned errors are found, the softening plant must be service-checked.

9.2.10 Survey of Alarm Conditions

LED functions:
During normal operation the LED shines in correspondence with the components it represents.
Error conditions:

External stop high-pressure pump: (Transport pump is working)	(1) shines + (3) flashes slowly (½ Hz) (Power) (High-pressure pump)
External stop transport pump: (High-pressure pump does not work) can be jumped by start-up	(1) shines + (4) flashes slowly (Power) (Transport pump)
On-time alarm on transport pump: (Nothings's working - permanent condition)	(1) shines + (6) shines + (4) flashes slowly (Power) (Alarm) (Transport pump)
Re-start alarm on transport pump: (nothing is working – permanent condition)	(1) shines + (6) shines + (4) flashes quickly (5 Hz) (Power) (Alarm) (Transport pump)
Too low inlet pressure (re-start): (HP pump stopped – TP pump is working)	(1) shines + (2) flashes slowly (Power) (inlet)
Too low inlet pressure (alarm): (Nothings is working – permanent condition)	(1) shines + (6) shines + (2) flashes slowly (Power) (Alarm) (Inlet)
Too low water level (no alarm): (TP pump stopped – HP pump is working)	(1) shines + (5) flashes slowly (Power) (water level)
Too high water level (alarm): (nothing is working – permanent condition)	(1) shines + (6) shines + (5) flashes quickly (Power) (Alarm) (water level)



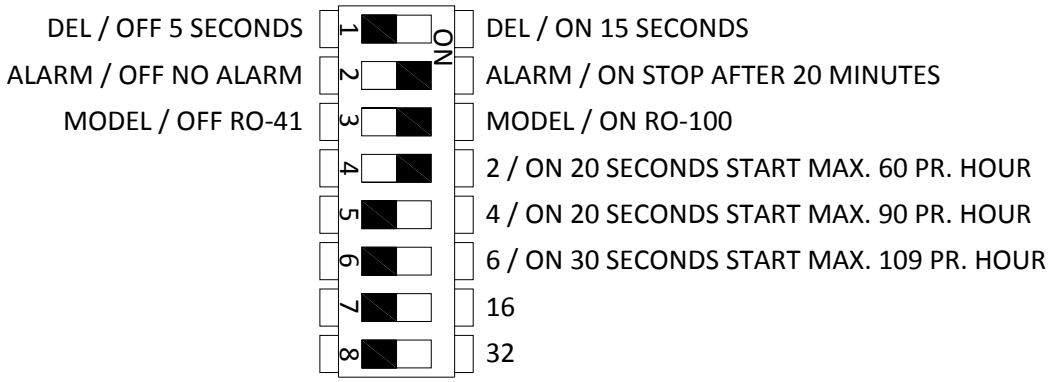
9.2.11 Time Settings

It is possible to change the various time settings for Start, Stop and Alarm, plus start-up delay of pumps.

Use of jumpers/switches:

No. 1 High-pressure pump
No. 2 Transport pump
No. 3 Selection of RO model
Nos. 4-6 Transport pump

FACTORY SETTING



10. TECHNICAL SPECIFICATION

10.1 Technical specifications

Signature	Designation	Type/data
P1	High-pressure pump	Procon: 2539/Grundfos MG80B, 12-16.5 bar, 1x230V, 0.55kW
P2	Reservoir pump	CHI2-50, 1x230V, 0,80 kW
FI 1	Flow meter	Ø20 PVC
PI 1	Manometer	0-40 bar, ¼"
V1	Needle valve	¼" brass
V2	Needle valve	¼" brass
Y1	Solenoid valve NC	½" brass
PS 1	Pressure switch NO	¼" 0.5 bar
PS 2	Pressure switch NC	½" 2-6 bar
QIS 1 (Option)	Conductivity meter	½" connection for sensor

10.2 Technical data:

RO 100 SERIES	RO 111	RO 112	RO 113	RO 114
Capacity l/h*	**50**	**100**	**150**	**200**
Maximum recovery, %**	40-80	40-80	40-80	40-80
Salt retention, %	95-98	95-98	95-98	95-98
Conductivity, µS/cm	<20	<20	<20	<20
Reservoir l	100	100	100	100
Electrical Connection, V	230	230	230	230
Electrical consumption, kW	1.3	1.3	1.3	1.3
Electrical frequency, Hz	50	50	50	50
Pipe inlet, Diameter, "	½"	½"	½"	½"
Concentrate outlet, Diameter, "	10mm Hose	10mm. Hose	10mm. Hose	10mm. Hose
Permeate outlet, Diameter, "	¾"	¾"	¾"	¾"
Height, mm	850	850	850	850
Length, mm	580	580	580	580
Depth, mm	580	580	580	580
Max.water temp.	25°C	25°C	25°C	25°C
Max. water press.	7 bar	7 bar	7 bar	7 bar
Min. water press.	2 bar	2 bar	2 bar	2 bar
Weight (full)	150 kg	151 kg	152 kg	153 kg
Number of membranes	1	2	3	4

* At drinking water quality 10°C, 3 bar, max. 500 mg/l total salt content ± 15% capacity

** Calculated by drinking water quality of 500 µS/cm

11. FUNCTIONAL DESCRIPTION

Raw water must be drinking water quality with residual chlorine. If there is free chlorine in the raw water >0.1 mg/l, a carbon filter must be installed ahead of the plant.
The stated capacities and qualities are based on a salt content in the raw water of maximum 500 mg/l TDS and 10 °C. In case of a different raw-water quality, the supplier must be contacted. (See the paragraph: Water Quality).
The raw water is pressed through the RO module (modules) by means of a high-pressure pump. The desalinated water penetrates the RO membrane and is collected in the reservoir. The water containing the concentrated salts (the concentrate) is led through the RO module/s and on to drain. The ratio permeate/drain has been pre-adjusted manually by means of a needle valve.
The raw water passes a pre-filter with a 5-micron cartridge. If necessary, a dechlorination filter with active carbon cartridge (aux. equipment) can be installed by a chlorine content of >0.1 mg/l.
A pressure switch on the raw-water inlet stops the raw-water pump in case of too low pressure (<0.5 bar). To get the plant started again, you have to switch off the power and then reconnect again (interrupt for 20 sec.).
The permeate hose is equipped with level switch controlling the raw-water intake and the high-pressure pump stop and start. Likewise the reservoir pump is stopped prior to possible dry-running of the tank.
Desalinated water is automatically led to consumption by means of the reservoir pump. Consumption, however, is limited by the plant permeate capacity and by the storage size 100 l.
If necessary it is possible to install an ion exchange unit (mixed-bed) in order to improve the water quality, and/or a UV-lamp for sterilization (aux. equipment).
The plant is fitted on casters and should be assembled with flexible connections. Place the plant so that it can be pulled out for service check-ups.
Under normal operating conditions the RO.membranes have a long life. But even with a good raw-water quality there will be a coating of impurities and thus a slow reduction of the permeate capacity. When the capacity has been reduced by 10 %, the membranes must be cleaned. if regular cleaning is done at correct intervals, the original capacity can easily be restored.
NB! The permeate capacity is also directly dependent on the raw-water pressure and the water temperature. the capacity will deteriorate by poor pressure and temperature, and it will increase by rising temperatures. In case of reduced capacity, the raw-water pressure and temperature shall be checked before proceeding to the cleaning procedure.

12. CLEANING/-REPLACEMENT OF MEMBRANES

Read paragraph 12 carefully before cleaning/replacing the membranes.

12.1 Cleaning Procedure:

Following shall be done prior to cleaning:
Empty out approx. 50 litres of treated water from the reservoir tank.
Switch off the power supply.
Shut off the raw-water supply.
Dismount the raw-water inlet hose at the opposite end of the pre-fitler (M-figure 3).
Take out the micron filter located in the pre-filter housing (M-figure 3). Fill the filter housing with raw water before re-mounting it.
Open the outlet valve (B-figure 3) completely and close the recirculation valve (D-figure 3).
Lead the permeate hose (A-figure 3) away from the reservoir tank and lead the hose up into the bucket containing cleaning agent.
Take a plastic bucket, , minimum 25 litres, or order special CIP tank for RO111-114 from HOH Water Technology A/S and fill in 25 litres of warm raw water 40°C.
Place the bucket on a somewhat higher level than the pre-filter (M-figure 3)
Lead the raw-water connection all the way into the bucket.
Short the wires on the safety pressure switch fitted on the filter housing (M-figure 3) by connecting the 2 wires or jump the terminals 1 and 4.
Lead the outlet hose (C-figure 2) into the bucket with the heated water.
Start the plant by re-connecting power to the plant.
When it starts up, the plant will make some “noise” until the warm water has entered the plant.
Ooperate the plant in this way for 20-30 minutes, until the plant components (membranes/-pump) are heated up to approx.. 40°C. Replace the water in the bucket continuously in order to keep the water at 40°C during the heating period.
When the plant components are heated up at 40 °C, you must stop the plant by switching off the power.
Re-fill water into the bucket, 40°C. We recommend using treated water for this purpose.
Mix in citric acid in the ratio 2% in 25 litres of water. I.e. ½ kg citric acid for 25 litres of water.
Re-start the plant by switching on the power.
Operate the plant for 5 min. with this solution of citric acid.
Then stop the plant for 5 min.
Operate the plant again for 5 min.

This procedure must be carried out 3 times, i.e. 3 times 5 minutes in operation and 3 times 5 minutes' break between each operating period.
If the membranes are very clogged due to belated cleaning, it is recommended to perform the cleaning procedure from the start once more with a new solution of citric acid. This extra cleaning should not be necessary if the capacity has only dropped by 10 %.
When the cleaning procedure is finished, the cleaning agent shall be disposed of in a sensible way, and the raw-water hose (A-figure 2) shall be reconnected to the raw water.
The outlet hose (C-figure 2) shall be led back into the drain.
Refit (possibly a new) 5"-5µ pre-filter in the pre-filter housing (M-figure 3) and reconnect the wire to the pressure switch on the pre-filter.
Restart the plant and flush the plant for 20-30 minutes.
When the plant has been flushed, adjust the outlet/recirculation valve (B-figure 3) again. (see paragraph: Start-up of Plant).
When the plant operating pressure, which can be read on the manometer (E-figure 3) has reached 12-16.5 bar, check the permeate hose (A-figure 3) to make sure the water quality is <20 µS/cm (conductivity meter can be supplied as aux. equipment). If the water quality is >20 µS/cm, then the plant must operate for 10-20 min. before making a new check-up.
Check if the plant capacity, read on the flow meter (F-figure 3), is satisfactory.
When capacity and water quality are alright, lead the permeate hose (A-figure 3) back into the reservoir tank.
Now the plant is ready for normal operation.

If the plant does not reach full capacity after cleaning, you must perform a new cleaning.
If, after this cleaning, the capacity of the membranes is still not satisfactory, the membranes must be discarded and new ones must be installed.

12.2 Replacement of Plant Membranes

Before carrying out a cleaning, the following must be done:
Empty out approx. 50 litres of the reservoir tank.
Switch off the power.
Disassemble the plastic hoses located on the top of the membrane (J-figure 3).
Note: how the hose is connected, since it is <u>important</u> that the hose be refitted in the same way!
The hoses can be pulled out by pushing the ring placed on the stainless fitting; if pushed all the way down, the hose can be pulled out.
Dismount the U-lock located at the end of the membrane pipe. (The U-lock holds the membrane endplate in place). Remove the split pin from the U-lock and pull the lock out of the pipe.
The end plate can now be pulled out of the membrane pipe by wriggling the end plate from side to side and simultaneously pulling upwards.
Now pull the membrane out of the membrane pipe. Note! at which end the large black O-ring is situated on the outside of the membrane. When the new membrane is fitted, this O-ring must be fitted at the same end of the membrane as the old one, i.e. if the O-ring sits at the top of the membrane pipe, the O-ring of the new membrane must also be installed so that the O-ring gets to be placed at the top when the membrane is fitted inside the membrane pipe.
When the membrane has been replaced and the end plate has been refitted with the U-lock inserted, remount all hoses.
Note! When the hose connection is pushed into the stainless fitting, the "ring" must again be pressed all the way down and the same applies to the hose.
When all connections have been refitted and end plates are securely locked with the U-lock, the plant must be restarted.
You may replace pre-filter (M-figure 3) by new 5"-5µ membrane filter cartridge.
Reconnect the raw water.
Open the outlet valve (B-figure 3) completely.
Close the recirculation valve (D-figure 3) completely.
Dismount the permeate hose (A-figure 3) and lead it to drain.
Reconnect the power to the plant.
The plant will now be operating. Let it flush this way for 20-30 minutes.
Then adjust the outlet valve (B-figure 3) and the recirculation valve (D-figure 3), see paragraph: Start-up of plant.
Check the plant operating pressure on manometer (E-figure 3); it should be 12-16.5 bar which is normal operating pressure.
Check that the water quality is <20 µS/cm. This is checked on the permeate hose (A-figure 3) (Conductivity meter is available as aux. equipment). Lead the hose back when the quality is satisfactory.
Check on flow meter (F-figure 3) if the plant capacity is satisfactory, maximum 150 l/h. The plant is now in normal operation and ready for use.

<u>Write in the operating journal:</u>

1. Date of replacement of membranes
2. New capacity of plant (F-figure 3)
3. Water quality (µS/cm)
4. Plant operating pressure (E-figure 3)

5. Raw water temperature
6. Raw-water pressure

13. VARIOUS ENCLOSURES

13.1 Flowsheet

13.2 Layout drawings

13.3 Wiring diagram

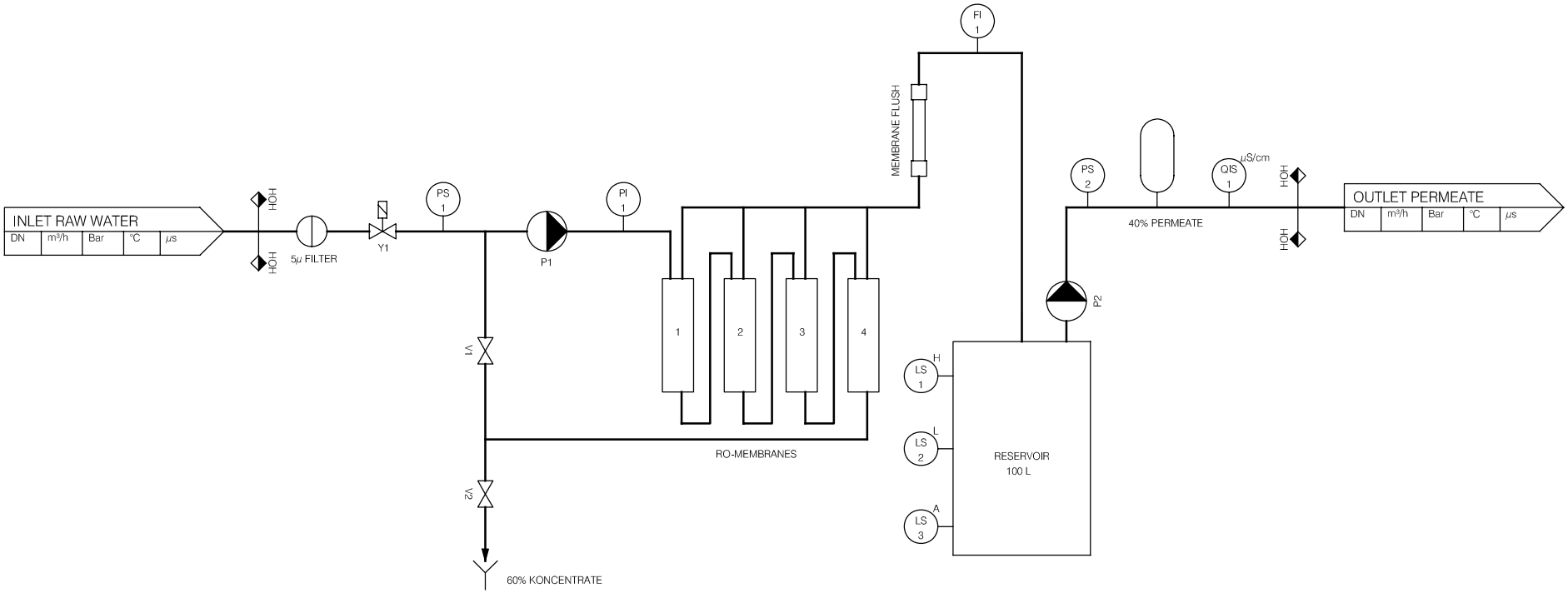
13.4 Servicing and maintenance table

13.5 Operating journal

13.6 Spare-parts list RO-100

13.7 Spare-parts drawing

13.8 Declaration of conformity



2-WAY VALVE
NEEDLE VALVE
NON-RETURN VALVE
SOLENOID VALVE
HYDROPHORE
HOH HOH LIMIT OF DELIVERY

PS PRESSOSTATE
FI FLOWMETER
LS LEVEL SWITCH
PI MANOMETER
PUMP
DRAIN

Scale	Designed by	Date	Quot. no.	Order no.	Drawing size	Material	Weight [kg]
	TC	98.05.25			A2		

Reverse Osmosis Plant RO 100
P & I Diagram

Last Revision Date	Drawn	Text

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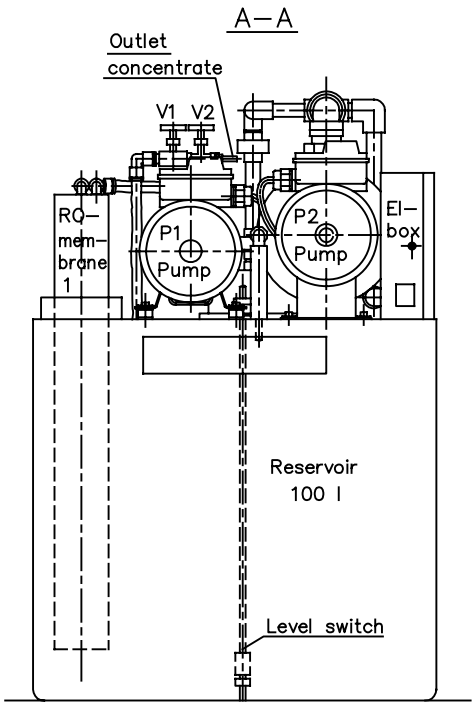
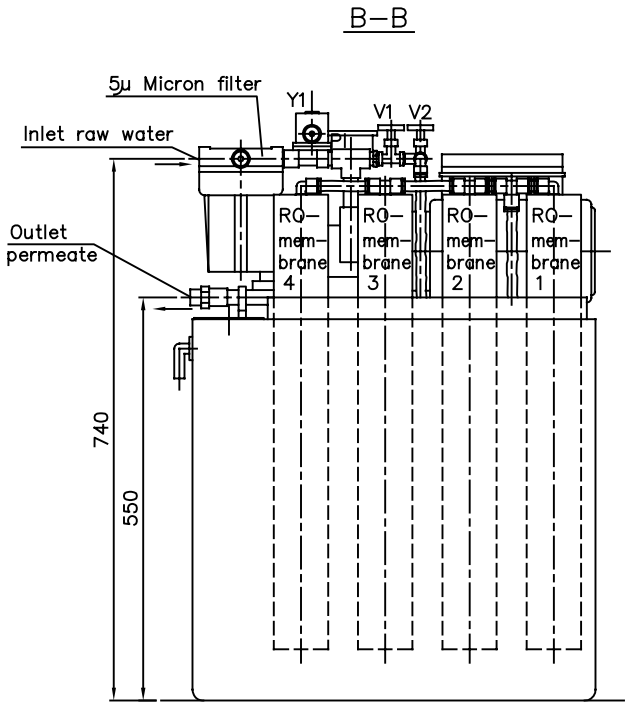
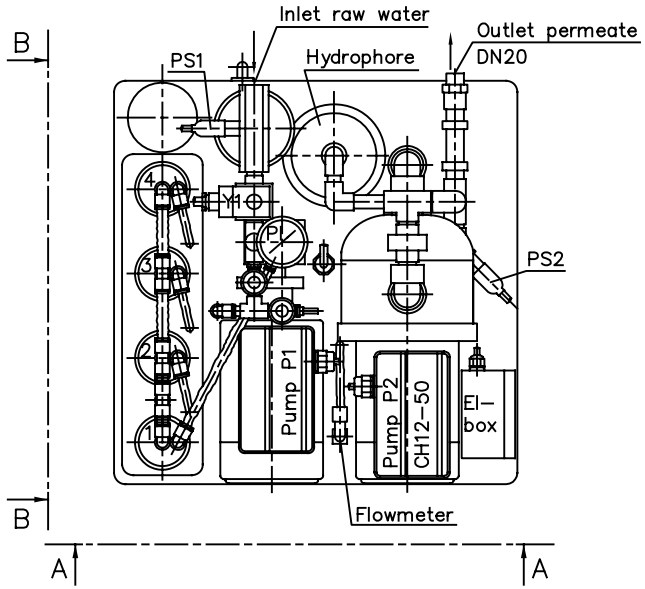
Geminivej 24, DK-2670 Greve
Tel. +45 43 600 500
Fax. +45 43 600 900
Web: www.hoh.com
E-mail: hoh@hoh.com

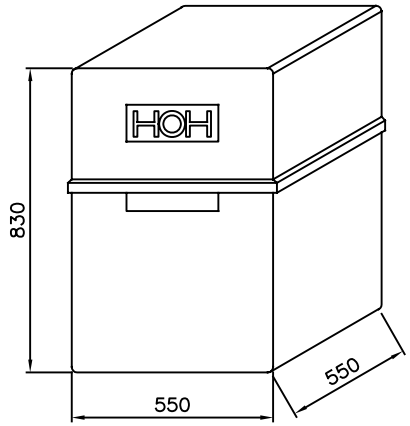
Drawing no.	Page	Revision
S172P01		B

CAD file: S172P01B









Scale	Designed by	Date	Quot. no.	Order no.	Drawing size	Material	Weight [kg]
1:5	TC	98.05.25			A2		

Reverse Osmosis Plant RO 100
Arrangement drawing

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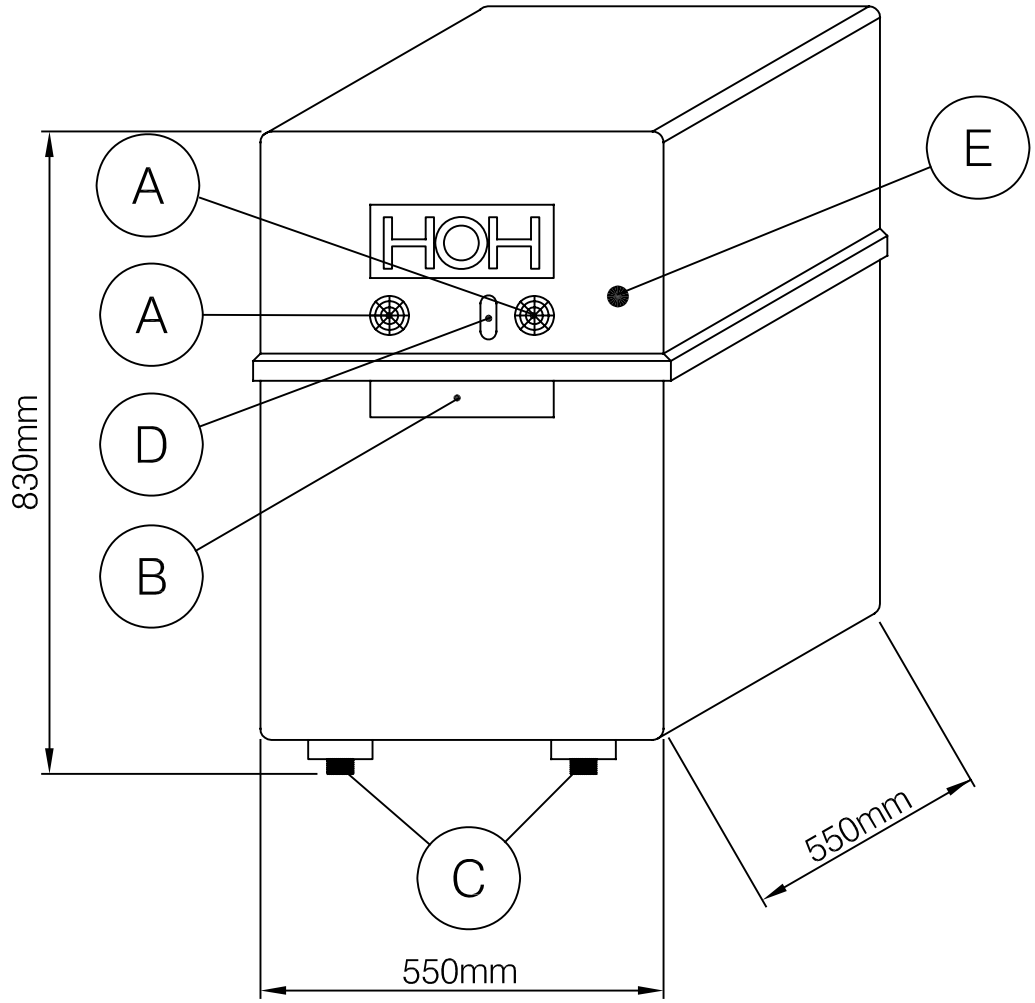
HOH Water Technology A/S
Geminivej 24, DK-2670 Greve
Tel. +45 43 600 500
Fax. +45 43 600 900
Web: www.hoh.com
E-mail: hoh@hoh.com

Drawing no.	Page	Revision
S172M05		
CAD file: S172M05		



A: Airintake for electric motors
B: Handle for moving of the plant
C: Wheels
D: Flowmeter for reading of permeate
E: Diode-alarm (lacking water pressure)

Scale	Designed by	Date	Quot. no.	Order no.	Drawing size	Material	Weight [kg]
	TC	95.11.10			A4		

RO SERIE 100
FIGURE 1
FRONT OF THE PLANT

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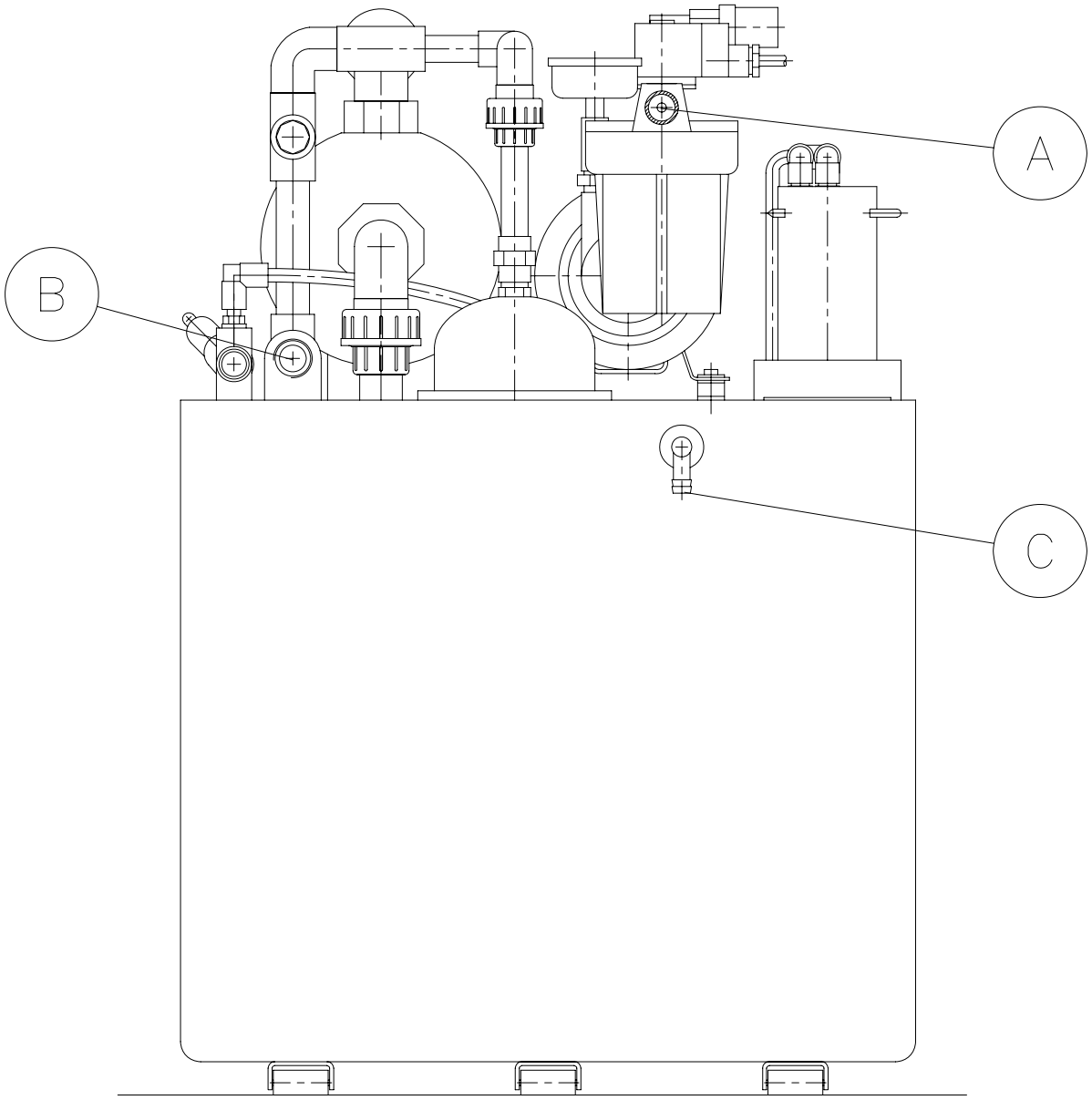
Geminivej 24, DK-2670 Greve
Tel. +45 43 600 500
Fax. +45 43 600 900
Web: www.hoh.com
E-mail: hoh@hoh.com

Drawing no.	Page	Revision
S172M07		A
CAD file: S172M07A		



A: Raw water inlet (1/2" pressure hose)
B: Outlet treated water (3/4" pressure hose)
D: Overflow brach (should be led to floor outlet)

Scale	Designed by	Date	Quot. no.	Order no.	Drawing size	Material	Weight [kg]
	TC	95.11.10			A4		

RO SERIE 100
FIGURE 2
BACKSIDE OF THE PLANT

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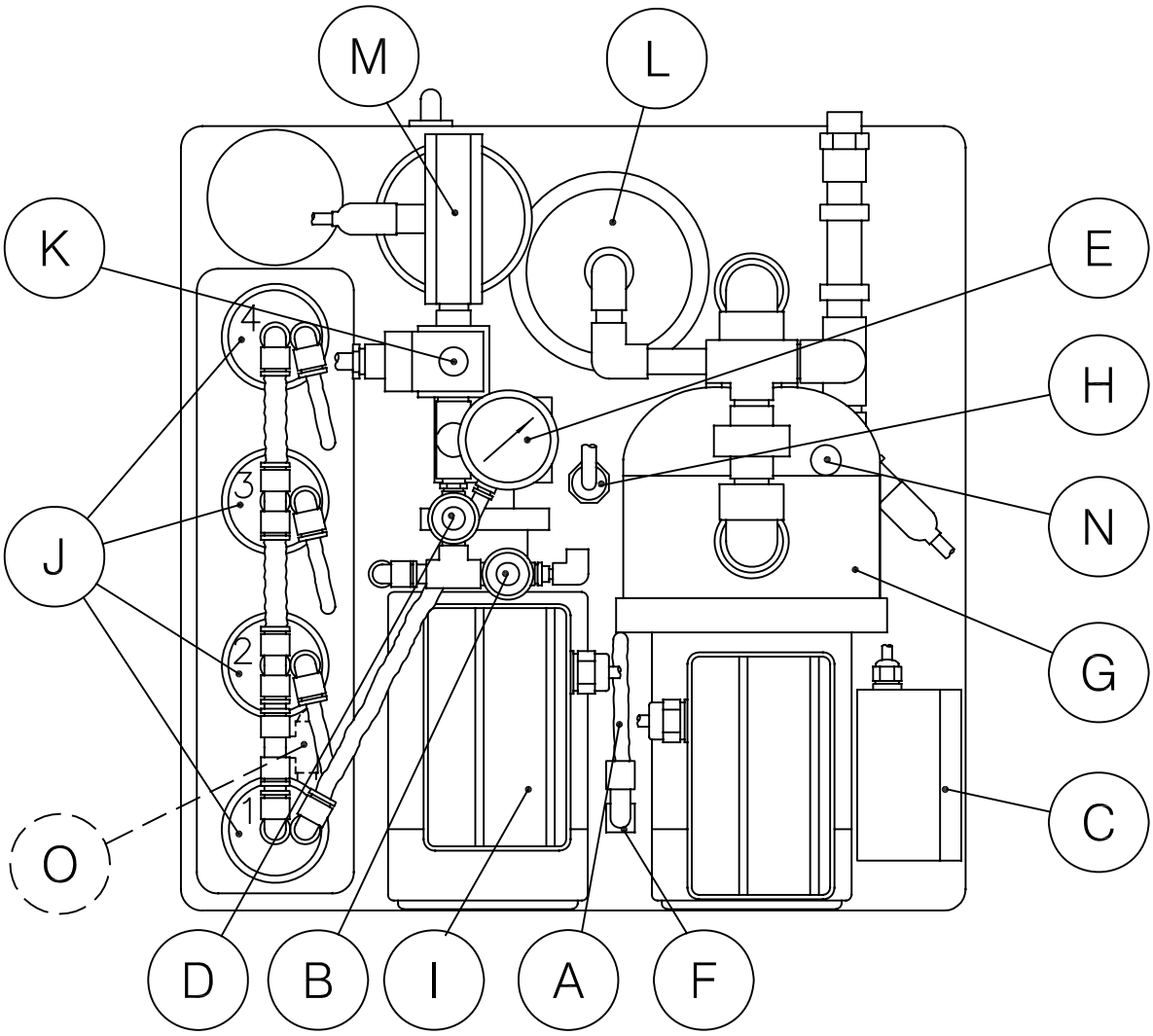
Geminivej 24, DK-2670 Greve
Tel. +45 43 600 500
Fax. +45 43 600 900
Web: www.hoh.com
E-mail: hoh@hoh.com

Drawing no.	Page	Revision
S172M08		C
CAD file: S172M08C		



A: Permeate hose
B: Outlet valve
C: Control box
D: Recirculation valve
E: Manometer
F: Flowmeter
G: Reservoir pumpe
H: Level stick
I: High pressure pump
J: Membranes
K: Solenoid valve
L: Hydrophore
M: Prefilter 5" - 5μ
N: Filler hole
O: (Option) Sensor for the conductivity meter

Scale	Designed by	Date	Quot. no.	Order no.	Drawing size	Material	Weight [kg]
	TC	95.11.10			A4		

RO SERIE 100
FIGURE 3
PLANT SEEN FROM ABOVE

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Geminivej 24, DK-2670 Greve
Tel. +45 43 600 500
Fax. +45 43 600 900
Web: www.hoh.com
E-mail: hoh@hoh.com

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S172M09		A
CAD file: S172M09A		

Page		Revision
1	Electrical connections.....	24-09-2008 09:30
2	Circuit board.....	24-09-2008 08:57

R051, 100, 270	Appr	24-09-2008			Main no.	Page no.
	Rev		HO		S347	I1
	Drw	11-06-2007	HO			
		Date	Ass	Appr		

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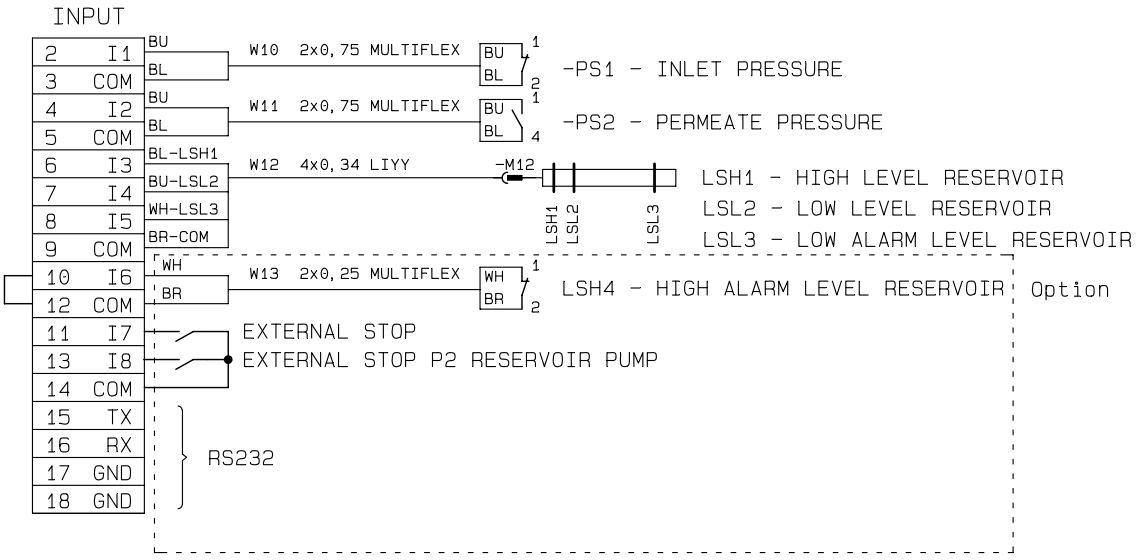
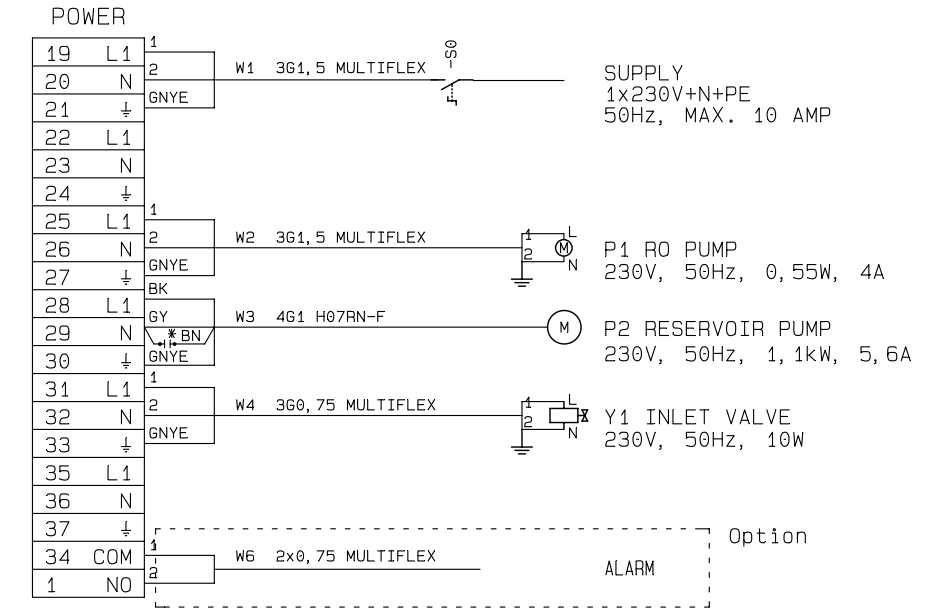
Drawing no.
64(000)





* CONDENSATOR : 20µf/450 VDB

RO51, 100, 270 Electrical connections	Appr	24-09-2008			Main no. S347	Page no. 1
	Rev					
	Drw	16-02-2007	HO	JRI		
		Date	Ass.	Appr		

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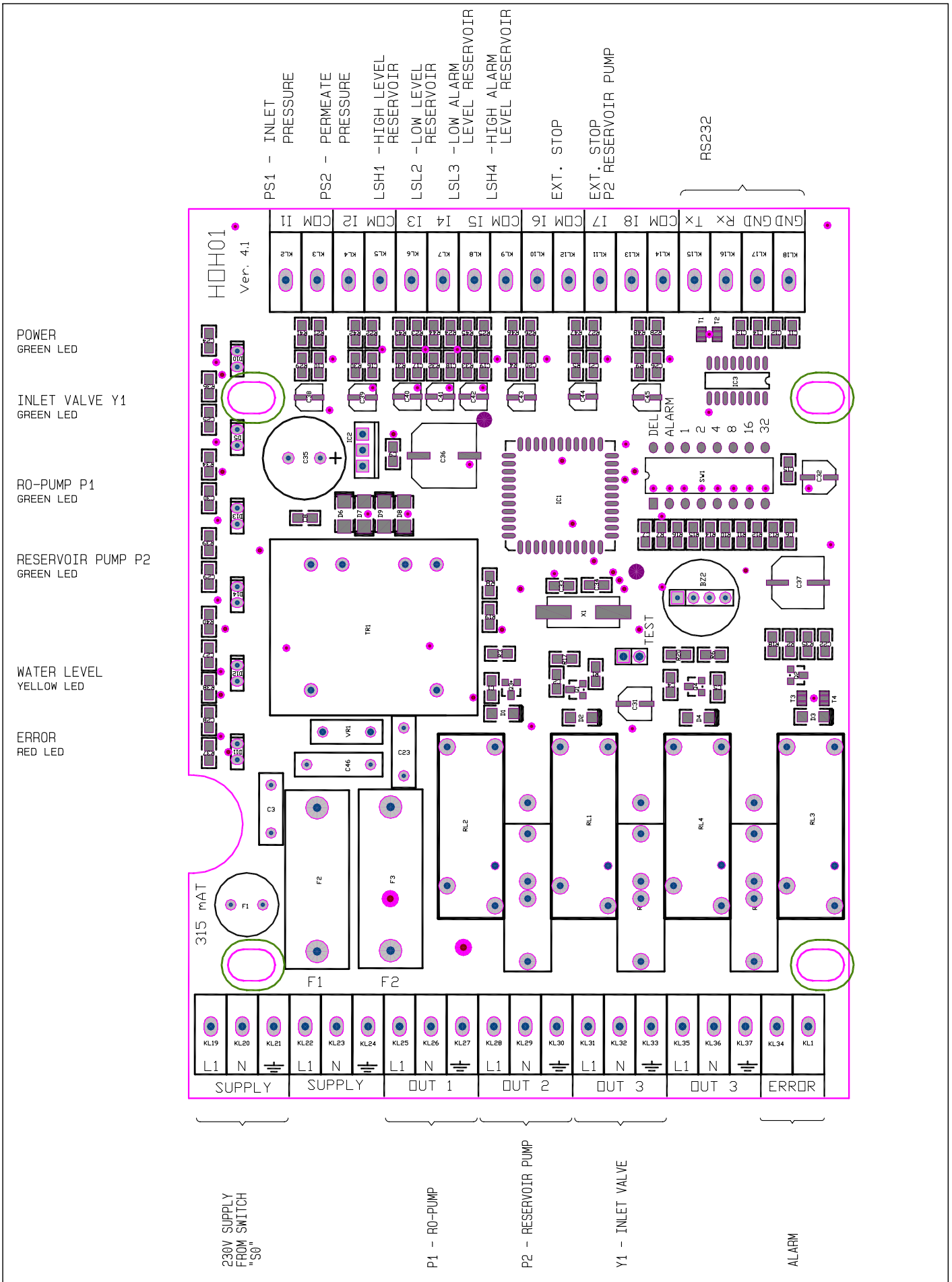

RO51, 100, 270

Circuit board

Appr	29-09-2008		
Rev			
Drw	11-06-2007	HO	JRI
	Date	Ass.	Appr

Main no. S347

Page no. 2

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Draw. no. 64(000)

13.4 Service og Maintenance Diagram

Service and maintenance of RO-100 R unit	Every day	Every week	Every 5th - 8th week	Every 25th week .(or as required)	Every 52nd week
(Not standard) Check-up of soft-water supply (soft water < 0.5°dH)					
Check-up of permeate capacity can be read on flow meter (F-figure 3) when the plant is operating. Check of UV lamp.					
Check-up of plant operating pressure. This can be read on the manometer (E-figure 3) with the plant in operation.					
Check-up, disinfection and cleaning of plant and reservoir tank.					
Cleaning of membrane(s) or sooner by 10 % capacity reduction					

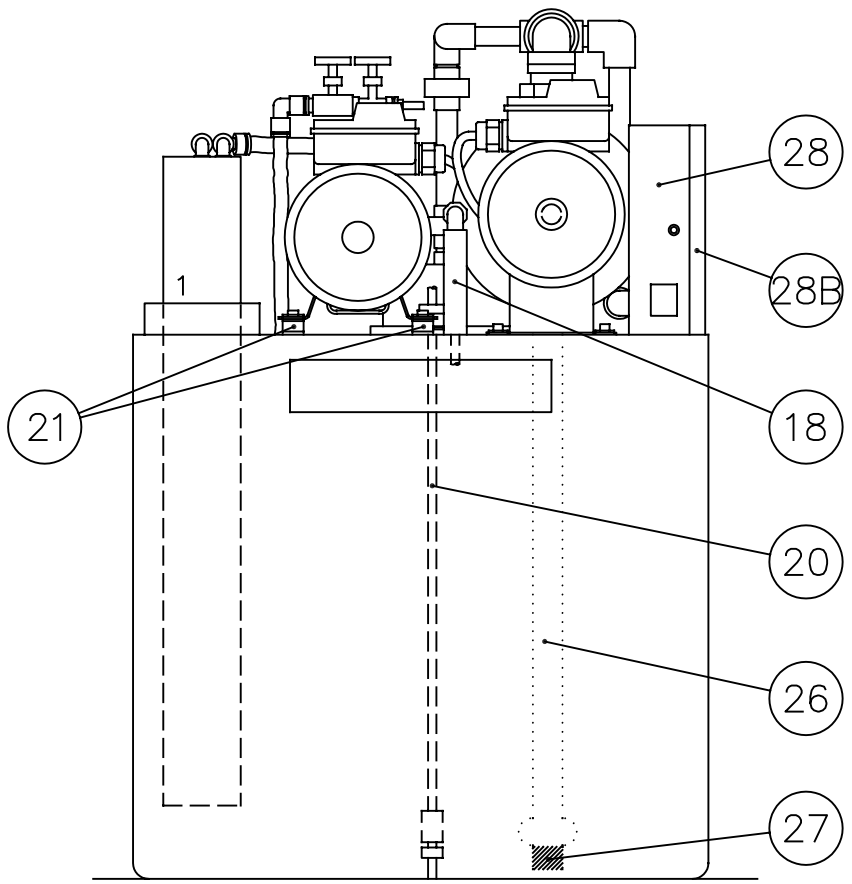
13.5 Operating Journal

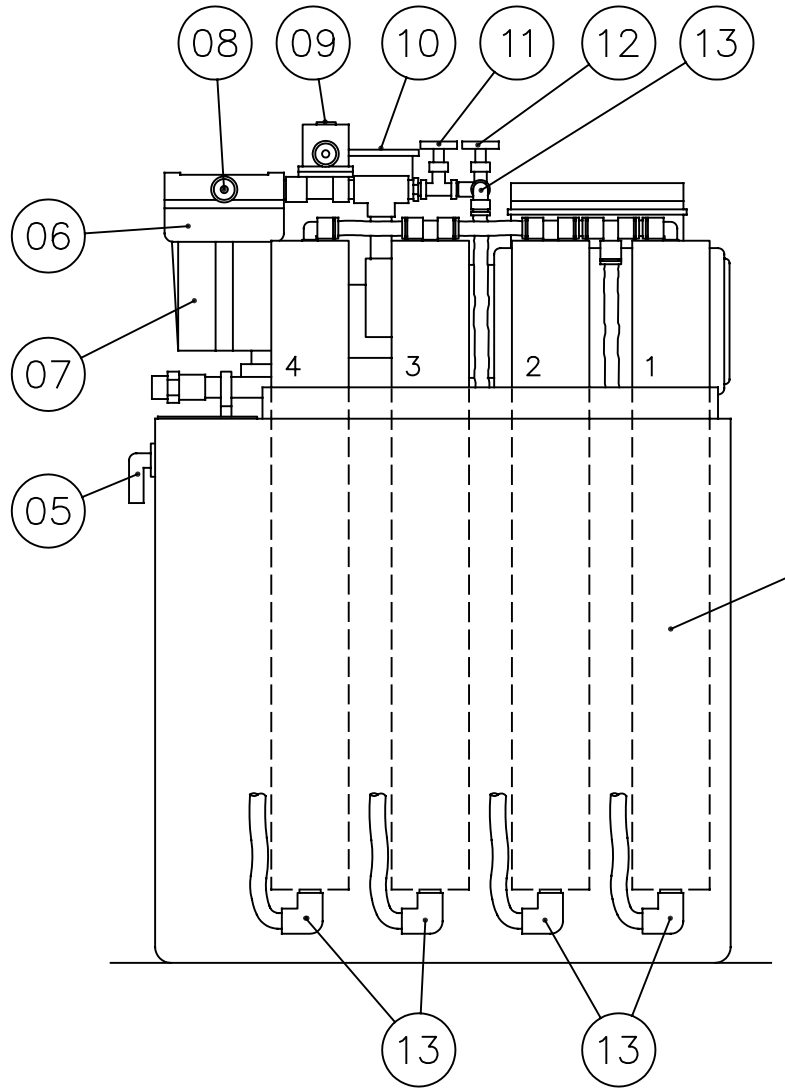
Date	Signa-ture	Softening unit (option) if installed		Raw water		RO-unit			Remarks
		Hardness dH° < 0,5	Salt-check	Raw-water pres-sure [bar]	Raw-water-tempera-ture [°C]	High-pressure pump oper-ating pres-sure [bar]	Flow meter Permeate [l/h]	Conductiv-ity meter (option) [µS/cm]	Disinfection date replacement of sterile air filter and re-placement of UV

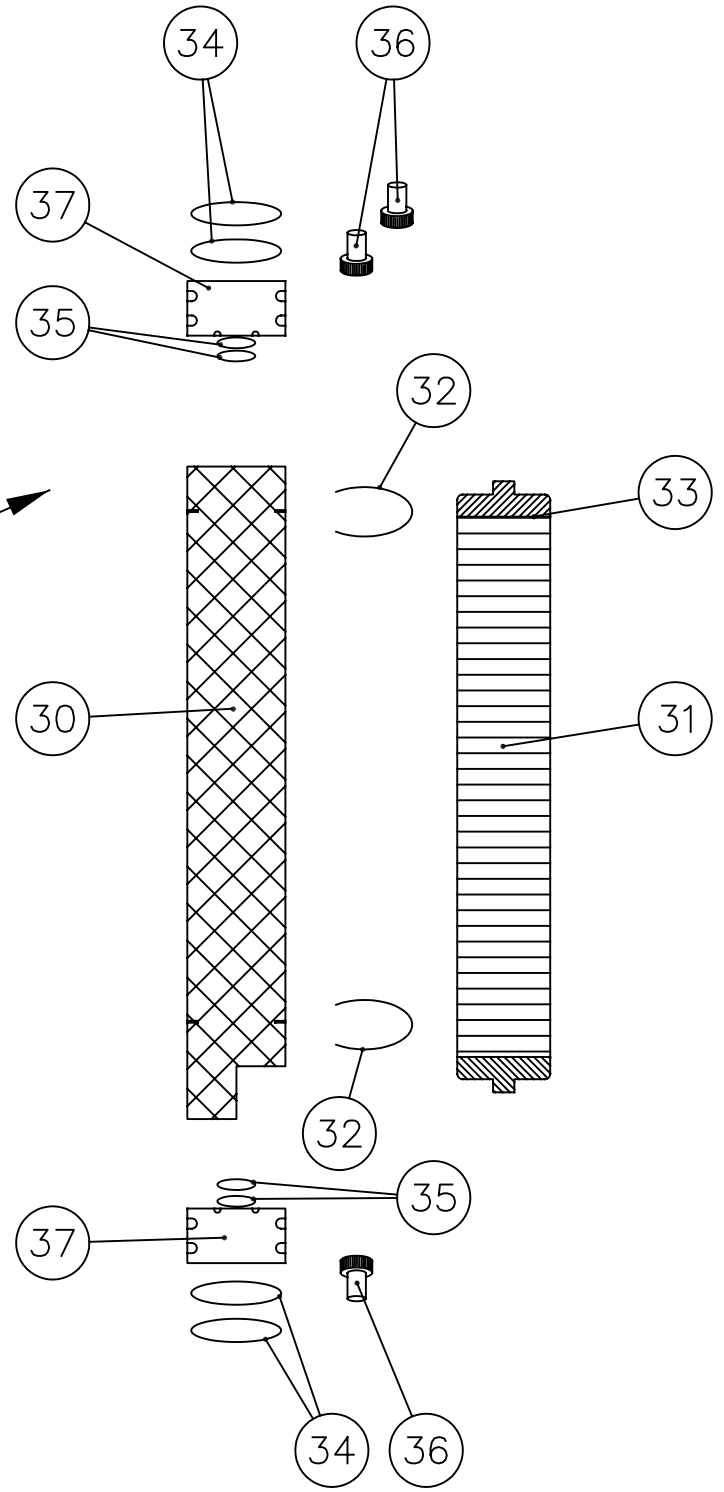
13.6 Spare Parts list RO-100

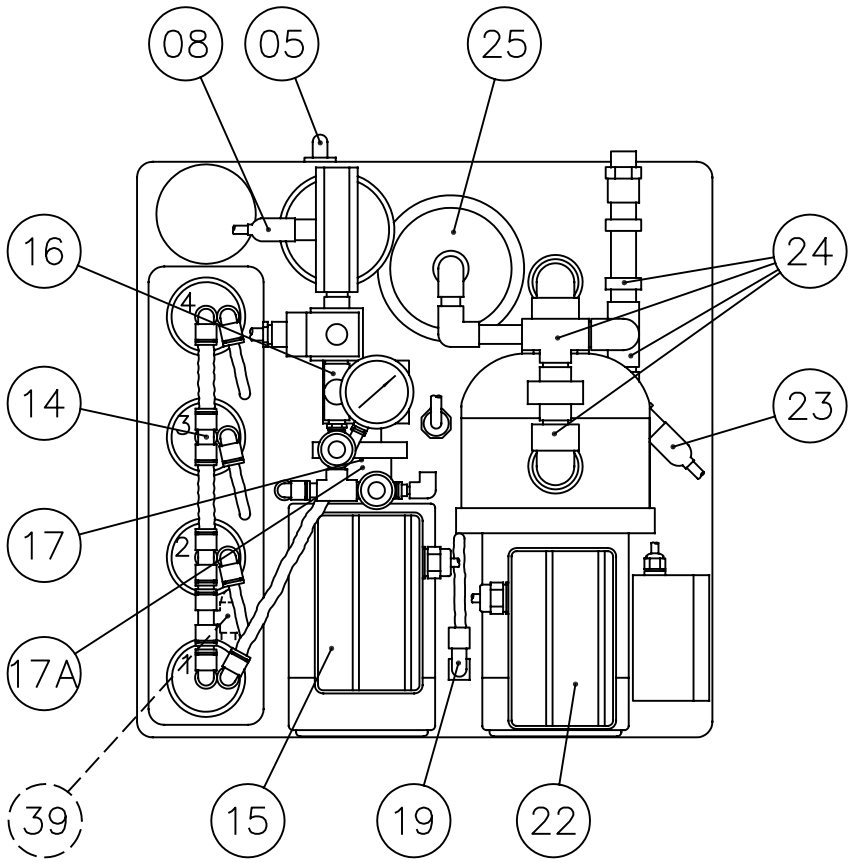
Item No.	RO Plant	Recommended spare parts	Article No.
01	Cover		
02	Cabinet complete		451202031
03	Rails		451202345
04	Air intake		451202330
05	Overflow nozzle		405100730
06	5" filter housing		321400000
07	5"-5µ filter cartridge	2	321410000
08	Pressure switch 0.5 bar	1	452550005
09	Solenoid valve ½	1	200752004
10	Manometer 0-40 bar	1	452216000
11	¼" needle valve 3.0 mm	1	200731010
12	¼" needle valve 3.3 mm	1	200731002
13	Quick coupler 10 mm elbow	1	454090010
13-A	Quick coupler 12 mm elbow	1	454090012
14	Quick coupler 10 mm tee	1	454095010
15	High-pressure motor		451202410
16	High-pressure pump		451202405
17	Coupling for high-pressure pump	1	451202450
17-A	Rubber coupling		451202425
18	Flowmeter, permeat		453010000
19	Plastic fitting (flowmeter)		061282021
20	Level sensor No. 3	1	451404425
20-A	Cable No. 6 for level sensor 0.5 m	1	451404450
21	Vibration damper		451202440
22	Reservoir pump - 230 Volt		454100710
23	Danfoss push-button switch, KPI 0.2-8 bar	1	451202802
24	Distribution system		451202215
25	Hydrophore		451404570
26	Piping suction rod		451202220
27	Non-return valve/bottom valve		200320032
28	Automatic controller, complete		451404406

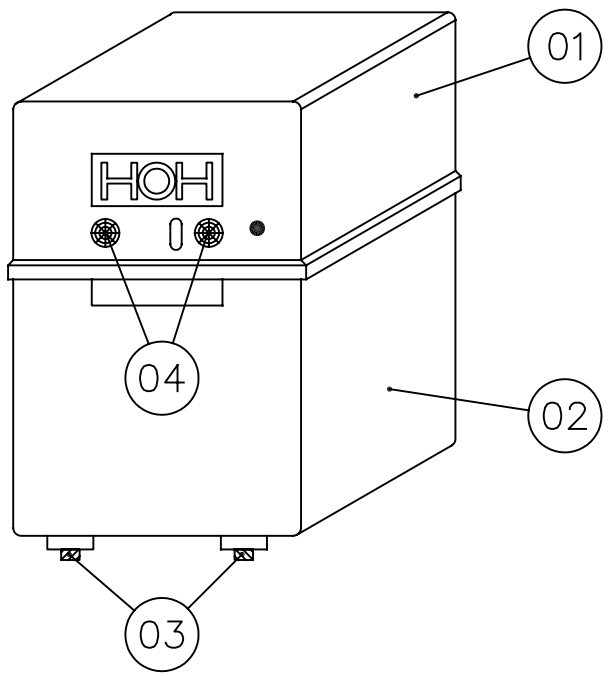
Item No.	RO Plant	Recommended spare parts	Article No.
	Membrane/pressure tube		
30	Pressure tube		451202068
31	Membrane	1-4	451202038
32	U-lock		451202120
33	Lip ring for membrane		
34	O-ring outside (large)	4-16	451202212
35	O-ring inside (small)	4-16	451404215
36	Snap coupler 10x¼", base	1	454065010
36-A	Snap coupler 12x¼", base	1	454065012
37	End plate (top) 2 holes	2	451202217
40	Membrane flush		451202840
	Various		
-	10 mm plastic hose	1 m.	454001010
-	12 mm plastic hose	1 m.	454001012
	Option		
-	Filter housing 10" complete		321401000
-	Filter key		321417100
-	Carbon filter 10"		321413000
-	Sensor (conductivity meter)		452536000
-	Conductivity meter		452525000
-	CIP tank, complete		451404573











Scale	Designed by	Date	Quot. no.	Order no.	Drawing size	Material	Weight [kg]
1:5	TC	98.05.25			A2		

RO K100 series
Drawing of spare parts

Last Revision Date	Drawn	Text

HOH Water Technology A/S
Geminivej 24, DK-2670 Greve
Tel. +45 43 600 500
Fax. +45 43 600 900
Web: www.hoh.com
E-mail: hoh@hoh.com

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S172M06		
CAD file: S172M06		

EC Declaration of Conformity
for Machinery
Directive 98/37/EC, Annex II, A
Low Voltage Directive
EMC Directive

HOH Water Technology A/S
Geminivej 24 - DK-2670 Greve
tel.: +45 43 600 500 - fax: +45 43 600 900
hoh@hoh.dk - www.hoh.dk

herewith declares that:

- **RO 111, 112, 113, 114**

- is in conformity with the provisions of the Machinery Directive (directive 98/37/EC)
- is in conformity with the provisions of the following other EC directives
- Low Voltage Directive (73/23/EEC)
- EMC Directive (89/336/EEC)

- Place: Greve, Denmark

- Date: 01-01-2006

CE

_____

Signature

Name: Lars Jensen