



BWT PERMAQ® PRO 2000
Reverse Osmosis Plant

UK

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1. GENERAL INFORMATION

This installation and operating manual applies to BWT PERMAQ® Pro 2000 total desalination plant.

This installation and operating manual contains important information about the correct installation and operation of the BWT Pro 2000 plant.

1. Enclosed "Start-up test" (section 13.4) shall be completed and filed together with the operating journal.
2. Operating journal shall be updated as described in "Operating journal" (section 13.5).
3. Floor drain must be available in the immediate vicinity of the plant.
4. The BWT PERMAQ® Pro 2000 plant removes more than 99 % of all salts, and that is why you need to be alert to possible post-treatment with mixed bed or similar, if a better water quality is requested.
5. The authorised agent takes on full responsibility without costs for BWT who, however, grants a 12 months guarantee inclusive of replacement of defective spare parts, on condition that the parts are returned to BWT along with a specification of the fault and stating production month/year (plant no.).
6. The warranty becomes invalid, if the plant is not commissioned by an authorised BWT service technician.

7. The warranty becomes invalid, if maintenance intervals are not met.

Your BWT PERMAQ® Pro 2000 plant is constructed in a compact design with reservoir (option) and softening unit (option) installed externally so that the plant takes up as little space as possible and can be installed in the most suitable way.

This instruction should be read carefully before installing and starting up the plant. Correct installation and operation will also form the basis of a factory warranty.

The BWT PERMAQ® Pro 2000 plant with its compact and finished design is easy to install, since all installations are pre-assembled and tested in our factory.

Your BWT PERMAQ® Pro 2000 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 BWT PERMAQ® Pro 2000 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.

Feed water: Is the water which will be desalinated by BWT PERMAQ Pro 2000 plant.

TDS: The amount of totally dissolved salts, measured in (mg/l).

Conductivity: Is the designation of salt concentration of the water, measured in (µS/cm). The lower the value, the better the water quality.

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

RO: The abbreviation for Reverse Osmosis.

Transport-pump: Is the pump which transports the treated water from the plant reservoir to the consumer.

Level switch: Is a switch, which gives a signal when the BWT PERMAQ® Pro 2000 plant must either be started or stopped, and it stops the transport pump in case of dry-running of the reservoir tank.

Softening plant: Is a pre-filter which softens the water, that means it re-

moves hardness from the water.

°dH is a term indicating the hardness of the water and the amount of dissolved salts in the water. The lower the number, the softer water

3. POSITIONING OF THE PLANT

The plant must be placed in a non-freezing environment on a level foundation, so that the water in the reservoir tank (option) does not overflow when the tank is full.

The foundation must be able to tolerate a weight load of 200 kg in total which is the approximate weight of the RO plant in operation. However, remember to take into account the weight of the softening unit and the reservoir tank!

The max. outside measures of the RO plants are WxDxH:

720 x 720 x 1690 mm, but when positioning the plant you must take into account that a softening unit (option) and possibly a reservoir tank (option) have to be installed too.

You have to allow for 1000 mm extra height in order to be able to take out the plant membranes.

Also, there has to be made room on the left side of the plant for the water installation, especially the outlet hose from the plant must be considered: The hose may never be bent!

Positioning of plant must be in such a way that the air intake at the top of the pump never becomes covered.

Furthermore, there are readings that have to be performed on the front of the plant, e.g. flow meter and possible alarm in case of lacking water pressure. Consequently the front must not be covered up, but should always be visible.

In case of a stoppage, situations may arise where the level in the reservoir (option) overflows.

Therefore, there shall always be a drain in close proximity of the plant, placed in such a way that the overflowing water does not cause any damage.

If there is no floor drain which has been dimensioned to the full capacity of the RO unit near the plant, installing the plant is at your own risk.

4. WATER QUALITY

The feed water, which is to be treated in the BWT PERMAQ® Pro 2000 plant, must be softened drinking water quality with maximum 500 mg/l TDS. Max. temperature: 35 °C. The plant is adjusted at 10 °C in our factory.

The feed water may maximum contain:

- * Hardness: 0.5 °dH (obtainable by installation a softening unit (option))
- * Fe: 0.05 mg/l
- * Mn: 0.02 mg/l
- * Cl: 0.1 mg/l
- * Turbidity: 1.0 NTU
- * SDI: 3.0 %/min

Water quality (contact BWT for technical advice)		
Content	Symptom	Preventive action
TOC, BOC and COD	Can cause slimy as well as firm hard film.	Can in some cases be micro-filtrated or removed by means of a carbon filter.
Iron, Manganese (ocher)	Precipitation of iron gives a reddish-brown film and precipitation of manganese gives a black deposit.	Sand filter – oxidation, softening, greensand.
Calcium, magnesium (hard water)	The membrane scales.	Softening, antiscalant.
Silica	The membrane scales.	Antiscalant.
SDI (silt)	The membranes gets clogged.	Microfiltration (absolute), ultrafiltration, flocculation.
Oil	The membrane is greasy from oil.	Carbon filter.
Particles	The membrane gets clogged due to hard deposits.	Microfiltration.
Chlorine, pesticides, organic solvents	Membrane deformed. Permeate capacity and quality changed and cannot be CIP-cleaned back to the original capacity. The deformation is not visible.	Free chlorine shall be removed by active carbon filter and chemical cleaning, either with Thiosulphate or sulphite.
Bacteria	Membrane is clogged by slime.	Chlorination + de-chlorination, UV, micro-filtration 0.2 µS/cm and ultra-filtration.

* KMnO₄ max: 10 mg/l

If there are doubts about the raw water composition, a water analysis must be made. The plant must be connected to a water pressure of minimum 3 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.

For connection of raw water to the softening unit, see the enclosed guide on the softening unit.

5.1 Connection of soft water to the RO-plant

Connect soft water to the connection on the left side of the plant on the backside (see encl. 13.2). We recommend connection with ¾" flexible pressure hoses. BWT stock complete assembly kits for the BWT PERMAQ® Pro 2000 series.

The best operating result is obtained by connection to minimum ¾" feed water pipe. In this way you obtain the necessary pressure and flow to the plant. In case of a too small feed water connection, there will be a risk of outage on the plant due to lacking water pressure/amount, e.g. during flushing of membranes, when the plant is started up, and a bad function of the softening plant.

5.2 Connection of permeate (desalinated water for consumption)

Connect desalinated water (water for consumption) to the water connection on the reservoir (option) – the reservoir pump is recommended connected with ¾" flexible pressure hoses.

Important! Totally desalinated water can accelerate corrosion, consequently you should always use corrosion proof piping for the treated water, e.g. stainless steel or PVC pipe.

5.3 Connection of outlet hose (concentrate)

The outlet valve (concentrate) shall be fitted with a 14 mm hose (enclosed). The hose shall be led to floor drain. (If a bent piece of hose has been fitted on the outlet valve, this shall be removed first).

Important! The outlet pipe must not be led all the way down into the water in the floor drain, as there is then a risk it will get sucked back into the plant in case of a stoppage.

Important! It should never be possible for the outlet hose to become bent or in any other way clogged, as it would damage the membrane(s).

6. ELECTRICAL CONNECTIONS

Note! The electrical connections must be made in compliance with local regulations.

The electrical connection to the BWT PERMAQ® Pro 2000 plant must be as follows:

*Voltage: 3x400 V+N+PE

*Net: TN-S

*Frequency: 50 Hz

*Recommended Fuse: 16 Amp

See also electric diagram under encl. 13.3

7. START-UP OF THE PLANT

Read section below carefully before starting up the plant.

When the plant is started for the first time, the attached Start-up test (see Section 13.4) must be filled and archived together with

Operating Journal (see Section 13.5).

- Check before start-up that all water and electric connections are made in compliance with local regulations.
- Before start-up the softening plant (option) shall be adjusted at the current hardness in the feed water supply and then commissioned.
- Assuming that the softening plant is now in operation, check that it supplies soft water at the soft-water control valve (V4). Sampling set is included in deliveries of new softening plants (see instruction manual in the box).
- Pull out the permeate hose from the reservoir tank (option) and lead it away from the reservoir to a drain. (This does not apply to plants with quality flush (option)).
- Open the outlet valve completely (see encl. 13.7 Pos. 6).
- Now switch on the plant power supply. The plant will now be operating.
- Check that the motor runs in the right direction.
- Now the plant must operate and flush to drain for 20-30 minutes before re-adjusting the outlet valve.
- After completed flushing, adjust the outlet valve (see encl. 13.7 Pos. 6 and recirculation valve 13.7 Pos. 1).

7.1 Adjustment of outlet amount

Important! Read the entire chapter before adjustment is started.

The outlet amount must be adjusted and which amount is suitable on your plant depends on the feed-water quality. Too high water recovery will damage the plant membranes. On

condition that the raw water complies with the water quality requirements, it can operate at a recovery rate of 70-80% with softening depending on the amount of organic material in the water.

BWT PERMAQ® Pro	Permeate capacity (l/h)	Outlet amount (l/h) (with softened water)		
		Surface water (70% recovery)	Surface water (75% recovery)	Groundwater (80% recovery)
2010	600	257	200	150
2020	1200	514	400	300
2030	1700	729	567	425
2040	2300	986	767	575
2060	2800	1200	933	700
2080	3300	1414	1100	825

An easy way to check the outlet amount from the RO-plant, is:

$$\text{Outlet amount (l/h)} = \frac{100 \times \text{Permeate capacity (l/h)}}{\text{Recovery(\%)}} - \text{Permeate capacity (l/h)}$$

Ex.: BWT PERMAQ® Pro 2020

with 80 % recovery:

$$\text{Outlet amount} = \frac{100 \times 1200}{80} - 1200 = 300 \text{ (l/h)}$$

When the desired amount of outlet water has been obtained, tighten the counter nuts on the outlet valve so that it is locked. It is important that the outlet amount is checked after counter nuts have been tightened to make sure that the valve has not moved. Both counter nuts must be locked/tightened. Important! The needle valve must be locked on the prescribed outlet amounts. If the needle valve is closed so that the outlet amount becomes reduced, it will damage the plant membranes.

7.2 Adjustment of recirculation amount

Adjust the recirculation amount by loosening the counter nuts on the recirculation valve. Adjust the amount of permeate so it corresponds to the values in the table, at a temperature between 10-25 °C.

If the temperature is below 10 °C, the capacity must be 3% lower than normal capacity for each degree below 10 °C.

E.g. if the feed water temperature is 8 °C, for an BWT PERMAQ® Pro 2030 it means that the permeate capacity will

be 6 % below the normal 1700 l/h, i.e. 1598 l/h.

When the requested pressure and permeate capacities have been obtained, check again if the outlet amount has been adjusted correctly. (It is recommended to loosen both counter nuts while fine-adjusting the valves).

When both valves have been adjusted, lock both valves with the counter nuts. Take care not to move the valves when tightening the counter nuts.

Important! Both counter nuts must be locked/tightened on the valves.

NB! After the valves have been locked, the plant must be started and stopped 2 times, and then the flow shall be checked again – the valves can then be readjusted if necessary.

Check on the high-pressure manometer that it shows the correct operating pressure.

Please note that the operating pressure may vary by different temperatures and capacities.

BWT PERMAQ® Pro	2010	2020	2030	2040	2060	2080
Pressure after HP-pump (bar)	19	19	19,5	18	17	15
Flow after HP-pump (l/h)	1750	2425	3250	4250	5500	6125
Flow permeate (l/h)	600	1200	1700	2300	2800	3300
Flow concentrate (l/h)	150	300	425	575	700	825
Flow recirculation (l/h)	1000	925	1125	1375	2000	2000

8. AUTOMATIC FUNCTIONS

The BWT PERMAQ® Pro 2000 plant is equipped with a control box which has following built-in control functions:

- Level switch (option) for start/stop of high pressure pump
- Indication of low water level and stop of transport pump (option)
- Solenoid valve controls feed water inlet
- Pressure switch for start/stop transport pump (option)
- Alarm will go off when feed water pressure drops below 0.5 bar for more than 2 min
- Stop of pump is delayed by 20/30 seconds.
- Extra level switch, Alarm High level (Option).
- Alarm conditions and DIP-switch - see section 9.2.10 and 9.2.11.

9. MAINTENANCE AND TROUBLE-SHOOTING

(See also encl. "13.5 Operating journal").

9.1 Maintenance:

The BWT PERMAQ® Pro is produced and designed for a minimum of maintenance and service. However there are some functions which should be checked regularly, therefore it is important to comply with maintenance intervals.

Maintenance intervals are compiled by updating BWT PERMAQ® Pro's operating journal "13.5 Operating journal".

Daily:

- Capacity permeate FI1
- Conductivity (option) QIS 1
- Pressure after the high-pressure pump PI1
- Feed water pressure
- Feed water temperature
- Draw daily feed water samples (applies only if a softening unit is installed ahead of the BWT PERMAQ® Pro). If the water hardness after a softening plant is above than 0.5 °dH check the salt tank and refill if necessary.

Every month:

- Flushing of the membranes must be done at least once a week. Open valve V3 completely for half an hour while the plant is operating. Then adjust valve V3, so that the concentrate flow becomes 20-30% again, see chapters 7.1 and 7.2

Biannually:

- Check of pump. Follow the manufacturer's instructions.
- Check pipelines and connectors for leaks.
- Check all pressure switches, i.e. function and settings.

Note! If the plant needs to be taken out of operation for a long time, or there is a risk it might be exposed to frost, each membrane element must be preserved.

How long the plant can be out of operation before the membranes need to be preserved, depends on the intensity of the organic growth. By surface water the membranes must be preserved at a standstill lasting 3 days or longer, and by ground water the membranes must be preserved at a standstill lasting 7 days or longer.

For preservation, fill the membranes with a following solution:

Mix proportion	Preservation [%]	Frost protection [%]
Mono Propylene Glycole	-	20.0
Sodium-bisulphite	1.0	1.0

For longer-lasting preservation be aware of organic growth. When frost-protecting you also need to be aware that the pH-value should never drop below pH 3. In that case there will be a risk that the bisulfite oxidises into sulphuric acid.

Following must be checked regularly:

- The capacity has dropped by more than 10% compared to the value at start-up
- The pressure after the high-pressure pump has increased compared to the value at start-up
- The conductivity has increased (option) compared to the value at start-up

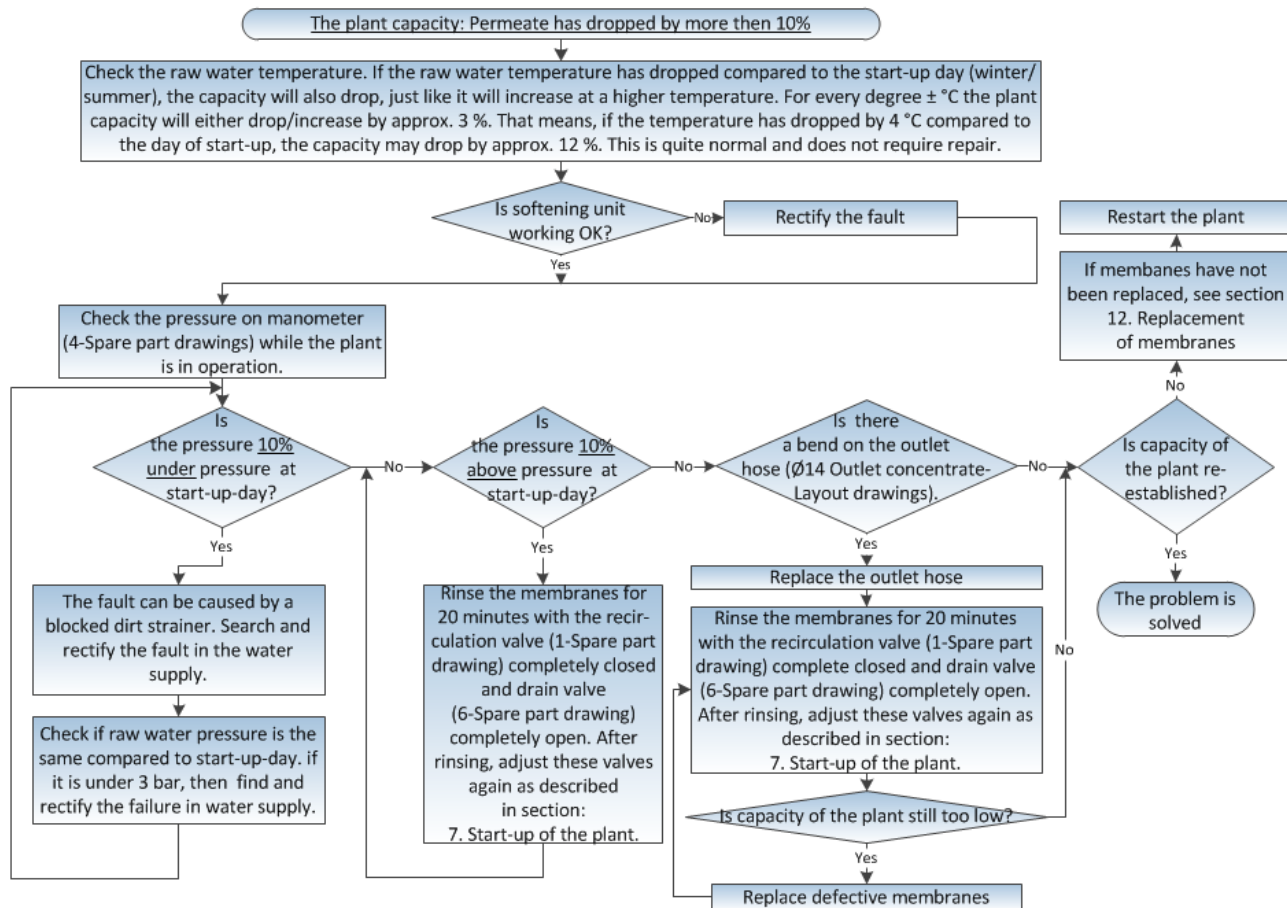
If the plant operating conditions and/or capacity change compared to the start-up day, the plant must be checked in preparation for a possible cleaning of the membranes and/or adjustment of the plant capacity.

For problem solving, see chapter "9.2 Troubleshooting".

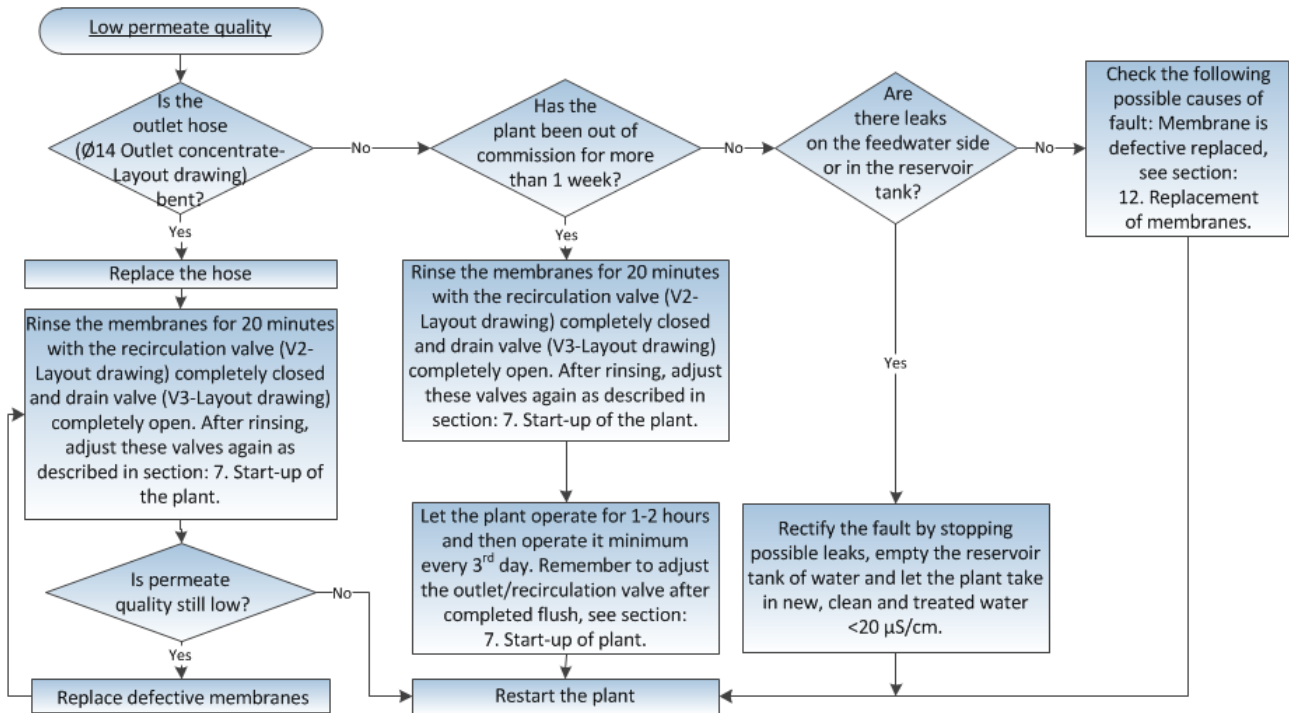
9.2 Troubleshooting

This section deals with the problems that may arise on the plant.

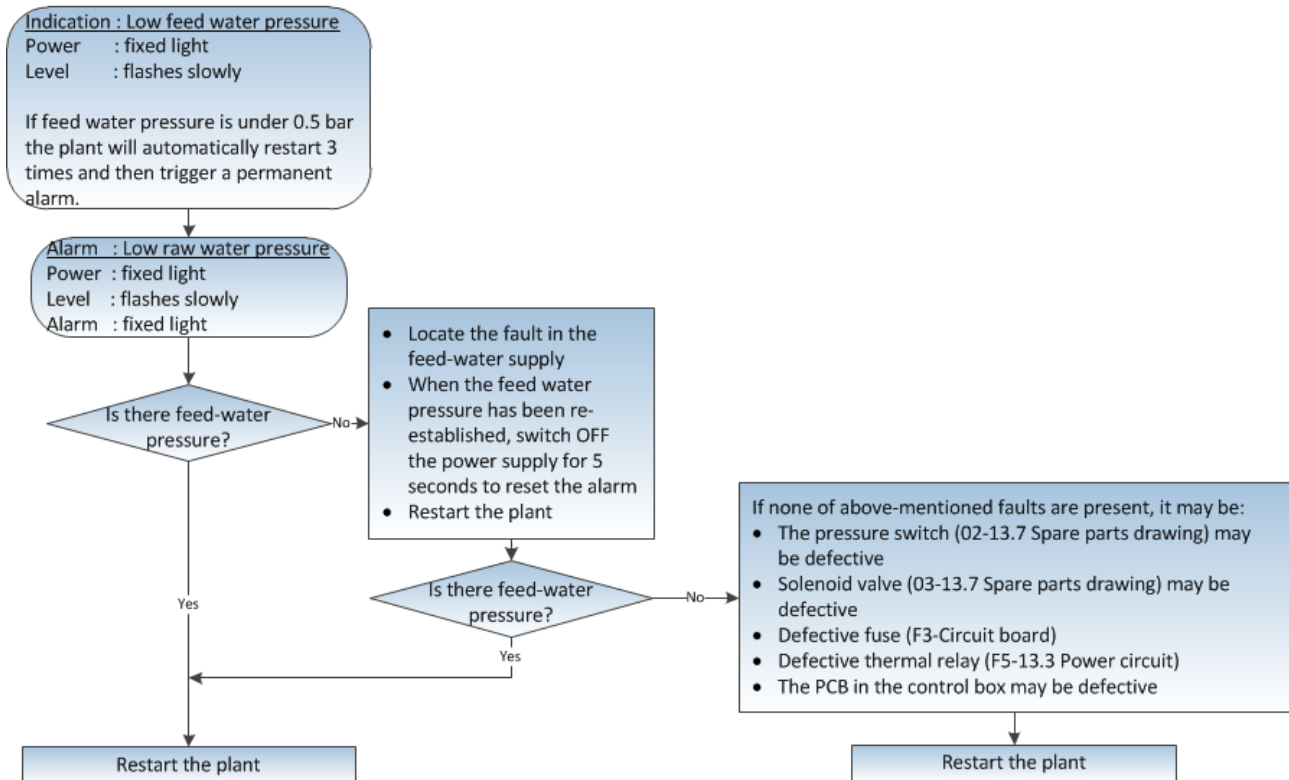
9.2.1 The plant capacity has dropped



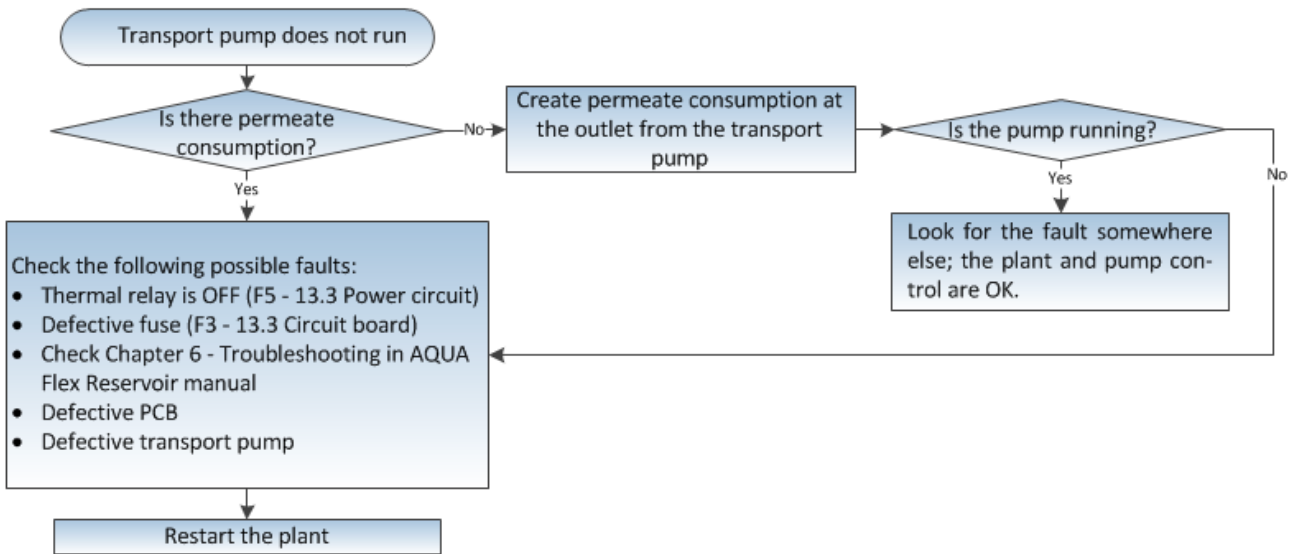
9.2.2 The quality of the treated water is higher than 20 µS/cm



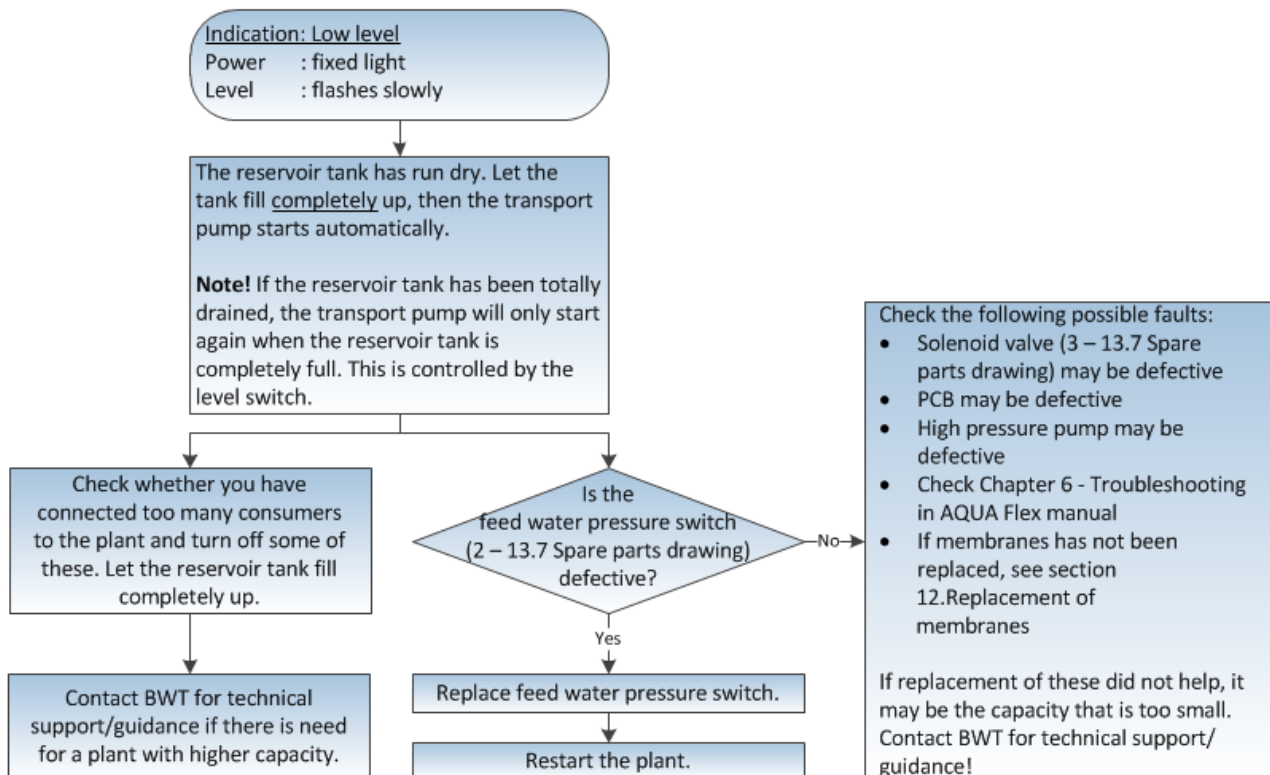
9.2.3 Alarm: Low feed water pressure



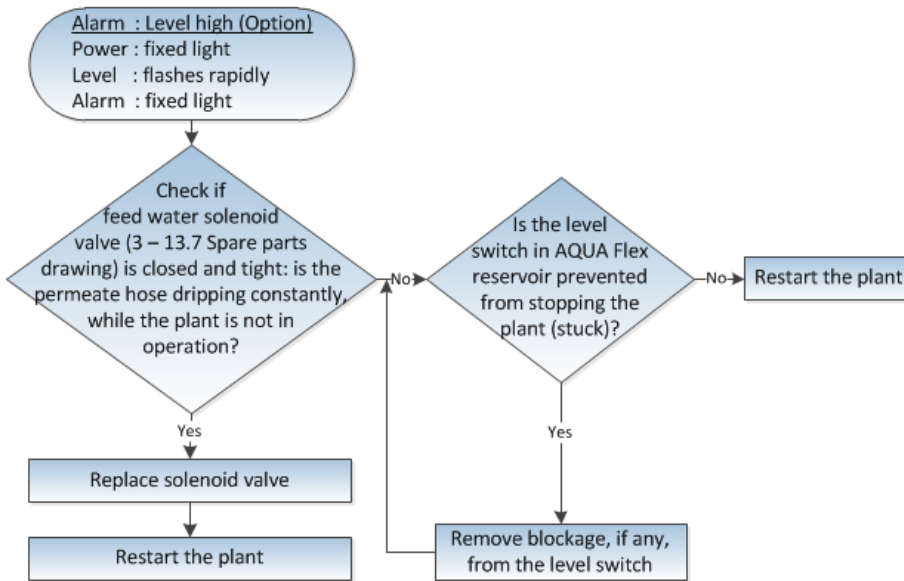
9.2.4 Alarm: Transport pump



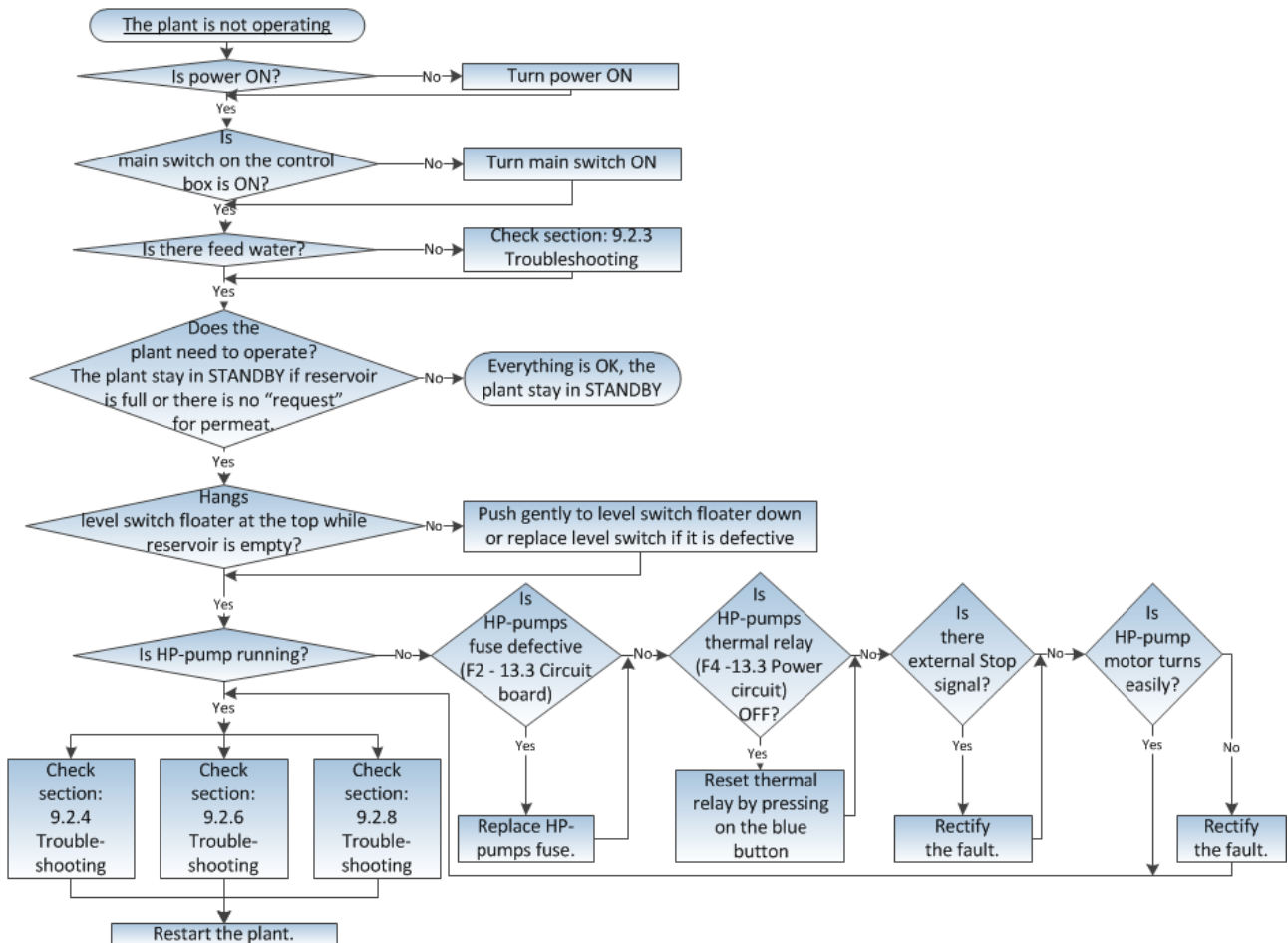
9.2.5 Indication: Level low



9.2.6 Alarm: Level high



9.2.7 The plant is not operating



9.2.8 Alarm: The transport pump stops and starts
Check AQUA Flex's manual chapter 6. Troubleshooting

9.2.9 Hard water is measured at the soft-water tap
Check softening plants manual for troubleshooting

9.2.10 Survey of Alarm Conditions

LED function: In normal operation the LED's are lit corresponding to the components they represent.

						"Re-start ALARM" on TP-pump: (Nothing is working – permanent condition)	Section 9.2.8
						ALARM - Too high water level: (Nothing is working – permanent condition)	Section 9.2.6
						ALARM -Low water pressure and Low water level: (Nothing is working – permanent condition)	Restore feed water pressure to >0.5 bar (Section 9.2.3), then check why water level is low (Section 9.2.5)
						Too low water level (no ALARM): (TP-pump stopped, HP-pump is working)	Section 9.2.5
						"On-time ALARM" - on TP-pump: (Nothing is working – permanent condition)	Section 9.2.4
						ALARM - Too low feed water pressure: (Nothing is working – permanent condition)	Section 9.2.3
						Too low feed water pressure: (HP-pump stopped – TP-pump is working)	Automatic restart (3 times) if feed water pressure is <0.5 bar
						External stop - TP-pump, can be jumped at start-up: (HP-pump is working)	Check the reason for the external stop and rectify the fault
						External stop - HP-pump: (TP-pump is working)	Check the reason for the external stop and rectify the fault
ALARM	LEVEL	TRANSPORT PUMP (TP-pump)	HIGH PRESSURE PUMP (HP-pump)	INLET	POWER	Description of alarm- and fault conditions	Trouble-shooting/ comments
LED's are lit		LED's flash slowly (½ Hz)			LED's flash rapidly (5 Hz)		

BWT PERMAQ® Pro emits beep tone at Alarm condition (Nothing is working), which can only be neutralised by rectifying the fault, then switching the plant OFF for 5 seconds and switching ON again.

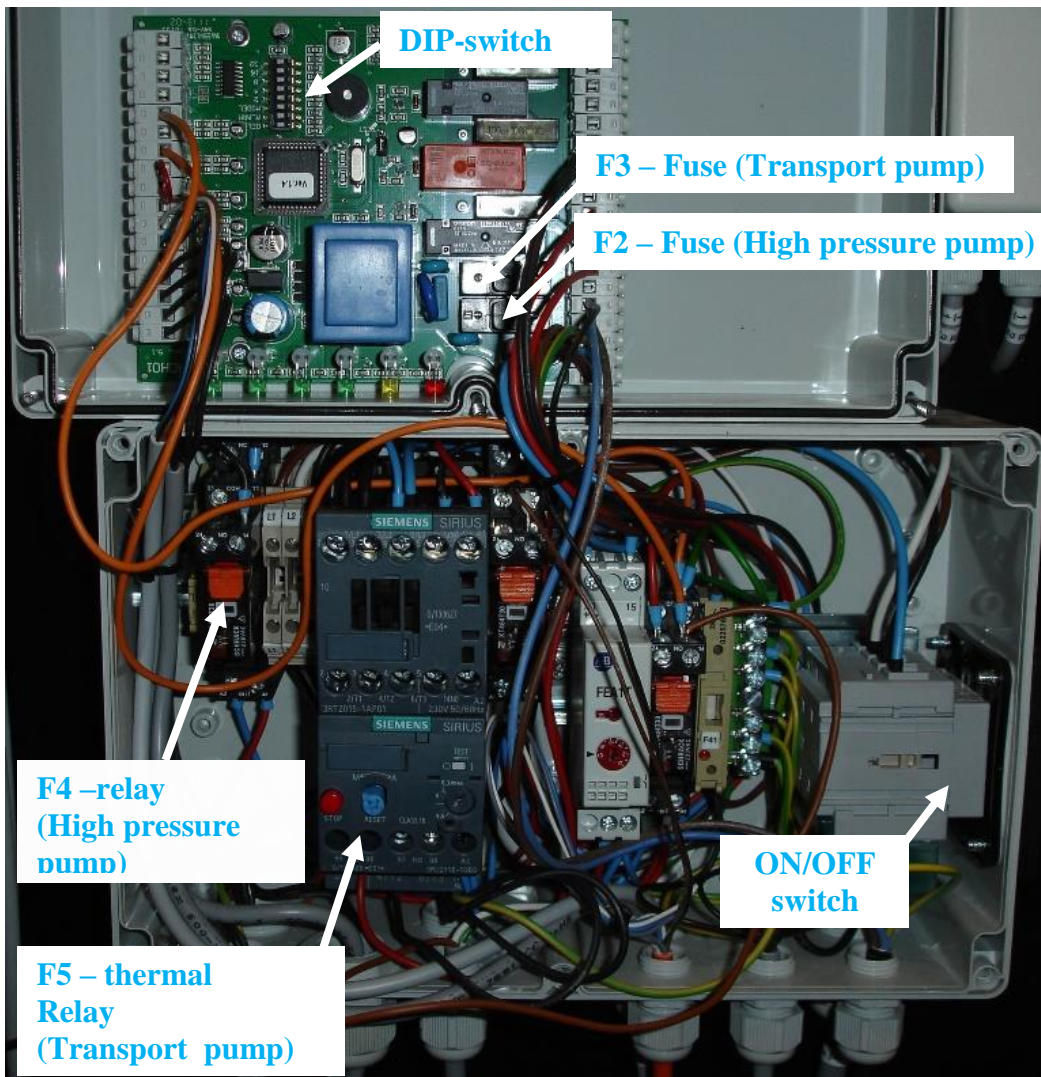
9.2.11 Settings

It is possible to adjust the various time settings for Start, Stop and Alarm, plus insert a start-up delay of the pump.

Use of DIP-switch:

- No. 1 High-pressure pump
- No. 2 Transport pump
- No. 3 Selection of BWT PERMAQ® Pro 2000 model
- No. 4-6 Transport pump

Factory settings	
DEL / OFF 5 SECONDS	DEL / ON 15 SECONDS
ALARM / OFF NO ALARM	ALARM / ON STOP AFTER 20 MINUTES
MODEL / OFF PERMAQ COMPACT 41	MODEL / ON PERMAQ Pro 2000
	2 / ON 20 SECONDS START MAX. 60 PR. HOUR
	4 / ON 20 SECONDS START MAX. 90 PR. HOUR
	8 / ON 30 SECONDS START MAX. 109 PR. HOUR
	16
	32



10. TECHNICAL SPECIFICATION

10.1 Technical specifications

BWT PERMAQ® Pro 2000 series		
Signature	Description	Type/data
P1a	High-pressure pump	2,2 kW, 4,45A
P1b	High-pressure pump	4,0 kW, 7,9A
P1c	High-pressure pump	4,0 kW, 7,9A
P2 (option)	CIP pump	0,85 kW, 4,5A
P3a (option)	Transport pump	0,85 kW, 4,5A
P3b (option)	Transport pump	1,2 kW, 3,0A
P5 (option)	Antiscalant pump	0,017 kW, 0,5A
P6 (option)	Pressure booster pump	0,5k W, 3,0A
FI 1A	Flow meter (permeate)	Ø40 PVC
FI 1B	Flow meter (permeate)	Ø63 PVC
FI 2 (option)	Flow meter (concentrate)	Ø32 PVC
PI 1	Manometer	0-40 Bar, ¼"
V1	Ball valve (control)	Brass
V2	Needle valve (recirculation)	Brass
V3	Needle valve (concentrate)	Brass
V4	Ball valve (check valve)	PVC
V5 (option)	Needle valve (mixing)	Brass
V7 (option)	Ball valve (CIP)	Brass
V8 (option)	Ball valve (CIP)	Brass
V9 (option)	Ball valve (preparation for CIP)	Brass
V10 (option)	Ball valve (CIP)	Brass
Y1	Solenoid valve NC (raw water)	POM
Y2 (option)	Solenoid valve NC (quality flush)	POM
Y3 (option)	Solenoid valve NO (quality flush)	POM
Y5 (option)	Solenoid valve NC	POM
PS 1	Pressure switch NO	¼" 0,5 Bar
PS3a (option)	Pressure switch NC	¼" -0,2 to 8 Bar
PS3b (option)	Pressure transmitter	0-6 Bar
PS 6 (option)	Pressure switch NC (pressure booster pump)	¼" -0,2 to 8 Bar
FS 5 (option)	Flow switch (antiscaling)	EPDM
QIS 1 (option)	Conductivity meter	½" connection for sensor

10.2 Technical data

BWT PERMAQ® Pro		2010	2020	2030	2040	2060	2080
Capacity	l/h*	600	1200	1700	2300	2800	3300
Number membranes	pcs	1	2	3	4	6	8
Maximum water recovery	%	75-80					
Salt retention	%*	>99					
Conductivity	µS/cm*	<20					
Weight (full)	kg	129	163	176	186	214	229
Power connection	V/Hz	400/50					
Power consumption	kW/m ³	3,4	1,8	1,8	1,3	1,2	1,1
Pipe inlet	inch	¾"					
Concentrate outlet	mm	14					
Permeate outlet	mm	¾"				1"	
Width, Depth, Height (WxDxH)	mm	720 x 760 x1690					
Water temp. (Min./Max.)	°C	5 / 30					
Inlet water pressure (Min./Max.)	bar	3 / 7					
High pressure pump		P1a		P1b	P1c		

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

11. FUNCTIONAL DESCRIPTION

The water is pressed through the RO membrane by means of a high-pressure pump. The permeate (desalinated water) is then led to consumption and can e.g. be collected in a reservoir. The concentrate (the water containing the concentrated salts) is led to outlet. The relation between permeate/ concentrate shall be adjusted manually on the needle valve.

Under normal operating conditions the RO membranes have a long lifetime. But even with a good feed water quality, layers of impurities will, to a certain extent, occur and there will be a slow reduction of the permeate capacity.

12. REPLACEMENT OF MEMBRANES

Read this chapter before dismounting/replacing the membranes.

Turn off the power and disconnect the water to the plant.

Dismount the U-lock placed at the top of the membrane pipe. (the U-lock keep the membrane bottom in place).

Remove the pin in the U-lock and pull the lock out of the pipe.

The end plates can now be pulled out of the membrane

pipe by wriggling the end plates from side to side and simultaneously pull upwards.

Note! it may be necessary to use a puller to get the end plates out of the membrane pipe. Order a puller for a 4" membrane pipe from your usual supplier or from BWT.

The membrane can now be pulled out of the membrane pipe.

Note! at which end the big, black V-cup seal, located on the outside of the membrane is placed. When the new membrane is to be fitted, this V-cup seal must be fitted at the same end of the membrane as the former one, i.e. if the V-cup seal is located at the top of the membrane pipe, then the new membrane V-cup seal shall also be placed in that way, so that the V-cup seal is located at the top when the membrane is refitted in the membrane pipe.

When all connections have been refitted and the end plates securely fastened with the U-lock, then the plant must be started up again.

Re-connect raw water.

Open the outlet valve completely and close the recirculation valve completely (section 13.7, pos. 1).

Lead the permeate hose to drain.

Reconnect power to the plant.

The plant will now be in operation. Let the plant flush in this way for 20-30 minutes.

Then adjust the outlet valve and the recirculation valve.

Check the plant operating pressure on the manometer.

Check that the water quality is $<20 \mu\text{S}/\text{cm}$. This can be checked on the permeate hose (conductivity meter is optional equipment). Lead the hose back to the reservoir (option), when the quality is satisfactory.

Check on the flow meter that the plant capacity is satisfactory.

The plant is now in normal operation and ready for use.

Make notes in the operating journal:

1. Date of replacement of membranes
2. New capacity on the plant, flow meter FI1 and FI2 (13.7 Spare parts drawing Pos. 8)
3. Water quality, conductivity meter (option)
4. Plant operating pressure, Manometer PI1 (13.7 Spare Parts drawing, Pos. 4)
5. Feed water temperature
6. Feed water pressure

UK

13. ANNEX

13.1 P&I Diagram

13.2 Layout drawings

13.3 Wiring diagram

13.4 Start-up test

13.5 Operating journal

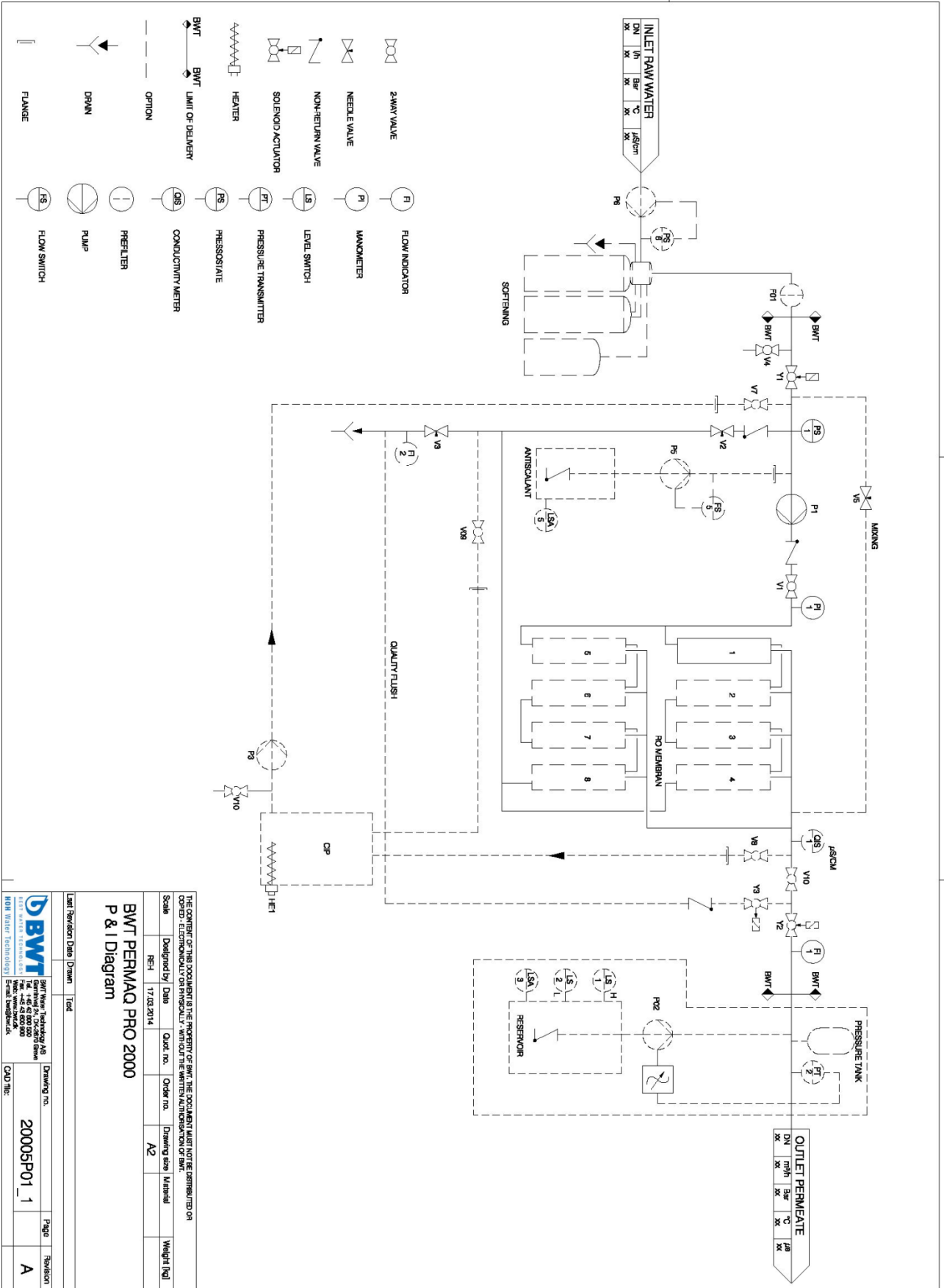
13.6 Spare-parts list BWT PERMAQ® Pro 2000

13.7 Spare-parts drawing

13.8 Options

13.9 Declaration of conformity

13.1 P&I Diagram



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Scale	Designed by	Date	Quot. no.	Order no.	Drawing date	Material	Weight [kg]
	REH	17.03.2014			A2		

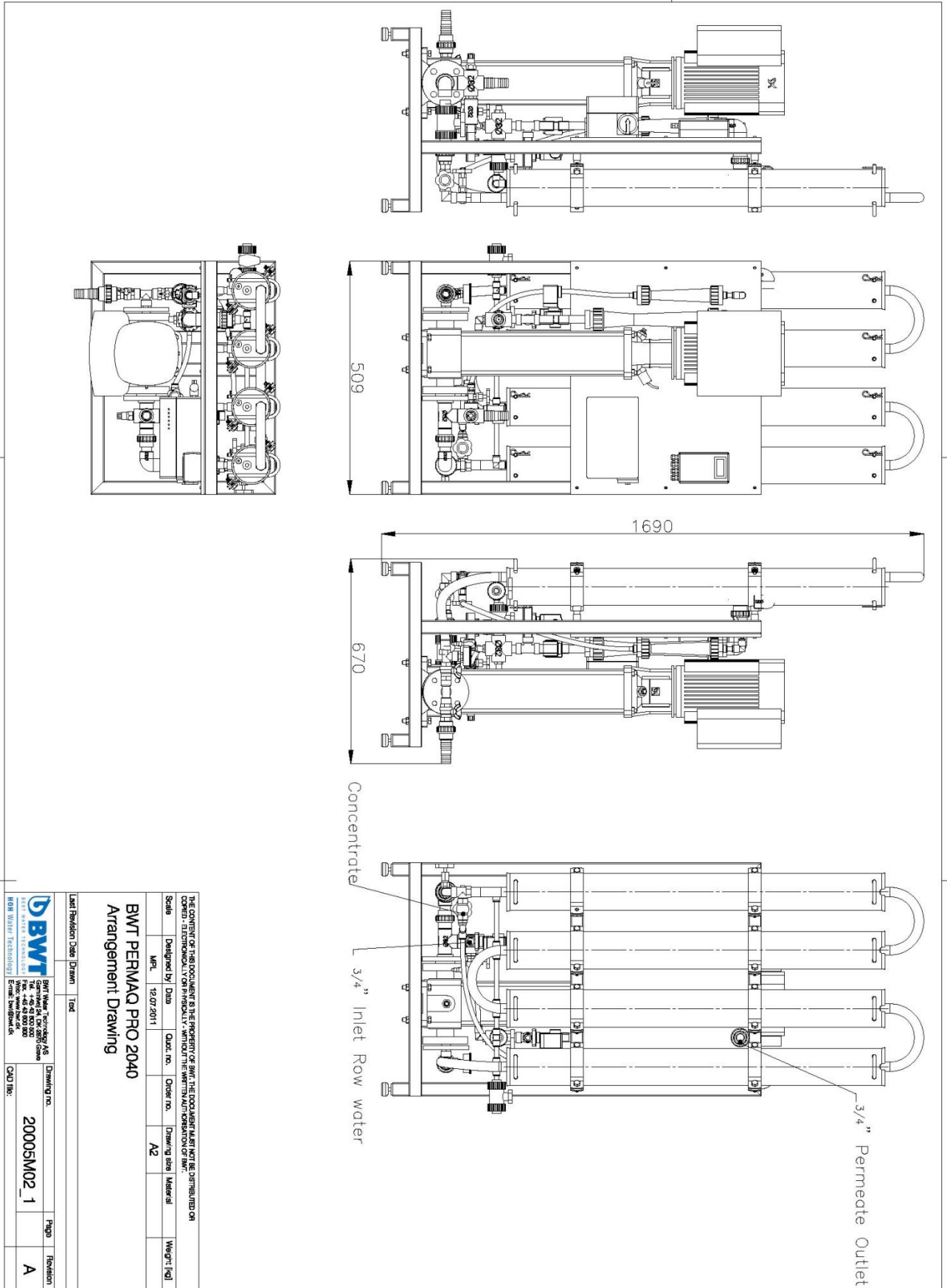
BWT PERMAQ PRO 2000
P & I Diagram

Last Revision	Date	Drawn	Tool

Drawing no.	Page	Revision
2000SP01_1	1	A

BWT Water Technology AS
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 Tlf: +47 22 00 00 00
 E-mail: bwt@bwt.no
 Web: www.bwt.no
 BWT Water Technology AS
 Stein Wegmanns vei 1
 2000 Oslo

13.2 Layout Drawings



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Scale	Designed by	Date	Quot. no.	Order no.	Drawing size	Material	Weight [kg]
	MPL	12.07.2011			A2		

BWT PERMAQ PRO 2040
Arrangement Drawing

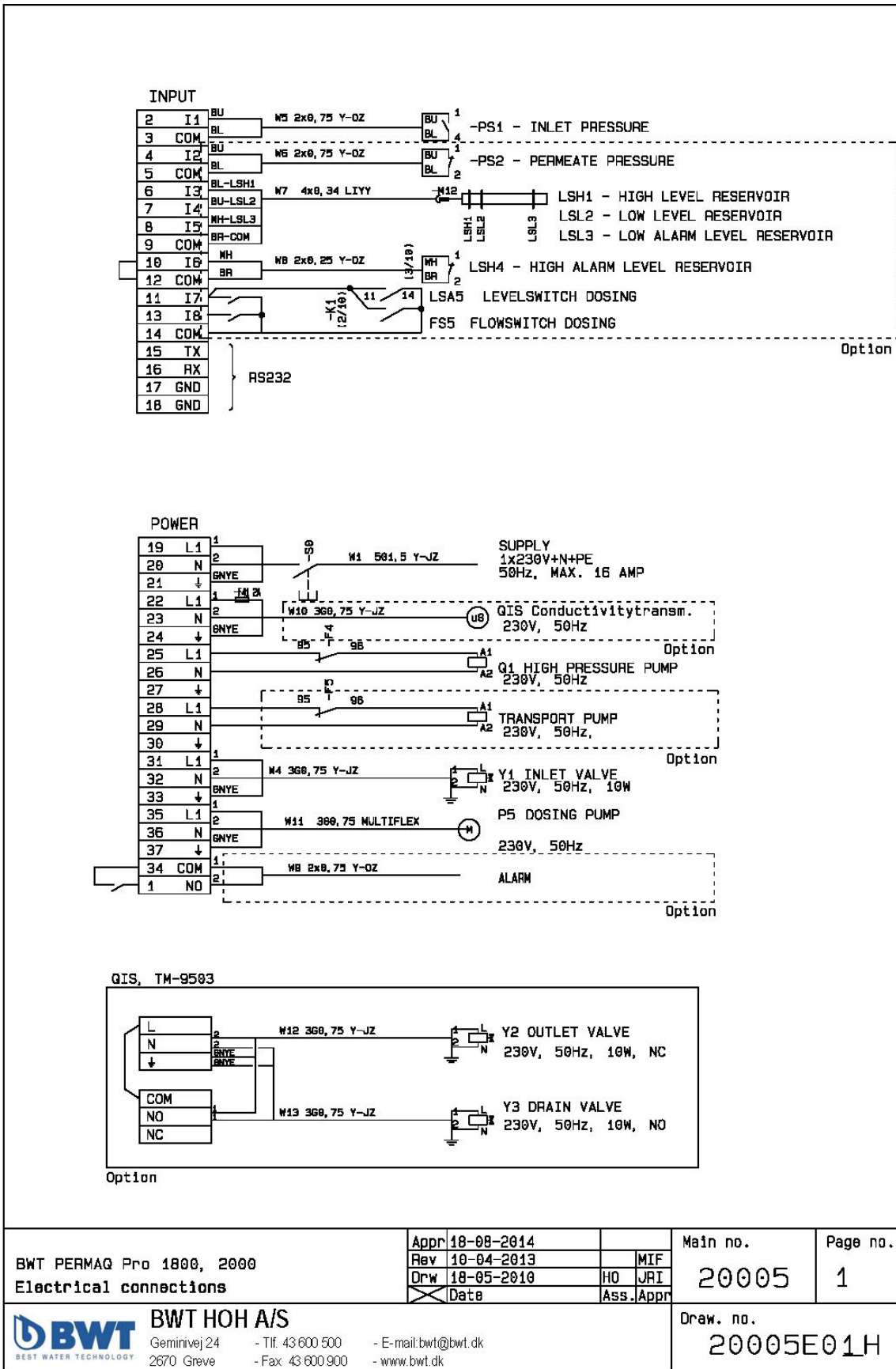
Last Revision Date	Drawn	Tool

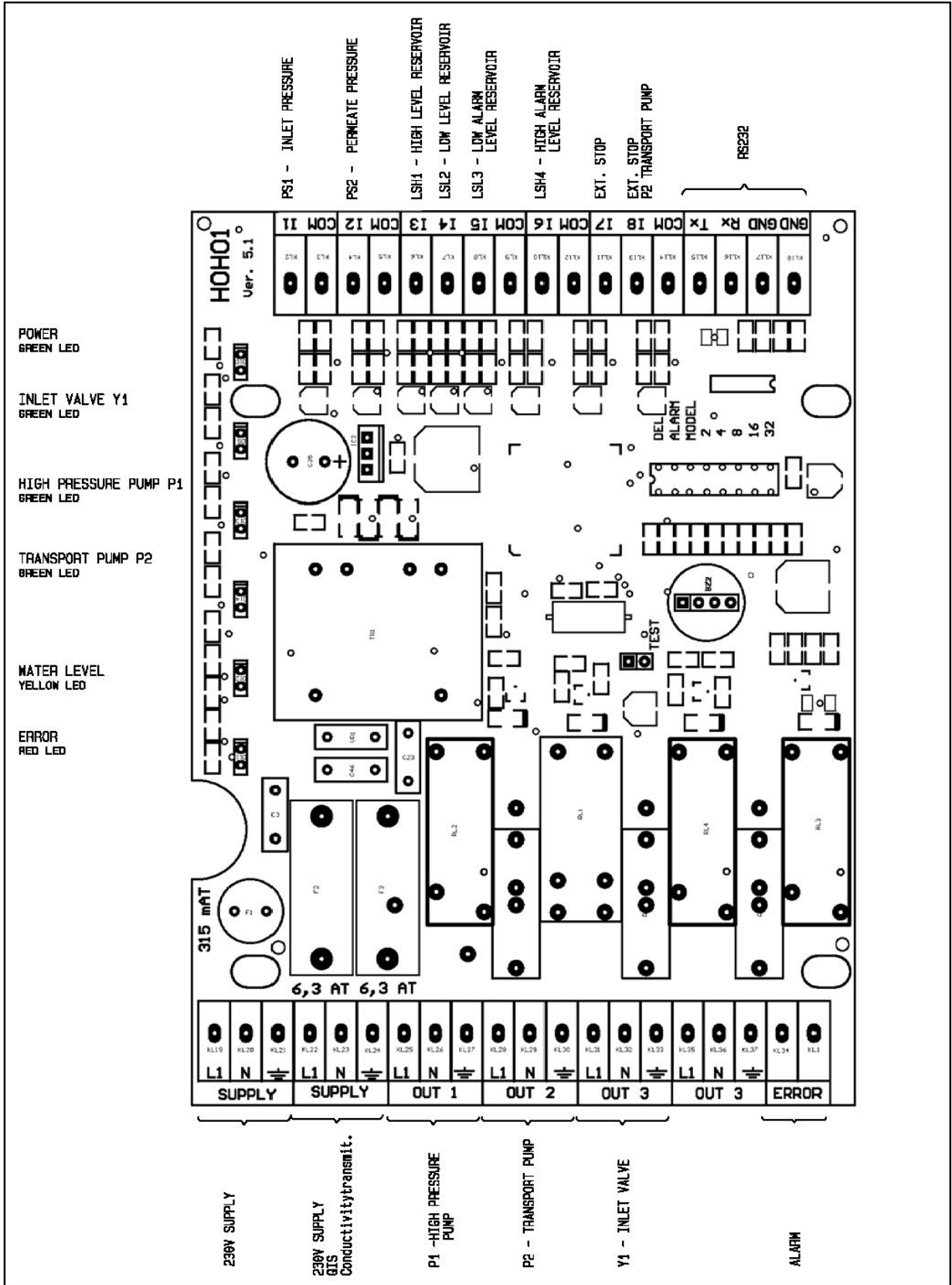
Drawing no.	Page	Revision
20005M02_1		A

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Germany

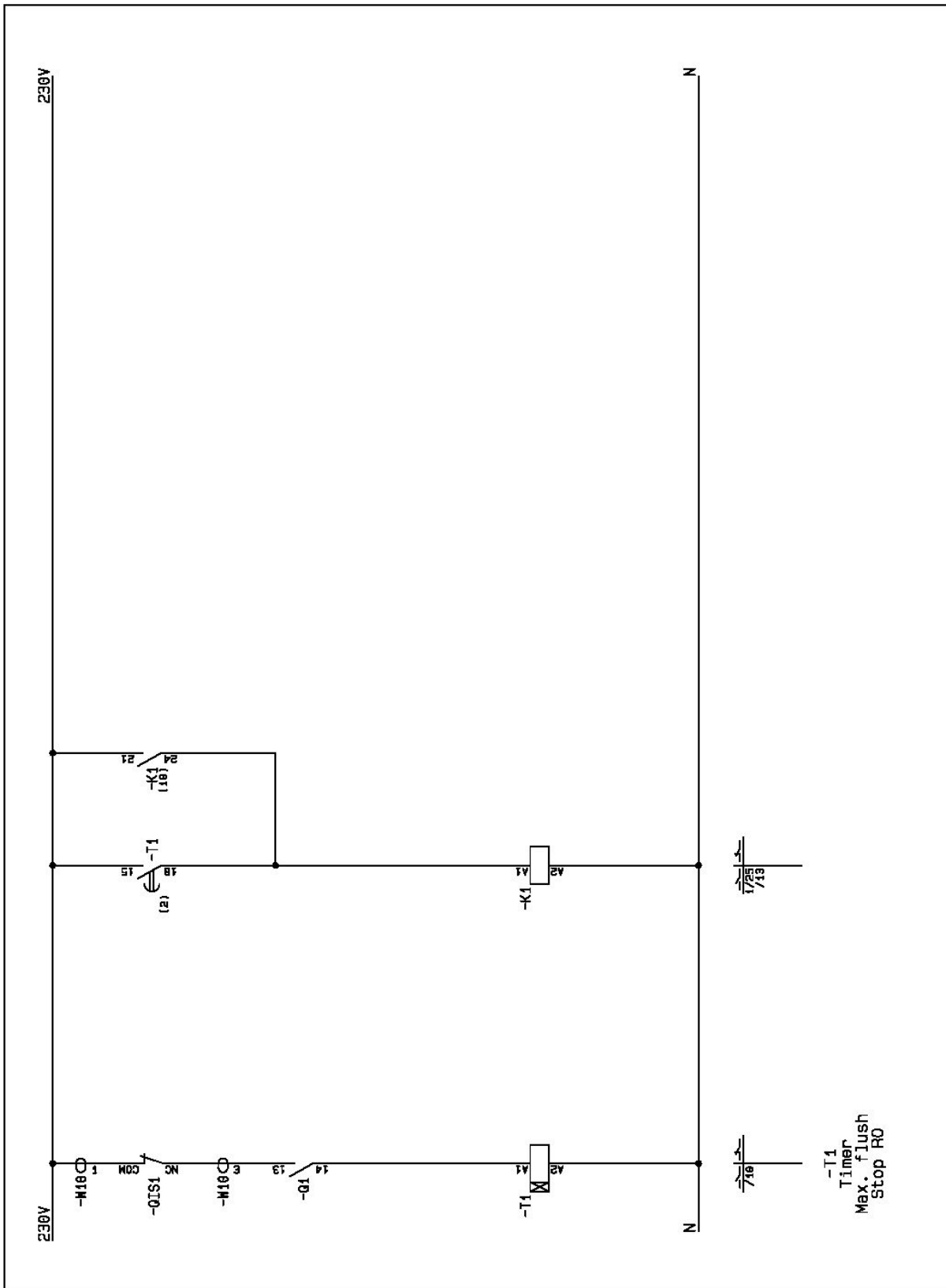
CAD FILE:

13.3 Wiring Diagram



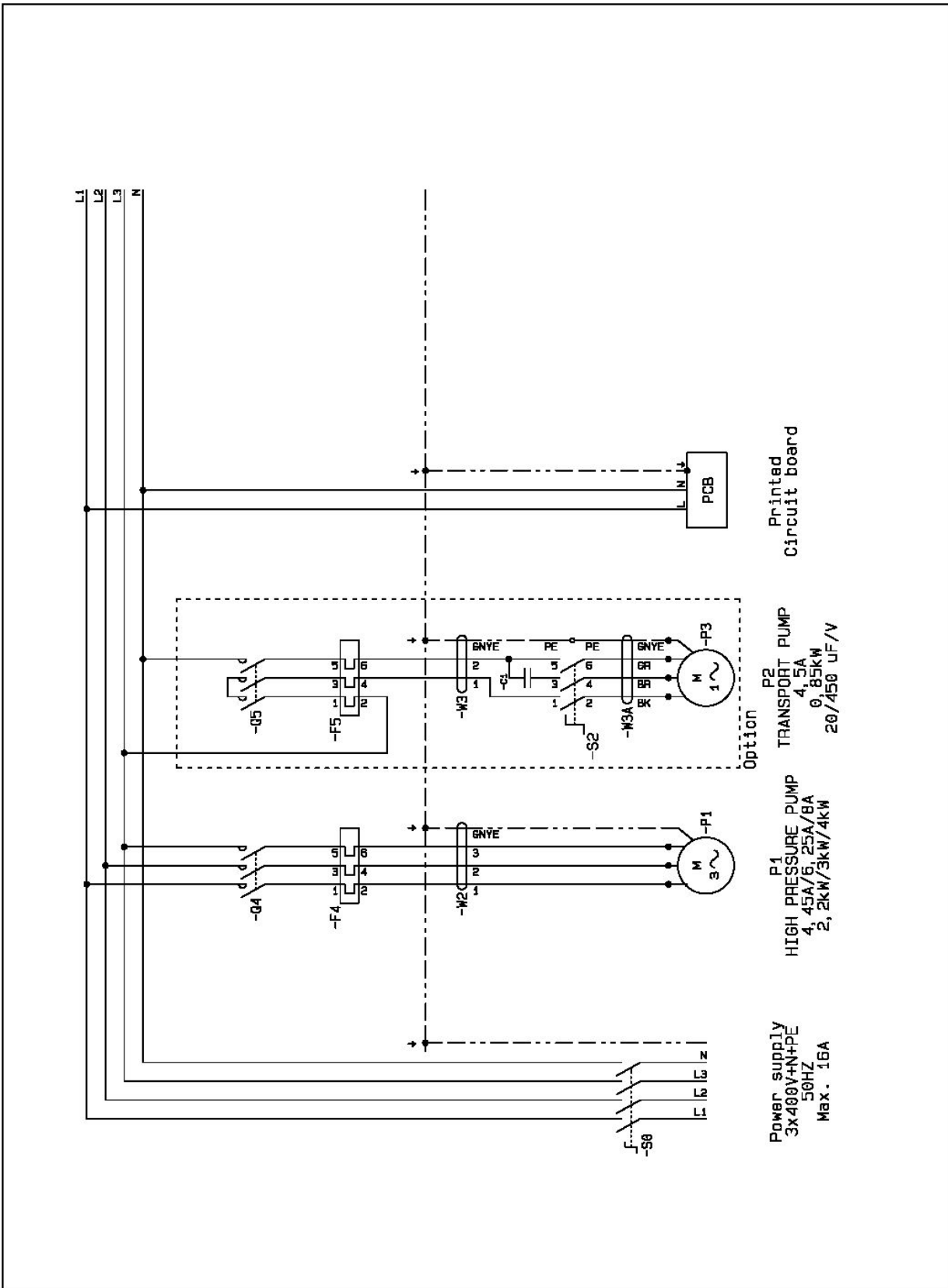


BWT PERMAQ Pro 1800, 2000 Circuit board	Appr 14-04-2014	Main no. 20005	Page no. 2
	Rev 10-04-2013	MIF	
	Drw 06-05-2009	HO JRI	
	Date	Ass. Appr	
BWT BEST WATER TECHNOLOGY	BWT HOH A/S Geminivej 24 - Tlf. 43 600 500 - E-mail: bwt@bwt.dk 2670 Greve - Fax 43 600 900 - www.bwt.dk		Draw. no. 20005E01H



-T1
Timer
Max. flush
Stop RO

BWT PERMAQ Pro 1800, 2000 Circuit diagram	Appr 02-06-2014	Main no. 20005	Page no. 3
	Rev		
	Drw 18-05-2010	JRI	
	Date	Ass.Appr	
BWT BEST WATER TECHNOLOGY	BWT HOH A/S Geminivej 24 - Tlf. 43 600 500 - E-mail: bwt@bwt.dk 2670 Greve - Fax 43 600 900 - www.bwt.dk	Draw. no. 20005E01H	



BWT PERMAQ Pro 1800, 2000 Power circuit	Appr 14-04-2014		Main no. 20005	Page no. 4
	Rev 10-04-2013	MIF		
	Drw 06-05-2009	HO JRI		
	Date	Ass.Appr	Draw. no. 20005E01A	



BWT HOH A/S
 Geminivej 24 - Tlf. 43 600 500 - E-mail: bwt@bwt.dk
 2670 Greve - Fax 43 600 900 - www.bwt.dk

13.4 Start-up Test

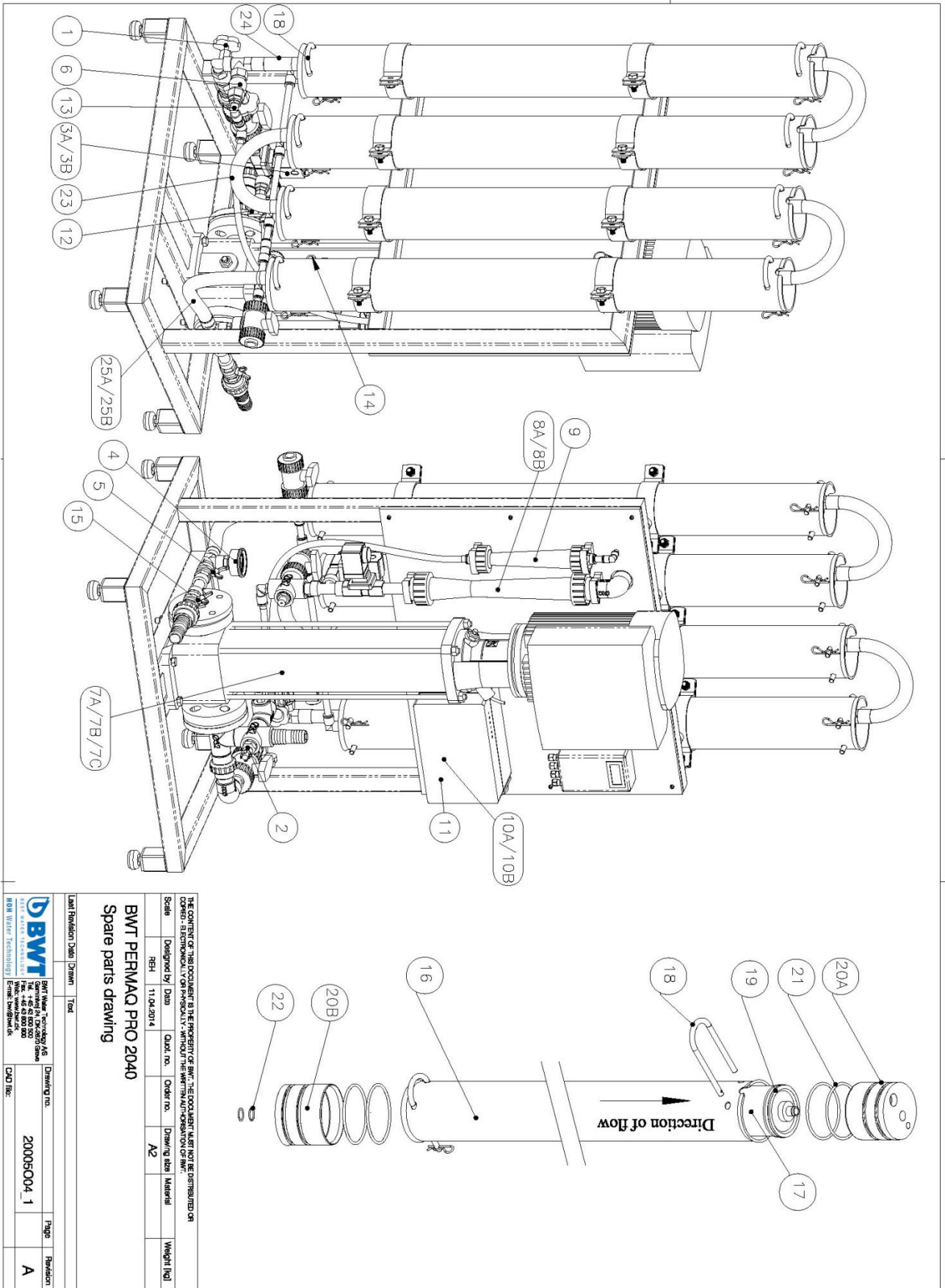
Start-up test			
The start-up test sheet must be completed and filed together with the operating journal.			
Name of customer:		Plant number:	Work-sheet number:
Test of raw water			
Temperature [°C]:	Conductivity [µS/cm]:	Hardness [°dH]:	Inlet pressure [bar]:
Softening unit		<input type="checkbox"/> YES	<input type="checkbox"/> NO
<i>If "no" skip this section</i>			
Type of plant:		Hardness [°dH] after softening:	
<i>Tick if "yes"</i>			
<input type="checkbox"/> Time-controlled	<input type="checkbox"/> Quantity-controlled	<input type="checkbox"/> Dimensioned correctly for RO	
<input type="checkbox"/> New	<input type="checkbox"/> Old	<input type="checkbox"/> Plant and salt valve set at the correct hardness	
RO-plant			
Type of plant:	Raw -water pressure [bar]:	Outlet press., high-press. pump [bar]:	Recirculation flow [l/h]:
Permeate flow [l/h]:	Concentrate flow [l/h]:	Outlet press., permeate [l/h]:	Conductivity, permeate [µS/cm]:
<input type="checkbox"/> Inlet press. switch is OK			
<input type="checkbox"/> Direction, high-press. pump is OK			
<input type="checkbox"/> Level switch, start/stop of high-press. pump is OK			
Permeate tank			
<input type="checkbox"/> Pre-pressured hydrophore is OK		<input type="checkbox"/> Pressure switch start/stop, transport pump is OK	
<input type="checkbox"/> Level switch have the right length for the plant		<input type="checkbox"/> Drainage protection, transport pump is OK	
Status on start-up			
<input type="checkbox"/> Start-up by BWT		<input type="checkbox"/> Start-up by dealer, specify dealer _____	
Problems on start-up			
<input type="checkbox"/> YES, there were problems at start-up		<input type="checkbox"/> NO, there were no problems at start-up	
<i>In case of problems, please fill in the problem report</i>			
Problem report			
Can the problem be related to the manufacturing?			
<input type="checkbox"/> YES, the problem can be related to the manufacturing		<input type="checkbox"/> NO, the problem cannot be related to the manufacturing	
Can the problem be related to the plant or the installation?			
<input type="checkbox"/> YES, the problem only concerns the plant		<input type="checkbox"/> YES, the problem only concerns the installation	
<input type="checkbox"/> YES, the problem concerns both the plant and the installation		<input type="checkbox"/> NO, the problem does not concerns the plant or the installation	
The plant - we mean only the part of the whole installation which was delivered by BWT (i.e only the plant). The installation - we mean the piping etc. leading to the plant.			
Can the problem be related to the sales department?			
<input type="checkbox"/> YES, the customer was misinformed		<input type="checkbox"/> NO, the customer had been well-informed	
Description, please describe the problem			
Signature			
Name/initials of technician:		Date:	Time consumption for the start-up [hours]:

13.6 Spare Parts List BWT PERMAQ® Pro 2000

Item No.	P&I id	BWT PERMAQ® Pro 2010-2080	Recommended spare parts	Article No.	Recommended replacement frequency
1	V2	¾" Needle valve (Recirculation)	1	200731006	
2	PS1	Pressure switch 0,5 Bar	1	452550005	
3A	Y1	¾" Solenoid valve (Pro 2010-2040)	1	200752006	
3B	Y1	1" Solenoid valve (Pro 2060-2080)	1	200752010	
4	PI1	Manometer 0-40 Bar	1	452266000	
5	V5	¾" Ball valve (control valve)	1	200742006	
6	V3	¾" Needle valve (outlet valve)	1	200731006	
7A	P1	High-pressure pump (Pro 2010-2020)		454101225	
7B	P1	High-pressure pump (Pro 2030)		454102226	
7C	P1	High-pressure pump (Pro 2040-2080)		454102222	
8A	FI1	Flow meter, Permeate (Pro 2010-2040)		453010325	
8B	FI1	Flow meter, Permeate (Pro 2030-2080)		453010340	
9	FI2	Flow meter, Concentrate (Pro 2030-2080)		451405100	
10A		Control box complete (Pro 2010-2020)		451404812	
10B		Control box complete (Pro 2030-2080)		451404813	
11		Control PCB complete			
12	V4	Test valve (water hardness test)		200721020	
13		Quick fitting 14 mm, elbow	1	454090014	3 years
14		Quick fitting 14 mm x ½", Base		454065014	3 years
15	V7	¾" Ball valve			
		Membrane/pressure vessel			
16		Pressure vessel		451404079	
17		Membrane	1-4	451404960	*
18		U-lock		451404090	
19		V-Cup seal for membrane	2-8	451404208	
20A		End plate	1	451404113	3-5 years
20B		End plate	1	451404112	3-5 years
21		O-ring outside (large)	8-32	451404211	2 years
22		O-ring inside (small)	8-32	451404215	2 years
23		¾" Pressure hose, L=400 mm	1	451404177	
24		¾" Pressure hose, L=130 mm	1	451404178	
25A		¾" Pressure hose, L=480 mm (Pro 2010-2020)	1	451404174	
25B		¾" Pressure hose, L=320 mm (Pro 2030-2080)	1	451404165	
		Spare parts for options			
		Sensor (conductivity meter)		452536007	
	QIS1	Conductivity meter	-	452525000	
		14 mm hose		454001014	3 years
	P5	Antiscalant pump		100513000	
	FS5	Antiscalant flow switch		110844420	
	Y2	¾" Solenoid valve, (Pro 2010-2040)		200752006	
	Y3	¾" Solenoid valve, (Pro 2010-2040)		200752008	
	Y2	1" Solenoid valve, (Pro 2060-2080)		200752010	
	Y3	1" Solenoid valve, (Pro 2060-2080)		200752012	

* Contact your local BWT dealer for detailed information.

13.7 Spare Parts Drawing



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Scale	Designed by	Drawn	Checked no.	Order no.	Drawing size	Material	Weight [kg]
	RBH		11.04.2014		A2		

BWT PERMAQ PRO 2040
Spare parts drawing

Last Revision	Date	Drawn	Tool

BWT BWT Water Technology AG Gartenweg 24, D-82070 Garmisch Tel.: +49 89 300 000 Fax: +49 89 300 000 E-Mail: bwt@bwt.de www.bwt.de	Drawing no.	Page	Revision
NON WATER TECHNOLOGY	20005004_1		A
	CAD file:		

13.8 Options

For BWT PERMAQ® Pro 2010-2080 reverse osmosis unit you can select between following options, contact **BWT Sales for further information.


13.8.1 Option 1 - Hose Connector Kit

Part No.: 656530195		BWT carry complete assembly kits (hose kits) for BWT PERMAQ® Pro 2000 reverse osmosis unit.
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13.8.2 Option 2 - Softening Units

Part No.: **		For optimal utilization of the water and to prolong the membrane lifetime we recommend installing a BWT softening unit with your BWT PERMAQ® Pro 2000.
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13.8.3 Option 3 - Booster Pump Unit

Part No.: 454100560		A booster unit can be installed ahead of the softening unit in case of lacking water pressure.
---------------------	--	--

13.8.4 Option 4 - Carbon Filter/ μ -Filter

Part No.: *****		<p>In order to reduce the content of free chlorine, pesticides, and organic solvents you may install a carbon filter.</p> <p>In order to prevent particles from clogging the membranes, you can install a 5μ micron filter.</p> <p>We recommend installing an extra manometer after the pre-filter. A pressure drop of >1bar across the pre-filter indicates that the filter cartridge should be replaced.</p>
-----------------	--	--


13.8.5 Option 5 - Mixing

Part No.: 451404197		If you need to increase the permeate conductivity over 20 μ S/cm we recommend mixing for BWT PERMAQ® Pro 2000.
---------------------	--	--

13.8.6 Option 6 - Conductivity Meter

Part No.: 451202013		BWT PERMAQ® Pro 2000 units may be equipped with a conductivity meter for measuring the water quality.
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13.8.7 Option 7 - Conductivity Meter including a 4-20 mA output

<p>Part No.: 45120213 and 452536010</p>		<p>BWT PERMAQ® Pro 2000 units may be equipped with a conductivity meter for metering and signal output. The conductivity meter activates two solenoid valves, if the water quality is $>20 \mu\text{S}/\text{cm}$ so that the "bad" water is led to drain (quality flush).</p>
---	---	--


13.8.8 Option 8 - Storage Tank

<p>Part No.: **</p>		<p>200-2,000 litre AQUA FLEX reservoir with integrated transport pump and pressure switch used for controlling start and stop of the BWT PERMAQ® Pro 2000.</p>
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13.8.9 Option 9 - Mixed-bed

<p>Part No.: **</p>		<p>If a water quality $< 0,5 \mu\text{S}/\text{cm}$ is required, we recommend a BWT HOH Demi Mix (a mixed-bed unit) for post-treatment of the reverse osmosis water.</p>
---------------------	--	--

13.8.10 Option 10 - Upgrade Kit

<p>Part No.: **</p>		<p>If a larger permeate capacity is required, we recommend installing an extra membrane which is included in the upgrade kit for BWT PERMAQ® Pro 2000.</p>
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13.8.11 Option 11 - Tool/Spare Part Box

<p>Part No.: 451409000</p>		<p>The tool/spare part box contains the most commonly needed small parts and tools to be used when servicing the BWT PERMAQ® Pro 2000, e.g. when replacing membranes.</p>
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13.8.12 Option 12 – Preparation for CIP

<p>Part No.: 451202016 for Pro 2010-2040</p> <p>Part No.: 451202007 for Pro 2060-2080</p>		<p>Preparation for CIP consists of connections which enable installation of a CIP unit on the RO plant</p>
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13.8.13 Option 13 – Stationary CIP

<p>Part No.: 421072000 for Pro 2010-2040</p> <p>Part No.: 421072280 for Pro 2060-2080</p>		<p>During normal operation, depending on inlet, water quality, temperature, operating conditions etc, the RO membranes will successively loose capacity due to the varying content of mineral salts, biological matter, colloid particles and other insoluble organic particles in the water. These deposits accumulate during operation and cause an increased pressure drop across the membrane and consequently a reduced capacity and poorer water quality. In order to prolong the lifetime of the membranes, we recommend cleaning the membranes with a CIP unit.</p>
---	--	---

13.8.14 Option 14 – Quality flush

<p>Part No.: 451405112 for Pro 2010-2040</p> <p>Part No.: 451405114 for Pro 2060-2080</p>		<p>The quality flush system monitors that the RO plant produces permeate <20µS. If the limit value is exceeded, the poor permeate will be led to drain until the permeate quality has been re-established.</p>
---	--	---

13.8.15 Option 15 – Antiscalant unit

<p>Part No.: 421072270 for Pro 2030-2080</p>		<p>Antiscalant is a product which will be added to the raw water to avoid precipitation of lime on the membrane, as these would otherwise clog the membrane.</p>
--	--	--

Application of the antiscalant dosing unit: A water analysis must always be available before starting up the unit, so that the antiscalant dosing can be adjusted correctly.

Antiscalant is mixed in the measuring reservoir to a 1 % solution. Do not fill in more antiscalant in the reservoir than for one month’s consumption as the fluid will decay with time and then cannot be used.

Note! If the level switch registers that the minimum level in the antiscalant reservoir has been reached, an alarm will be triggered and the RO plant stops. (The antiscalant reservoir must be refilled with cleaning fluid)

UK

Antiscalant must be dosed in relation to the content of salts, lime etc. in the water and shall be adjusted on starting up the plant. 0,4 ml of concentrated antiscalant per m³ raw water must be dosed, i.e. if you have a 1 % solution, the pump shall dose 40 ml/m³.

A flow checking device is installed on the outlet of the dosing pump. This indicates if there is flow or not. Note! If the flow fails, the check device will register this and stop the plant plus trigger the alarm. (Check the flow check device and restart the RO plant).

For adjustment of this device, carry out the following steps:

1. Let the dosing pump operate for approx. 15 minutes until it is warm and all air has been displaced from the pump.
2. Disconnect the dosing monitor cable (to shortly deactivate the dosing monitoring).
3. Turn the dial to the left ("-").
4. Set the desired operating pressure on the pressure line.
5. Set the desired dosing amount on the running pump (via frequency and stroke length).
6. Reconnect the dosing monitoring cable.
7. The "Flow" on the pump LCD-monitor flashes for every pump stroke.
8. Slowly turn the dial of the dosing monitor to the right ("+"), until "Flow" stops flashing.
9. Turn the dial back a little once more until "Flow" starts flashing again.
Now turn the stroke length of the pump back approx. 20 % (scale parts) (note the old value) – "Flow" should stop flashing. If not you must turn again the dial of the dosing monitor slowly to the right ("+"), until "Flow" stops flashing. Note: "flow" vanishes from the display when the Reed switch has been switched off (when the float is in top position).
10. Reset the stroke length to the old value – "Flow" should start flashing again.
11. Check that the dosing nipple (dosing location) is tight, and then the plant is ready for operation.

Important! The stroke length of the dosing pump must not be set at a value below 50 %.

- Every week the reservoir must be emptied and rinsed and new antiscalant filled in.
- Every third month the reservoir must be rinsed and cleaned before filling in new antiscalant.

Above-mentioned dosing amounts are calculated on basis of our standard dimensioning conditions; if you are in doubt, BWT will be pleased to calculate the correct amounts for your plant.

13.8.16 Option 16 – Frequency control of HP-pump

Part No.: 421072005 for Pro 2030-2080		Frequency-controlled high-pressure pump will be suitable when a specific permeate flow is required.
--	--	---

13.8.17 Option 17 – Concentrate flow meter

Part No.: 451405100 for Pro 2030-2080		To give a more varied picture of the capacity of the RO unit, you may install an optional concentrate flow meter.
--	--	---

13.9 Declaration of Conformity

EC Declaration of Conformity for Machinery
Directive 2006/42/EC, Annex II, A
Low Voltage Directive
EMC Directive



BWT HOH A/S
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bwt@bwt.dk - www.bwt.dk

Herewith declares that:

BWT PERMAQ® Pro 2010, 2020, 2030, 2040, 2060 and 2080

- is in conformity with the provisions of the Machinery Directive (Directive 2006/42/EC)
- is in conformity with the provisions of the following other EC directives
- Low Voltage Directive (2006/95/EC)
- EMC Directive (2004/108/EC)

- Place: Greve, Denmark

- Date: 19-09-2014

Lars Jensen
Head of Product Management



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