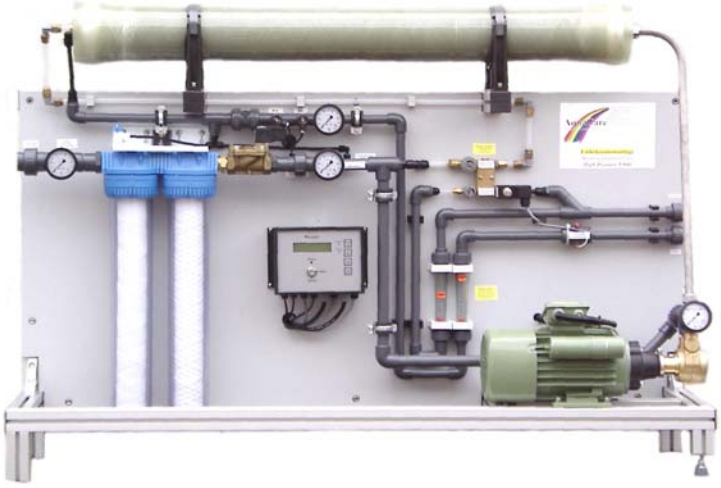
Systeme für Aquakultur,
Aquaristik, Labore und
zur Wasseraufbereitung

Systems for aqua culture,
sea water aquaria, labs and
water desalination and purification

Systèmes pour aquacultur,
aquariums eau de mer,
labaratoires et traîtements d'eau

AquaCare GmbH & Co. KG
Am Wiesenbusch 11
D-45966 Gladbeck
Tel.: +49-2043-375758-0
Fax: +49-2043-375758-90
http://www.aquacare.de
e-mail: info@aquacare.de

Instruction Manual Reverse Osmosis Unit *HighPower* size HP 6.000...24.000



HP 6.000

modifications possible

HP 12.000

modifications possible

Content

1. Safety Instructions

1.1. General information

This manual contains basic information that are important for assembly, operation, and maintenance. This should be read before mounting by the assembly operator and the responsible operator and/or qualified personnel. This instruction must be disposable the at unit at any time.

Pay attention to this safety instruction as well as to the special instructions within the other chapters. In addition local laws and safety instruction must be minded.

1.2. Indication of information

If safety information are important for life or health for persons they are marked with the relevant hazard symbol according DIN 4844-W9.

Safety information marked with this symbol can cause danger for the machine and its function if not respected.

This hints can ease the work with the machine and its maintenance.

At the machine directly marked information as rotation arrow, fluid connections and setting points should be noticed. These marks should be readable at any time.

1.3. Qualification of the personnel

The staff for operation, maintaining, inspection and assembly must be qualified for these work. Responsibility and controlling of the personnel should be directed by the operator.

genau geregelt sein.

1.4. Dangers if safety information are not minded

If safety information are not minded persons, environment, and the machine can be endangered. Failure of observe lead to loss of the warranty.

Failure of observe can coarse:

- Failure of important functions of the machine.
- Failure of stipulated methods for maintenance.
- Endanger of persons with electric, chemical or mechanical impacts.

1.5. Safe working

Working with the machine is only allowed if all safety information of this manual, national laws and rules for preventing accidents and internal working, operating and safety rules of the operator must be minded.

1.6. Safety information for the operator

Contact protection for rotating or moving parts should not be removed while operation.

Risks of electrical energy must be averted. Please pay attention to the local laws and information, too.

1.7. Safety information for maintaining and assembling personnel

The operator must take care that all works for assembling, inspecting and maintaining are made by authorized and qualified personnel. These persons must be informed about the machine and the works by reading the manual or otherwise.

Working at the machine is only permitted if unit is out of operation. The described procedure of putting out of operation must be redeemed. Immediately after the work safety and protection facilities must be mounted and put into function.

Before starting again all issues treated in the chapter “putting into operation” must be minded.

1.8. Arbitrary reconstruction and spare parts production

Reconstruction or modifying the unit are only proper if the manufacture agrees. Original spare

parts and authorized accessories by the manufacture are made for the safety. The use of other parts can destroy the warranty demands.

1.9. Illegal operation

Safety is only guaranteed if the unit is running within the field of application described in „designated use“ in this manual. The technical limits mentioned in manual (chapter “Technical data and unit protocol”) must be redeemed.

1.10. Linked aggregates

The listed information dealing with safety and operation in manuals of linked aggregates must be redeemed, too.

1.11. Protection against the environment

 Ad a basic principel technique with water may cause water damages. Before installing the system evaluate what damages leaking water is able to cause. A central floor drainage or a leak detecting system may prevent large losses.

2. Transport

2.1. Mechanical conditions

 The unit may transported only with suitable lifting tools. Pay attention to the transport weight listed in chapter “Technical data and unit protocol”.

 Do not tilt the unit more than 10% out of the horizontal position.

Plants with more than 4 pillars may not lifted in the center without auxiliary support. The plant should be lifted and transported with suitable tools at both sides of the frame.

Before transporting the unit it must be totally empty (this does not apply to the filter bed granules).

2.2. Climate conditions

 Reverse osmosis membranes are sensitive to frost. If additional safety actions are not done (e.g. frost protection) the temperature should never fall below zero.

If safety actions are done for the transport the frost protection is shown in degree centigrade with a label at the transport box.

 The temperature should never drop below the minimum temperature. If the R.O. plant is flushed with water the frost protection does not exists any longer.

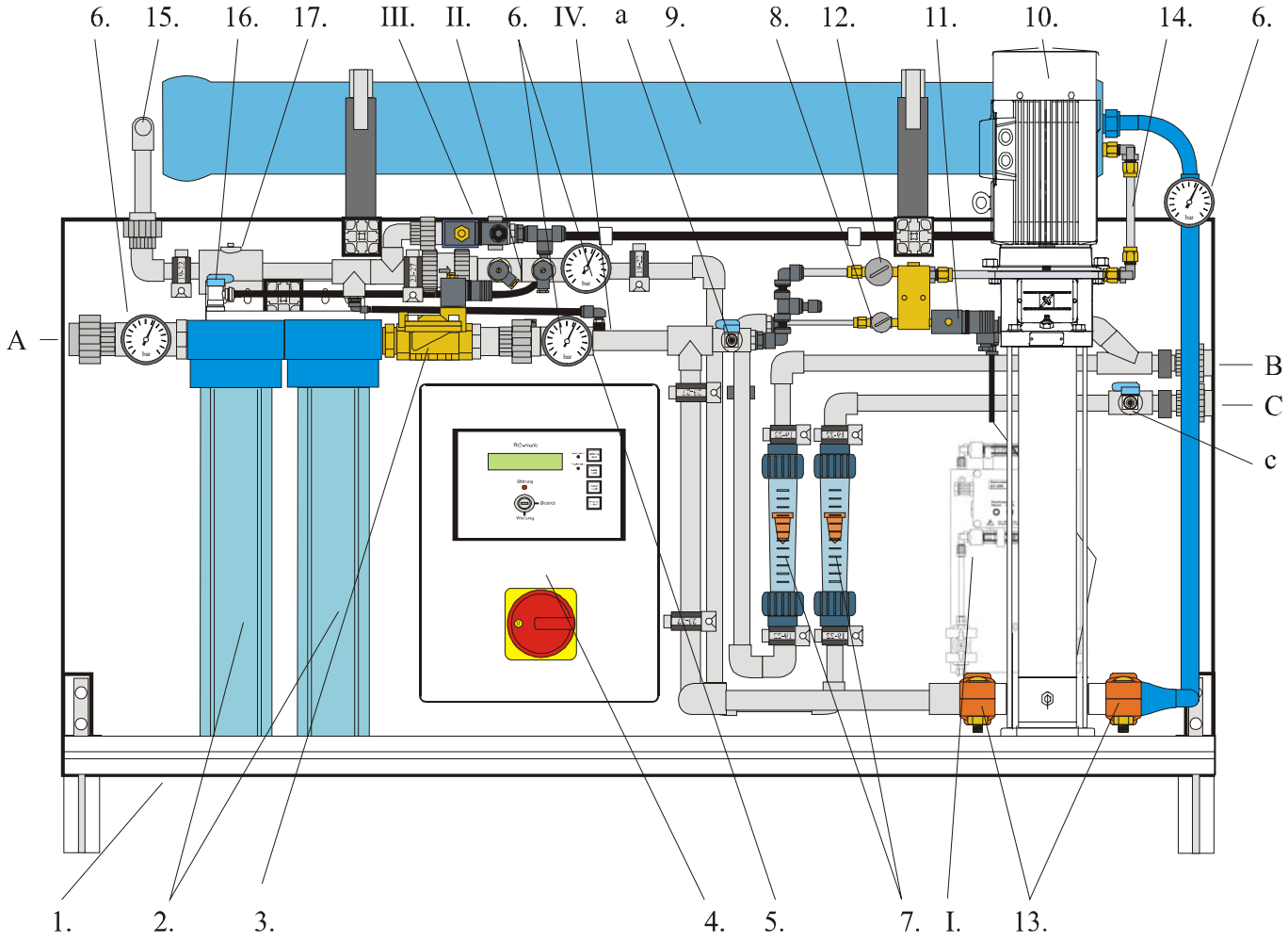
3. Designated use

AquaCare reverse osmosis units are build only for particle free water. Depending on the type of plant (tap water, surface water, brackish water, sea water) the feed water should not exceed the maximum concentration of salt (TDS) as shown in the protocol. If you use other waters than shown in the protocol you must ask AquaCare – otherwise the warrantee will be lost.

4. Configuration

The AquaCare R.O. unit is completely equipped. The unit has to be connected with feed water, drain and pure water line and of course with the electric. Please control the delivery if it is complete and not broken.

4.1. Basic equipment



The unit consists of following parts:
1. rigid frame made of aluminium profile (stainless steel frame on request);
2. pre filters with filter cartridges;
3. inlet solenoid;
4. electrical switch board (HP 6,000 only with RO-matic);
5. feed pressure switch;
6. pressure gauge;
7. flow meters for permeate and concentrate;
8. concentrate valve;
9. pressure housing with R.O. module(s);
10. multistage high pressure pump made of stainless steel or roto vane pump (HP 6,000);
11. flushing solenoid;
12. bypass valve / recycling valve (operation pressure valve);
13. VICTAULIC connector (not HP6.000);
14. concentrate tubing;
15. permeate tubing (collecting tube);
16. drain valve of pre filters;
17. conductivity cell;

A. feed; a. sample valve “feed”;
B. concentrate;
C. permeate; c. sample valve “permeate”

4.2. Options

Following option might be installed:
I. Hardness control unit
II. Pressure switches for pressure tank control
III. Permeate rejecting valve

5. Principle of function

With the help of the water pressure (A) the water is pressed through a semipermeable membrane (9.). The membrane is build in that way that even dissolved salts (salt, hardness, nitrate, silicic acid, etc.) and organic substances (pesticides and medicine residuals, etc) are rejected. To prevent blocking of the membrane a part of the water

with all the rejected substances is drained continuously (concentrate, B).

Water flow and pure water quality depend on several factors. The better the feed water quality the better the quality of the pure water. The higher the feed water pressure the better the quality and the higher the permeate water flow. Large units are equipped with a pressure pump (10.).

The water temperature affected the pure water flow: the warmer the water the more the water flow (see appendix “temperature correction factor”). The water temperature should never exceed 40°C – otherwise the membranes will be damaged.

To prevent the membranes against particles every AquaCare R.O. unit has a pre filtration (2.): a sediment filter (50 µm) and a combi filter (5 µm).

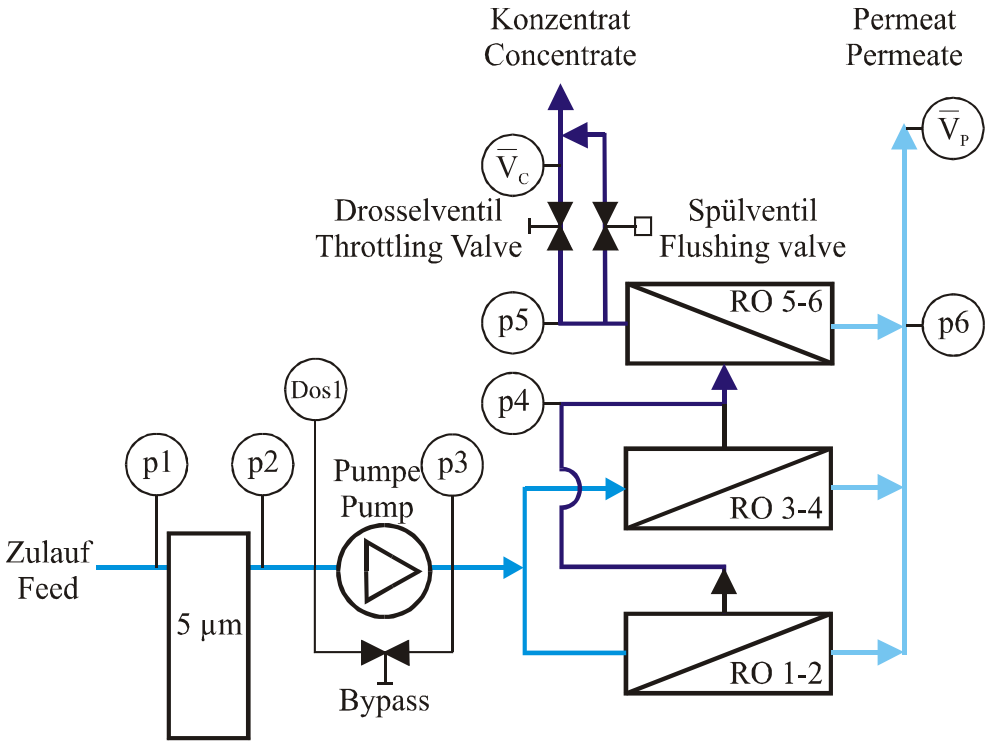
The activated carbon part of the combi filter will adsorb gaseous substances like chlorine.

The feed water pressure is controlled by a sensor (5.). If the pressure drops below the minimum pressure (see appendix “protocol”) the unit shuts down to prevent the pump for running dry. The pressure pump increases the operation pressure to 8…80 bar – depending on the type of unit.

At the membranes (9.) the water is divided into the pure water (C.) and waste water = concentrate (B.).

For a better recovery a softener of an antiscalling device is necessary.

The whole unit is controlled by a micro processor unit (RO-matic) or an PLC (Programmable Logic Controller).



6. Installation

6.1. Assembly

To guarantee a faultlessly operation of the R.O. unit it should be erected on an even and stable ground. Uneven parts of the floor might be balanced with the level pillar. Do not unscrew the pillar totally.

On each side of the R.O. unit there should be minimum 1.2 m space to change the membranes without difficulties. At the front you need space for doing the operation and may be to errect a CIP-station (clean in place).

If the ambient temperature exceeds the maximum shown in appendix “protocol” or if the motor is located 1000 meters above sea level or more, it may be necessary to use a motor with a higher rated output (if air cooled).

6.2. Water connectors

To operate the unit you must install water inlets and outlets.

 The connection with PVC-U must be glued with approved adhesion only. The processing regulation of the adhesion should be minded.

Connect the feed (A.) with the intended water source. The water must have the specification in quantity and quality as shown in the appendix "protocol".

 If strong impurities, oxidizing agents (e.g. chlorine), iron, manganese, barium or strontium are in the feed water, you must take steps to prevent the R.O. unit against failures. Please ask AquaCare.

 If the feed water pressure is not within the limits as shown in the appendix „protocol" you must take steps. At too low pressure you need a booster pump, at too high pressure you must use a suitable pressure relief valve.

 If you use a softener it should be monitored regularly (e.g. before a regeneration process). The hardness must be below 0.5°dH. If the softener fails the R.O. membranes will block. A automatically working hardness control shuts down the R.O. unit if hard water will reach the membranes.

 If you use an antiscaling station the dosing of the chemical must be done carefully. Local laws and safety instruction of the chemical producer must be minded. Dosing of chemicals should be done in combination with a static mixer only.

 The waste water = concentrate of the unit should be drained without pressure. The concentrate line **never** be closed or throttled. If the concentration line is very long (more than 5 meters) the diameter of the tube has to be adapted.

 The pure water = permeate should flow without pressure (except if a pressure tank is installed). Never close or throttle the permeate line. If the permeate line is longer than 5 meters the diameter of the tube has to be adapted.

If a pressure tank and its control sensors (II.) are installed the permeate line may be throttled or closed (after the pressure tank).

 The permeate pressure is shown at the pressure gauge "permeate" and works against the membrane pressure: e.g. operation pressure = 10 bar, permeate pressure = 2 bar, membrane pressure = 10 – 2 = 8 bar. If the water should flow in very long lines or to high points a inline booster pump should be installed.

 The permeate of a R.O. unit is not contaminated with bacteria. But in the permeate water lines biofilms can occure. To prevent bacterial growth the whole water lines have to be disinfected. Please ask AquaCare.

6.3. Electrical connection

The electrical connection must be done by authorized and qualified persons according with the local regulation only.

 Before opening a terminal box and before every disassembling of electrical components the supply voltage must be disconnected at all phases (contact opening minimum 3 mm).

The operation voltage and frequency are marked on the unit name plate. Make sure that the unit is suitable for the electricity supply on which it will be used.

 If the voltage of the mains is not constant a voltage guard should be installed. If the rolling direction will change a direction guard should be installed.

7. Start up the unit

 Before start up the unit check out of all connections are done well. Make sure that all

PVC-unions are tight and their o-ring seals are in the correct position.

 Check out if units before and after the R.O. unit are installed well and if they are working correctly. Open the inlet water supply.

 **Stainless steel sediment filter** (if delivered): the manual inlet ball valve must be open every time, except for maintenance. Open the deaerating ball valve at the top unit water is coming. The pressure gauges „pre filter“ and „post filter“ must show more than the minimum pressure as shown in the appendix “protocol”. Otherwise the unit will not start and the pump gets problems.

Turn on the main switch or with HP 6,000 the RO-matic (see appendix “RO-matic” or “PLC”). The inlet valve (solenoid or automatic ball valve) opens and water is flowing into the unit. About 30 seconds later the main pump starts and the unit is running. Please control the rotating direction of the pump (not at HP 6,000) and change two phases if necessary.
The R.O. unit is starting only if the pressure tank (option) is empty or the minimum level switch (option) of the storing tank (option) is in the lower position.

Adjusting of the water flows:
If the unit is producing water permeate flow and concentrate flow must have the right relation.

Permeate flow

The AquaCare unit is delivered with the right settings. But different temperatures and feed pressures might cause other settings. The “membrane pressure” should never exceed the maximum as shown in the appendix “protocol” – too low pressures decreases the permeate water flow.

The operation pressure is correct if the “normal flow” is reached. If the permeat flow is higher than 10% of the normal flow the operation pressure should be reduced by opening the bypass valve (12.). If the water flow is too low close the bypass valve carefully.
If the feed water is cold you need higher pressures than with warm feed water.

 Higher pressures than the maximum pressure shown in the appendix „protocol” will damage the unit.

Reading out the pressure gauges and flow meter may only be done if the unit is producing water and is **not** in the flushing modus.

Concentrate flow

The AquaCare unit is adjusted to the right recovery. The recommended recovery is shown in the appendix “protocol” and should never drop below the minimum.

 The concentrate flow is adjusted with the concentrate valve (8.). If you close the valve less concentrate will flow. If you open it more concentrate will flow. **Never close the valve fully!**

 The recovery should be the same as shown in the appendix „protocol“. If you reduce the recovery too much (too less concentrate will flow), the permeate flow will decrease and the membranes will be damaged. If too much concentrate is flowing you need too much water and chemicals (softener, antiscalants).

If the recommended recovery is 75% the concentrate must have 25% of the amount permeate + concentrate = feed water. Measurement and adjustment should be done only if the unit is in operation and is **not** flushing.
If a pressure tank (option) is connected the measurement should be done at MINIMUM pressure.

Blend valve flow (Option)

With the „blend“ valve (IV.) you can mix feed water to the permeate. If an additional flow meter is installed the blended feed water flow is shown. With an additional conductivity meter you can measure the blended water.

If you shut down the unit please look at the manuals of the RO-matic (appendix) or PLC (appendix).

8. Maintain the unit

The AquaCare reverse osmosis unit needs less maintenance. But some adjustments and the con-

dition of the pre-filters should be monitored regularly.

8.1. Pre-Filters

The life time of the filter cartridges depends on the feed water quality and the operating hours. The life time can vary extremely.

If the pressure difference of the “pre filter” and “post filter” is more than 1 bar (e.g. pre filter = 4.0 bar, post filter = 2.5 bar: 4.0-2.5=1.5 bar difference pressure) the filter cartridges have to be changed.

 At more than 2 bar difference pressure the cartridges will collapse.

For changing the cartridges you must stop the R.O. unit (see appendix “RO-matic” or “PLC”). Turn off the main switch (not at HP 6,000).

Close the water supply and the manual inlet ball valve (only with stainless steel filters). Open the drain valve of the pre filters (16.) as long as the pressure of the gauges show more than 0 bar. Then close the drain valve.

Now open the filter housing with the wrench and take off the cup. Put out the old cartridges and fill in the new one. Use only filter cartridges with the right diameter, length and pore size.

Now closed the filter and take care with the o-ring. Start the R.O. unit as usual.

 Only with proper cartridges the R.O. is protected against particles in the feed water. Dirty or wrong filter cartridges may damage pump and membranes.

8.2. Monitoring the permeate

The quantity and quality of the permeate should be monitored regularly. You can read the permeate flow directly at the flow meter (7.). As an option the flow may be controlled automatically with a switch at the flow meter. The quality of the permeate should be read out at the conductivity display of the RO-matic respectively PLC. Please program the limiting values (see appendix “RO-matic” or “PLC”).

Alternative you can take samples at the sample valve (c.) and measure them with another conductivity meter. At recoveries of more than 50% the conductivity of the permeate must be below 15% of the feed conductivity (sample valve a.); at recoveries below 50% below 10%.

8.3. Flushing the membranes

If the water quality is gone worse (0.5% decrease) and/or the water flow is gone lower (10-15% lower) the membranes have to be flushed chemically.

Therefore use a CIP (clean in place) unit ( read its manual carefully!).

Alternative take out the membranes of the housings and send them for cleaning to AquaCare.

To take out the membranes shut down the R.O. unit and wait some minutes. Open the tube connectors at both side of the housing. Therefore take away the secure ring / plate, pull the caps out of the housing. Now pull / push the membranes out of the housing (in flow direction).Send the membranes in a plastic coat to AquaCare.

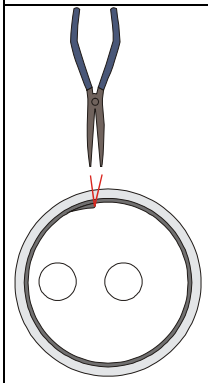
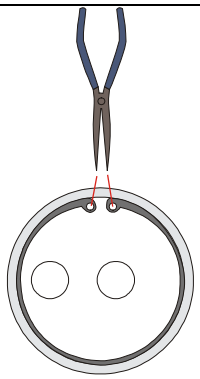
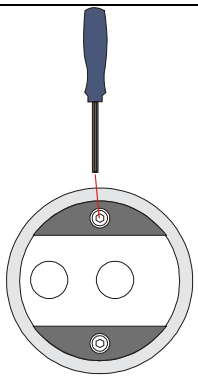
8.4. Changing the membranes

If permeate flow or permeate quality is too bad and chemical flushing has not effected the results significantly the membranes have to be changed.

Therefore shut down the unit and take out the membranes as described in the chapter before. Push the membrane in flow direction into the housings.

1. Take off the stainless steel tubing: Therefore

Take off both end plates of the membrane housing. There are different systems (depending on unit). Pull out the end plates parallel!

Spring with nipple: Take off the spring by pulling the nippel with a flat-nose pliers.	**Snap-in ring:** Take off the snap-in ring by using a pliers for snap-in rings. This special tool is unalterable! Otherwise you get hurt.	**Halfmoon plate**: Turn out the screws fixing the plate. Take out the plates. Turn in the screws and pull at them with a pliers.
		

2. Pull out the membrane in water flow direction. If the membrane stuck in the housing very tightly you can use a wooden

Take a little bit silicon fat for the o-rings. Do not forget the interconnectors if more than one membrane is in a housing.

Close the housings and take care that the sealing are in the right position. Take new o-rings if the are older than 1 year.

Put the unit into operation as used.

8.5. Servo valves

If you use warm water (> 20°C) and if the water contains more than 500 mg/l the servo valves should be cleaned every 6 months.

servo valve (inlet valve and/or flushing valve)

Therefore shut down the R.O. unit and wait some minutes. Turn off the retaining screw at the top and lift up the coil unit. Unscrew the four screws with a hex key. Lift the top part. If you see salt crusts at the black membrane clean it softly with warm water. If the membrane is broken (the valve is not closing although the voltage is turn off) replace it.

9. Trouble shooting

If you cannot eliminate the disturbance ask your service partner or AquaCare.

9.1. The feed pressure is too low – the unit shuts down

A.
Examine if a ball valve in the feed line is closed or not fully open.

Re-start the R.O. unit again.

The pressure “post filter” must have minimum 1.0 bar during operation. If not ensure a better feed water pressure by using another line or a booster pump.

B.
Check if the pressure difference „pre filter“ – „post filter“ is over1.0 bar. If so change the filter cartridges (see chapter “maintenance”).

C.
Ask AquaCare.

9.2. Too low rejection

A.
Check the pre filters and change the cartridges if necessary.

B.
Change the membranes as shown in chapter "changing the membranes".

C.
Ask AquaCare

10. Disinfection

If the feed water contains bacteria or if the risk of organic fouling is too high the R.O. membranes should be disinfected every month carefully. Use only AquaCare disinfection fluid! With others you may damage the membranes irreversibly.

Before you can use the AquaCare disinfection fluid you must mix it 24 hours before – see instruction manual of disinfection set.

Put the R.O. unit into operation. Open the concentrate valve (8) totally for about 5 minutes. Switch the R.O. unit on "stand by" (push button "Bereitschaft" at ROmatic): the pump stops.

Close the R.O. feed water valve. Open the valve (12) operation pressure totally.

Take the syringe from the disinfection set, use the adapter and connect it to the sample valve (a). Open the sample valve and inject the fluid into the system. Flush with twice the volume R.O. water (of tap water).

R.O. model	Needed disinfection volume
HP 6000	50 ml
HP 12000	100 ml
HP 18000	150 ml
HP 24000	200 ml

Now start the R.O. unit in maintaining modus: turn the maintaining key of the ROmatic to position "Wartung", display shows "Modus Service". Push button "Störung aus", display shows "Modus Wartung".

Now push the button "Leitwert". The R.O. pump starts and the display shows "RO". Do not mention the loud noise of the pump, in this modus the pump is cavitating.

After 5 minutes push the button "Leitwert" again, the pumps stops.

Turn the maintaining key into position operation "Betrieb".

Open the feed water valveand wait for about 24 hours. Do not wait longer than 48 hours.

Put the R.O. unit into operation as usual and adjust the concentrate valve (8) and the operaton pressure valve (12) as described before.

Drain the permeate for the first 15 minutes. It contains rests of the disinfecting fluid.

11. Warranty

You have 24 months warranty on all AquaCare units excepts spare parts like pump bearings and rotors. You have no warranty if parts are broken by violent (for example totally closed water inlet). For consequential losses AquaCare is not liable.

To asset a claim on membranes a regularly documentation of feed water quality (minimum requirements are shown in appendix "protocol"), of the parameters of the R.O. unit and the permeate quality has to be done.

Minimum feed water quality:
TDS < 2000 mg/l, iron < 0,1 mg/l, manganese < 0,05 mg/l, strontium and barium not detectable, oxidizing agents like chlorine < 0,1 mg/l (if any carbon filter is installed), silt density index SDI_{15min} <3,0

12. ANHANG:
RO-matik Reverse Osmosis Unit Control

ELWA

Klaus Warzog GmbH

Programmversion: V2.1

Content

12.1. Inputs

1 = mains PE
2 = mains N
3 = mains L1

25/26 = moisture sensor
27/28 = softner / antiscaling dosing
29/30 = pressure switch inlet
31/32 = disturbance RO pump
33/34 = flow meter permeate
35/36 = flow meter concentrate
37/38 = level max (storing tank)
39/40 = level min (storing tank)
41/42 = level shortage (storing tank)
43/44 = level empty (storing tank)
45/46 = disturbance storing tank pump
47/48 = pressure switch storing tank pump
49/50 = conductivity sensor permeate
50/42 = conductivity sensor deionate
53-56 = -

All contacts are open at disturbance.
Level contacts at rising water level must open.

12.2. Outputs (NO 230 V)

4/5 = inlet valve (additional)	5 A
6/7 = softener / dosing pump	5 A
8/9 = inlet valve R.O. unit	5 A
10/11 = pressure pump R.O.	10 A
12/13 = flushing valve	5 A
14/15 = pump storing tank	10 A
16 = alarm output: potential-free NC 17 = alarm output: potential-free C 18 = alarm output: potential-free NO	5A
19 = alarm output Deionate: potential-free NC 20 = alarm output Deionate: potential-free C 21 = alarm output Deionate: potential-free NO	5A
22 = alarm output Permeat: potential-free NC 23 = alarm output Permeat: potential-free C 24 = alarm output Permeat: potential-free NO	5A

12.3. Technical data RO-matic

Electric connection:	230 V +10% -15% 50/60 Hz
Power:	30 VA
Ambient temperature:	0-50°C
Degree of protection:	IP 54
Class of protection:	II
Conductivity:	Deionat 0-20 µS/cm Permeat 0-200 µS/cm
Factor of conductivity cell:	0,1
Fuse:	F0, 315 mA
Dimensions L×W×H:	190 × 144 × 120 mm
Opening in switch panel:	186 × 137 mm
Display:	alphanumeric display 2×20 digits
Language:	German
Technology:	single chip micro processor system

12.4. Functions

After power input
display: ** Bereitschaft ** (stand by)

After pushing button „Automatik“:
Display: ** Automatik ** (automatic)
- Anlaufbetrieb – (starting sequence)
direct opening of additional inlet valve (terminal 4/5)
1 s delay: dosing pump / softner (terminal 6/7)
1 s delay: inlet valve R.O. pump (terminal 8/9)
30 s delay: R.O. pressure pump (terminal 10/11)
Display: ** Automatik ** (automatic)
Deionat xx.x µS/cm
all contacts in action,
level contacts in action,
tank pump will run if level “shortage” and “empty” are in condition “filled”

Shut down the unit: push button „Bereitschaft“ (stand-by)
Display: ** Automatik ** (automatic)
- Bereitschaft – (stand by)

12.5. Programming

Turn key switch in position „Wartung“ (maintenance)
Display ** Modus Service ** (modus service)

Push button „Leitwert“ (conductivity)
Display ** Programmierung ** (programming)

Push button „Störung aus“ (disturbance off)
Display: Schaltpunkt Permeat (set point)
000 µS/cm

With button „Bereitschaft“ (stand by) chose the right digit

With button „Automatik“ (automatic) or „Leitwert“ (conductivity) choose the value

Set point permeat: 0…199 µS/cm

Choose next step with button „Störung aus“ (disturbance off)

Set point Deionate 0...19,9 µS/cm

Programming see above

Choose next step with button „Störung aus“ (disturbance off) – programming see above

Zeitverzögerung Schaltpunkt Permeat (delay set point permeate) – programming see above

Set point 0...10 min

Red LED „Schaltkontakt 1“ (contact 1) is flushing if conductivity in over the limit; relay contact 1 is working after the programmed delay.

Choose next step with button „Störung aus“ (disturbance off)

Zeitverzögerung Schaltpunkt Deionat (delay set point deionate) - programming see above

Set point 0...10 min

Red LED „Schaltkontakt 2“ (contact 2) is flushing if conductivity in over the limit; relay contact 2 is working after the programmed delay.

Choose next step with button „Störung aus“ (disturbance off)

Einstellung Spülzeit (set flushing time) - programming see above

Set point flushing time 0...10 min

Choose next step with button „Störung aus“ (disturbance off)

Set point 0…24 hours

Leave the programming modus by turning the key switch into position “Betrieb” (operation)

Display: ** Bereitschaft ** (stand by)

12.6. Maintenance

Turn key switch in position „Wartung“ (maintenance)
Display ** Modus Service ** (modus service)

Push button „Störung aus“ (disturbance off)
Display: ** Wartung ** (maintenance)

Button „Störung aus“ (disturbance off):
manually switching on and off: dosing pump
Display Dp

Button „Leitwert“ (conductivity):
manually switching on and off: R.O. pump, inlet valve R.O., additional inlet valve
Display: RO

Button „Automatik“ (automatic):
manually switching on and off: flushing valve
Display: Sv

Button „Bereitschaft“ (stand by)
manually switching on and off: pump storing tank
Display: Fp

Leave modus “maintenance” by turning the key switch to position Betrieb (operation)
Display: ** Bereitschaft **

12.7. Operating hours counter

Turn key switch in position „Wartung“ (maintenance)
Display ** Modus Service ** (modus service)

Push button „Automatik“ (automatic)
Display: Betriebstunden (operating hours)
RO pumpe xxxx Std (RO pump xxxx hours)

For deleting the hours push button „Störung aus“ (disturbance off) and „Bereitschaft“ (stand by) simultaneously.

Leave modus “operating hours counter” by turning the key switch to position Betrieb (operation)
Display: ** Bereitschaft **

12.8. General information for alarms

If a disturbance happens it will be shown in the display. The general alarm contact switches.

If the disturbance is repaired the display is eliminated with the button „Störung aus“ (disturbance off). The alarm relay is not active. Now you can restart the unit.

If the disturbance is not repaired you can inactivate the alarm relay by pushing the button „Störung aus“ (disturbance off). But the display is not cleared.

If more than one disturbances happens the next disturbance is shown if the first is cleared in the display.

If an input is not used you must use a jumper.

12.9. Disturbances

Moisture sensor:
Terminal: 35/26
at disturbance: shut down of the whole R.O. unit
Display: ** Bereitschaft ** (stand by)
Störung Feuchtigkeit (disturbance moisture)

Softner / antiscalant dosing pump:
Terminal: 27/28

at disturbance: shut down of additional inlet valve, R.O. inlet valve, R.O. pump
Display: ** Bereitschaft ** (stand by)
Störung Enthärtung (disturbance softener / dosing pump)

Feed pressure:
Terminal: 29/30
at low feed pressure: after 20 s shut down of additional inlet valve, R.O. inlet valve, R.O. pump
Display: ** Bereitschaft ** (stand by)
Störung Stadtw. Druck (missing feed water pressure)

RO pump:
Terminal: 31/32
at disturbance: shut down of additional inlet valve, R.O. inlet valve, R.O. pump
Display: ** Bereitschaft ** (stand by)
Störung HD-RO-Pumpe (disturbance RO pump)

Pressure / flow permeate:
at disturbance: after 20 s shut down of additional inlet valve, R.O. inlet valve, R.O. pump
Display: **Bereitschaft ** (stand by)
Störung Permeat (disturbance permeate)

Pressure / flow concentrate:
at disturbance: after 20 s shut down of additional inlet valve, R.O. inlet valve, R.O. pump
Display: **Bereitschaft ** (stand by)
Störung Konzentrat (disturbance concentrate)

Storing tank pump:
at disturbance: shut down of the whole unit
Display: ** Bereitschaft ** (stand by)
Störung Förderpumpe (disturbance tank pump)

Level control:
Level min. – level max.: if the water level reaches level max. the unit shuts down and the flushing system works
Display: ** Automatik ** (automatic)
Spülung in Betrieb (flushing in action)
after flushing
Display: ** Automatik ** (automatic)

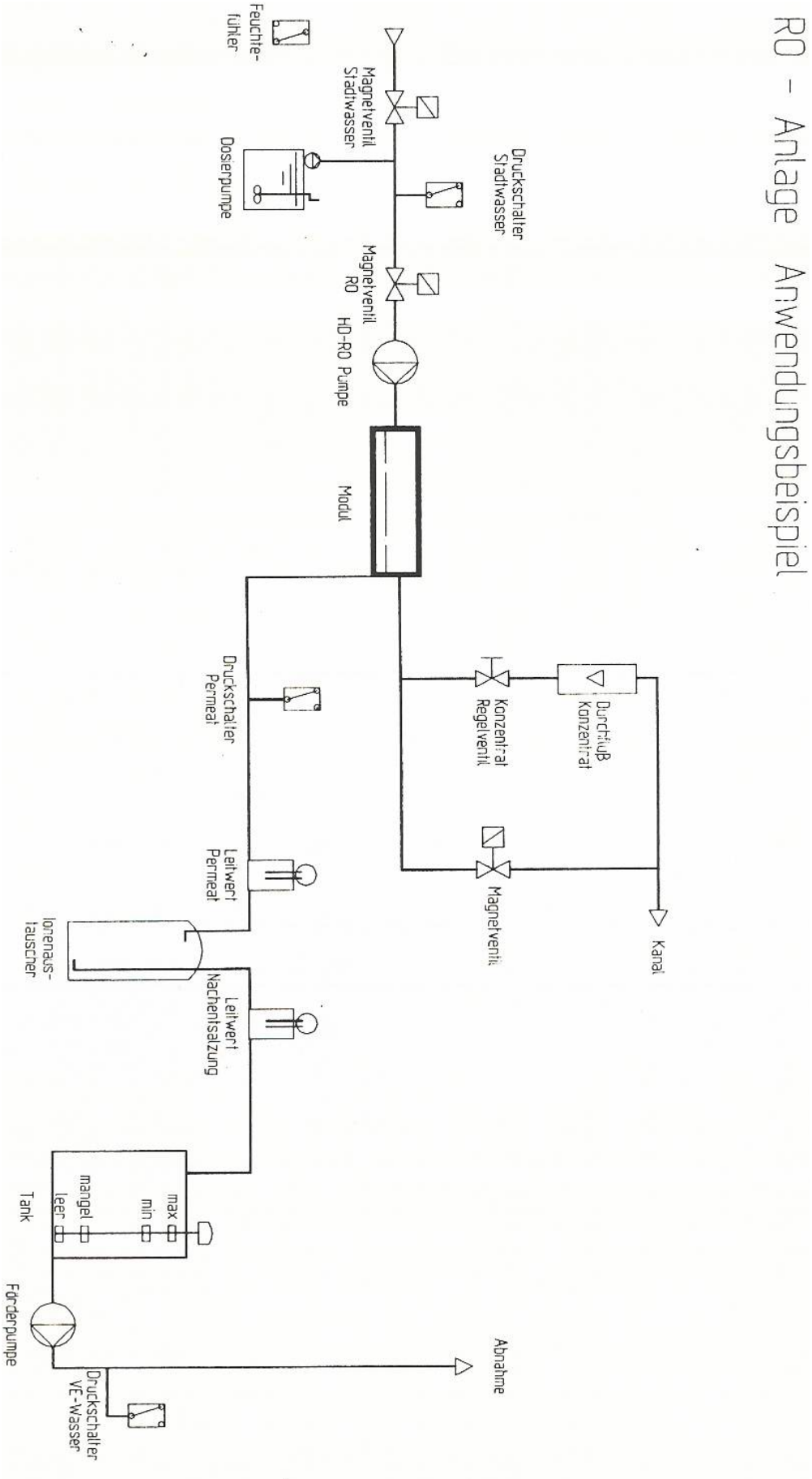
If the water level sinks below level min. the unit starts automatically.

Level shortage – level empty:
Control of the storing tank pump.
If the water is below both level switches the storing tank pump shuts down but the R.O. is still working:
Display: **Automatik ** (automatic)
- Tank leer – (tank empty)

If the water level is above the level “shortage” the storing tank pump is activ
Display: ** Automatik ** (automatic)
Deionat xx.x µS/cm

Permeate rejection:
Programming of the time delay of permeate and deionate to „11 min“.
If the water quality is worse than the set point contact 1+2 are active. If the quality gets better than the set point value the relays are inactive. If the set point value is not reached within 10 minutes following disturbance is shown:
Display: ** Bereitschaft ** (stand by)
Störung Verwurf. (disturbance rejection))

12.10. Typically RO-matic applications



13. Appendix: Protocol

Customer no.: Phone: Fax: Email: Com.	AquaCare® Aquatic Systems Research AquaCare GmbH & Co.KG. Josefstrasse 35-37 · D-45699 Herten · Germany Tel.: +49 / 23 66 / 3 25 52 · Fax: +49 / 23 66 / 10 43 85 http://www.aquacare.de · e-mail: info@aquacare.de

Type of unit	***HighPower* HP**
Permeate flow	m^3/h at 1 bar feed pressure 15°C, 500 ppm TDS
Unit no.	2-
Frame Dimensions L×W×H	aluminium profil frame × × m
Weight	kg
Feed pressure	1...6 bar
Max. operation pressure	16 bar
Operation temperature	4...40°C
Ambient temperature	4...45°C
Sediment filter: Flow at 0.3 bar Material Number of cartridges Length of cartridges Diameter cartridges Pore size of cartridges Connectors Material of seals	 2,5 m^3/h PP + SAN 1 + 1 20” 2,5“ 50 µm + 5 µm 1” NBR
Dosing pump Manufacture Type Model no. Data of running Electrical connection Supply to ROmatic	 Grundfos DM2-18AR-PV/V/V/C-F-3111F C96434905P105510001 2,5 l/h, 18 bar 230 V 50 Hz 18 W COM-NC
Static mixer Manufacture Material Connectors Injection port	 AquaCare PVC-U, DIN 1.4571 ASIS 316 Ti, EPDM unions d90 (DN80) 6 mm / ¼“ tube
Main pump (R.O. pump) Manufacturer Type No. Minimum flow	high pressure circulation pump Grundfos CRN 45-5 A-F-G-E-HQQE A96123125P10550 22 m^3/h
Motor: Manufacturer, No.	 Siemens

Electrical connection	380-480 / 660-690 V, 50 Hz, 18,5 kW
Control: Manufacture No. / Version Parameter in delivery condition	RO-matic ELWA 284/07 Version 2.12C (without RC-elements) flushing time: 10 min; flushing interval: 24 h switch point permeate: 50 µS/cm delay time permeate: 5 min switch point dionate: 5 µS/cm delay time deionate: 5 min
Valves Feed Flushing valve Mixing valve Reject valve	 ASV Servo Type 239, DN20 3/4", 230 V AC NC (47751) ASV 0...48 bar DN6, 1", 230 V AC NC (69308) - - -
Water connections	feed water: DN25, d32 PVC permeate: DN15, d20 PVC concentrate: DN15, d20 PVC
Pre pressure switch	Timmer: Schließer 0,2-1 bar / NO 0.2-1 bar
Check valve permeate	PVC d20 DN 15 with unions

R.O. Array: no. housing × no. membrane Module housing Membrane type	 1 × 1 CodeLine 40E30N-1 (300 psi, 21 bar) Filmtec TW30-4040 see appendix

Module no.	Druckrohr no.	Membrane no.	Membrane no.	Membrane no.	Membrane no.	Membrane no.
1						
2						
3						
4						

Electric switch board Soft starter Settings Other data of box	 with phase loss rotation indicator Ramp up: 5 s; Ramp down: 0 s; Init. Torque: 25% see appendix

Leakage test Total tubing Pressure tubing Pre pressure Level control Motor protection switch Electrical rotation Solenoids and actuators	 6 bar 24 h 16 bar 24 h ca. 0,5 bar - o.k. o.k. o.k.

Running test:		
Electrical data:	test conditions	normal conditions
Voltage L1-L2	- V	**400 V ± 10%**
dito L1-L3	- V	**.**
dito L2-L3	- V	**.**
dito L1-N	230 V	**230 V± 10%**
dito L2-N	- V	**.**
dito L3-N	- V	**.**
Current L1	- A	**max. A**
dito L2	- A	**.**
dito L3	- A	**.**
dito N	0,52 A	**0,8 A**
Pre pressure "pre filter"	bar	**2 bar**
Filter pressure "post filter"	bar	**1,8 bar**
Membrane pressure "pre membrane"	bar	**max. 16 bar**
Permeate pressure	bar	**0 bar**
Temperature	°C	**15 °C**
Testing time	h	
Concentrate	l/h	**83 l/h**
Permeate	l/h	**250 l/h**
Ratio: concentrate / permeate	1 : 3	**1 : 3**
Recovery	75%	**max. 75%**
Rejection	%	**95…98%**
Conductivity:		
"A" feed water, WTW*	µS/cm	**500 µS/cm**
"B" concentrate, WTW*	µS/cm	
"C" permeate, RO-matic	µS/cm	
"C" permeate, WTW*	µS/cm	

* measured with handheld conductivity meter WTW Cond 340i

Attention: to use only with accepted antiscalants or softener before

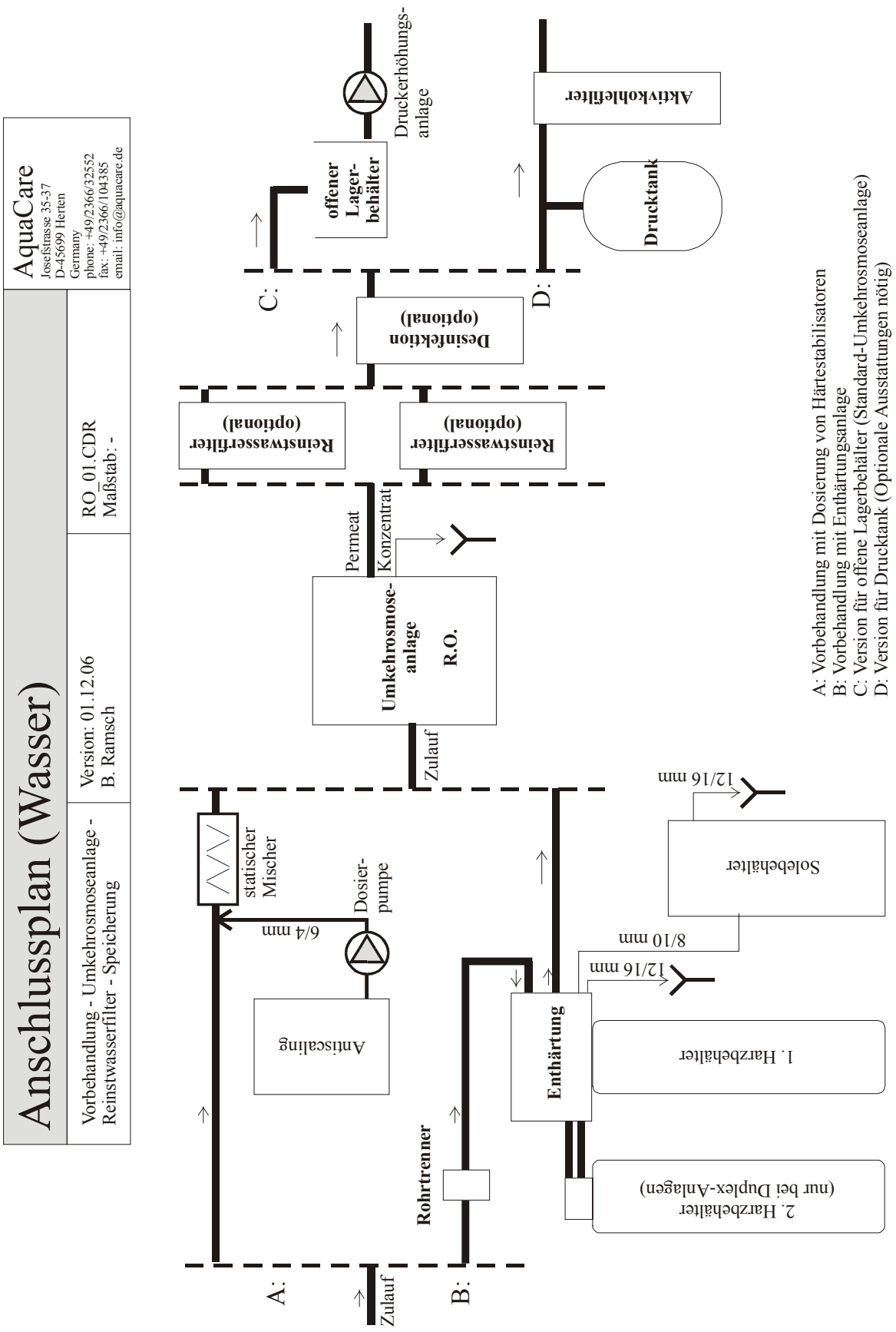
Attention: recovery not over 75%

Date: .....03. February 2006

AquaCare:..... Herr B. Ramsch Customer: .....

Signature:..... .....

14. Appendix: sketch (water) of additional units



15. APPENDIX: Backflow Preventer

16. APPENDIX: Softener

General information:

To adjust the water capacity in m^3 of the softener you must know the water hardness (German degrees). Take the maximum hardness that can occur with the seasons. If the hardness is extremely changing use a hardness control unit (option) to guard the RO unit.

Calculation: divide the unit capacity (in °dH*m^3, see packing list) by the hardness (in °dH) of the water. Take only 90% of the value (10% security factor) and you get the capacity in m^3.
example:

Total hardness: 15°dH, capacity of the unit 60°dH*m^3
60 / 15 = 4
minus 10% = 3,6 (you have to adjust the capacity of the softener to 3,6 m^3)

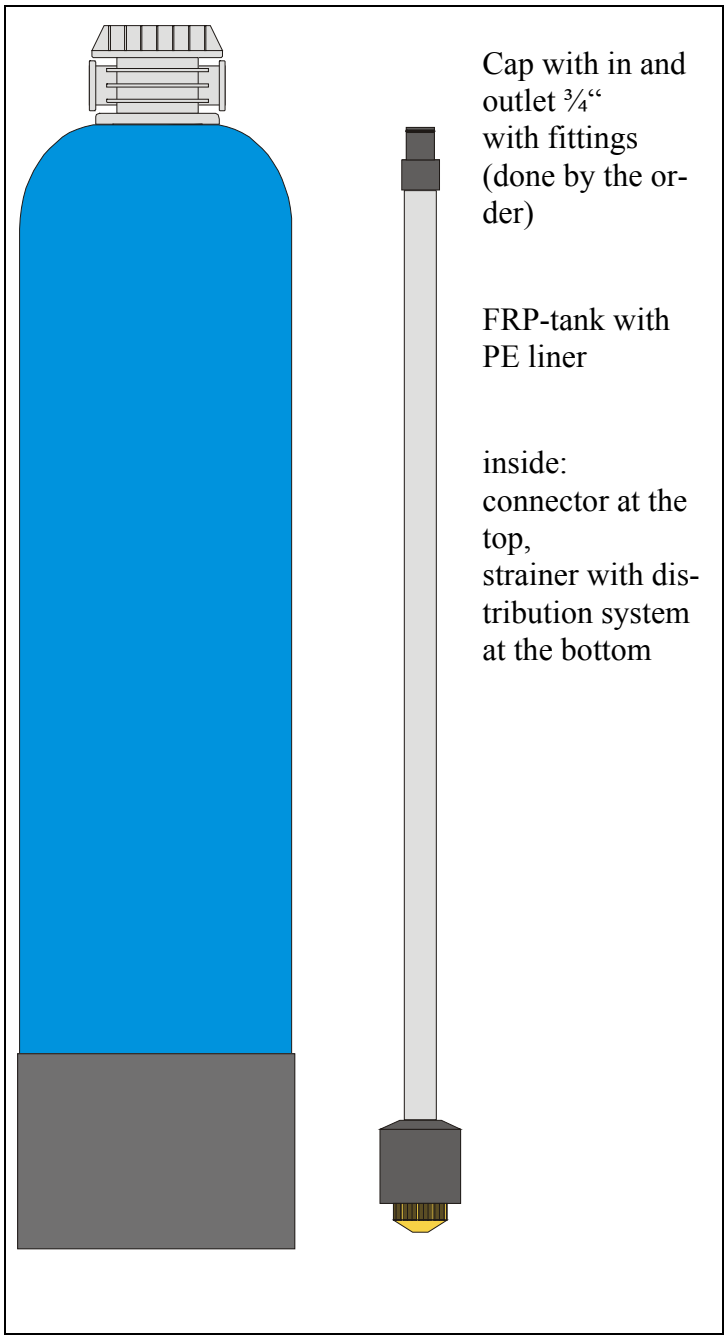
Important!

Be sure that the connection from brine tank to the control valve is tight (at modus “sucking brine”) any air bubble should be in the tube.

The salt tablets never be empty. If only 10 cm tablets are in the brine tank fill up the tank immediately. If hard water flows into the RO unit pump and membranes will be damaged. If the maintenance of the bring tank is not sure please use an “salt lack detector”.

Adjustment of the unit at delivery:
water hardness: 13°dH (see appendix), capacity of the softener 100°dH*m^3, setting 6,9 m^3

17. APPENDIX: desalination resin



R.O. water contains small amount of salts. To eliminate these rests a high effective ion exchange resin has to be connected after the R.O. unit.

AquaCare offers two versions:
1. The tank has its own conductivity meter and shows the conductivity
2. After the tank a conductivity probe is connected and the conductivity is shown in the ROmatic control of the R.O. system. To show the conductivity of the deionate (water after the resin) press button “Leitfähigkeit” (conductivity). You can set the switch point to your purposes. We recommend 2-3 µS/cm to be sure that silicic acid is out of the water.

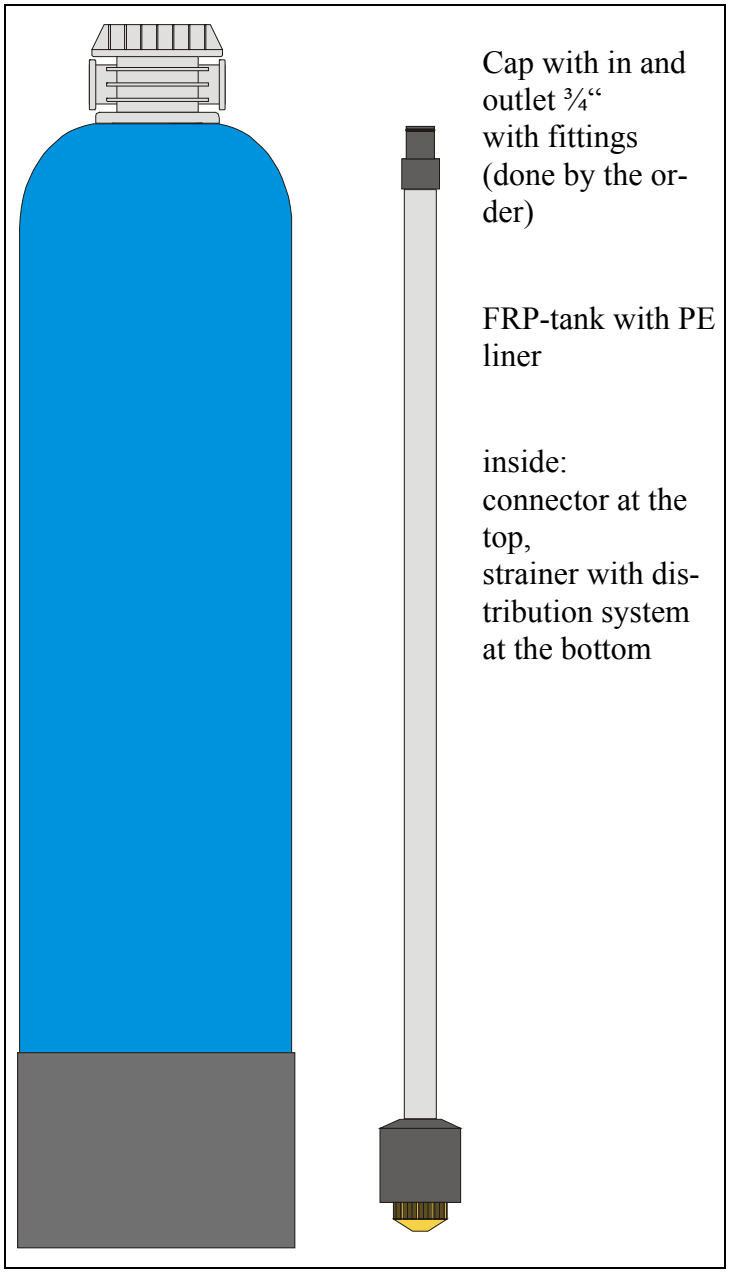
Changing the resin:

If the water quality gets worse shut down the RO system and disconnect the resin tank from the water line. If necessary remove the electric cable to the conductivity cell. Open the tank by unscrewing the cap. Pour out the old resin and flush with pure water. Fill in the new resin (use a sprue) - attention! Never let resin inside of the middle tube (PVC grey). To fill up the tank to the maximum pour a little bit permeate into the tank and the resin will settle down.

Take care that the o-rings an the top connector has a little bit silicone fat and that any material is fallen inside of the centre tube. The o-ring at the cap should be greased, too. Take care that any resin ball are in the thread.

The operation pressure at 20°C maximum 8.5 bar, maximum temperature: 45°C

18. APPENDIX: re-mineralising filter



R.O. water has only less minerals. To enrich the water with calcium and hydrogen carbonate at re-mineralising filter should be mounted after the R.O. unit. The carbonic acid in the permeate will dissolve the material inside of the tank.

If the water contains bacteria the tank should be disinfected regularly. Therefore shut down the R.O. unit and let the water out of the tank. Open the cap and fill disinfection fluid into the tank. After the reaction time drain the fluid and connect the tank to the R.O. system again.

Drain the first two volumes of the tank.

If the tank contains only ¾ calcite material of the total volume refill the tank totally. Therefore shut down the RO system and disconnect the calcit tank from the water line. If necessary remove the electric cable to the conductivity cell. Open the tank by unscrewing the cap. Fill in the new calcite balls (use a sprue) - attention! Never let the balls inside of the middle tube (PVC grey).

Take care that the o-rings an the top connector has a little bit silicone fat and that any material is fallen inside of the centre tube. The o-ring at the cap should be greased, too. Take care that any balsl are in the thread.

The operation pressure at 20°C maximum 8.5 bar, maximum temperature: 45°C

Size	Order number	Maximum flow in l/h	Minimum hardness at 15°C and maximum flow	Dimensions in mm: Diameter × total height
0.7 Liter	AH0001	6	1°dH	
6 Liter	AH0006	45		
10 Liter	AH0010	75		
14 Liter	AH0014	105		
25 Liter	AH0025	185		220 × 980
30 Liter	AH0030	225		
35 Liter	AH0035	260		
45 Liter	AH0045	330		

At higher temperatures and lower flow the concentrations of calcium and hydrogen carbonate will raise.

19. APPENDIX: Membranes

19.1. Temperature correction factor of CSM-ThinFilmComposite (TFC)-Membranes

Temperature	TN, BN, BE, TE grade	FE grade	BL, FL grade
5	2.134	2.328	2.093
6	2.049	2.225	2.012
7	1.969	2.128	1.935
8	1.892	2.035	1.861
9	1.818	1.947	1.791
10	1.748	1.864	1.723
11	1.681	1.784	1.659
12	1.617	1.709	1.597
13	1.556	1.637	1.539
14	1.498	1.569	1.482
15	1.442	1.504	1.428
16	1.388	1.442	1.377
17	1.337	1.383	1.327
18	1.288	1.326	1.280
19	1.242	1.326	1.235
20	1.197	1.222	1.192
21	1.154	1.173	1.150
22	1.113	1.127	1.110
23	1.074	1.083	1.072
24	1.036	1.040	1.035
25	1.000	1.000	1.000
26	0.970	0.972	0.971
27	0.940	0.946	0.942
28	0.912	0.920	0.915
29	0.885	0.895	0.888
30	0.859	0.871	0.863
31	0.833	0.847	0.838
32	0.809	0.825	0.815
33	0.785	0.803	0.792
34	0.763	0.782	0.770
35	0.741	0.762	0.748
36	0.720	0.742	0.728
37	0.699	0.723	0.708
38	0.680	0.704	0.689
39	0.661	0.686	0.670
40	0.642	0.669	0.652

To calculate the normal permeate flow at the actual water temperature (1. column) multiply the actual permeate flow with the temperature correction factor of the relevant membrane type (2. + 3. column).

19.2. Data of the membrane

20. APPENDIX: Electric Switch Board

21. APPENDIX: High Pressure Pump

22. APPENDIX: Dosing Pump