

Systeme für Aquakultur,
Aquaristik, Labore und
zur Wasseraufbereitung

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

Systèmes pour aquaculture,
aquariums eau de mer,
laboratoires et traitements 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 *Excel-Turbo 50 - 150*



Reverse Osmosis Unit *Excel-Turbo 50*
(modifications possible)

Table of contents

1.	Safety Instructions	3
1.1.	General information	3
1.2.	Indication of information	3
1.3.	Qualification of the personnel.....	3
1.4.	Dangers if safety information are not minded	3
1.5.	Safe working	3
1.6.	Safety information for the operator	3
1.7.	Safety information for maintaining and assembling personnel	3
1.8.	Arbitrary reconstruction and spare parts production	3
1.9.	Illegal operation	4
1.10.	Linked aggregates	4
1.11.	Protection against the environment.....	4
2.	Transport	4
2.1.	Mechanical conditions	4
2.2.	Climate conditions	4
3.	Designated use	4
4.	Configuration	4
4.1.	Basic equipment.....	5
4.2.	Options.....	5
5.	Principle of function	5
6.	Installation	6
6.1.	Aufstellung.....	6
6.2.	Water connectors	6
6.3.	Electrical connection.....	7
7.	Start up the unit	7
8.	Putting out of service	8
9.	Maintain the unit	9
9.1.	Pre-Filter	9
9.2.	Monitoring the permeate.....	9
9.3.	Changing the membranes.....	9
10.	Trouble shooting	9
10.1.	The feed pressure is too low – the unit shuts down.....	9
10.2.	Too low rejection	9
10.3.	Unit will not start	10
11.	Warranty	10
12.	Appendix: Spare Parts	11
13.	Appendix: Circuit diagram	12
14.	Appendix: Protocol	13
15.	Appendix: CE Declaration of Conformity	14
16.	Appendix: Sketch (water) of additional units	15
17.	Appendix: Membranes	16
17.1.	Temperature correction factor of CSM- ThinFilmComposite (TFC)-Membranes.....	16
17.2.	Data of the membrane	16

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.

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



At a basic principle 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”.

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 exist any longer.

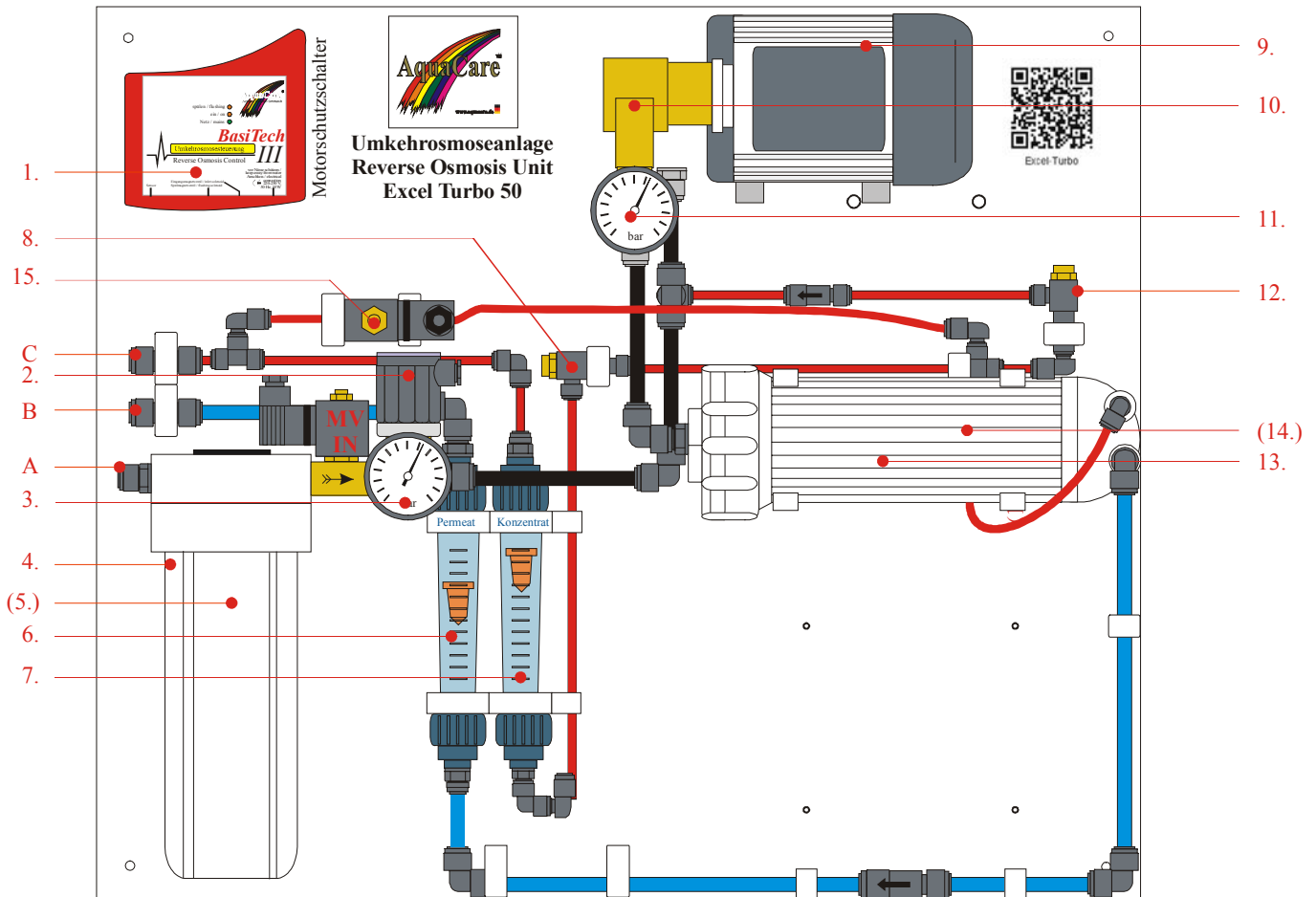
3. Designated use

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 warranty 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. *BasiTech* Reverse Osmosis control;
2. pre-pressure switch;
3. pre-pressure gauge;
4. filter housing
5. filter cartridge: 10" Combifilter 5 µm
6. flow meter permeate
7. flow meter concentrate
8. membrane pressure valve
9. motor;
10. roto vane pompe made of brass
(stainless steel on request);
11. membrane pressure gauge;
12. concentrate valve (recovery)
13. reverse osmosis housing
14. reverse osmosis membrane
15. flushing soleionid

- A. feed water;
 B. permeate (pure water);
 C. concentrat (waste water).

4.2. Options

Following option might be installed::

- I. Hardness control unit
- II. Mixing valve for raising the conductivity of the permeate with and without conductivity meter / with and without flow meter

5. Principle of function

With the help of the water pressure (A) the water is pressed through a semipermeable membrane (14.). 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, C).

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 (9.+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.

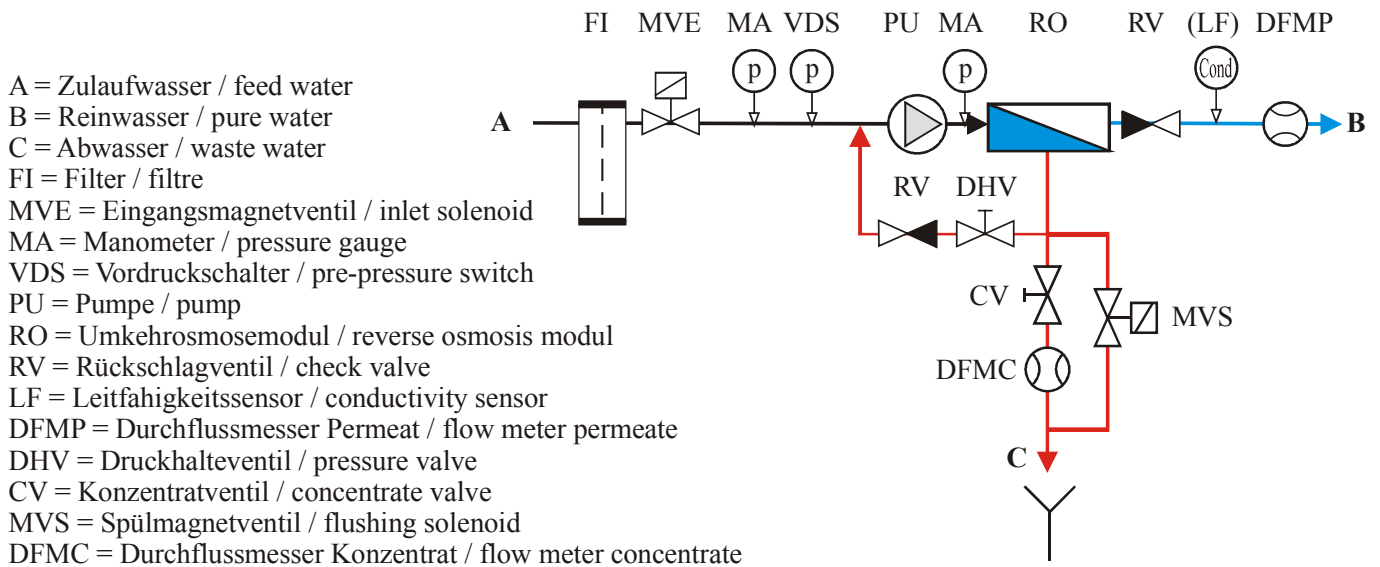
To prevent the membranes against particles every AquaCare R.O. unit has a pre filtration consisting of a housing (4.) equipped with a combi filter (5 µm) cartridge (5.). The activated carbon part of the combi filter will adsorb or destroy gaseous substances like chlorine.

The feed water pressure is controlled by a sensor (2.). 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 (see appendix “protocol”).

At the membranes (14.) the water is divided into the pure water (B.) and waste water = concentrate (C.).

For a better recovery a softener or an antiscaling device is necessary.

The whole unit is controlled by a small micro processor unit (1.).



6. Installation

6.1. Aufstellung



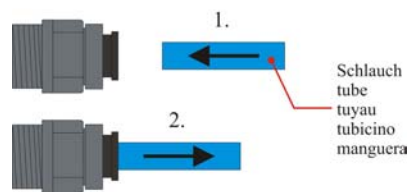
To guarantee a faultlessly operation of the R.O. unit it should be erected on an even and stable wall.



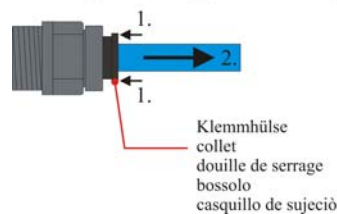
If the ambient temperature exceeds the maximum shown in appendix “protocol” or if the motor is located 1000 meters above sea level or more, it may be necessary to use a motor with a higher rated output (if air cooled).

6.2. Water connectors

Montage / connecting /
 montage / montaggio / montaje



Demontage / disconnecting /
 demontage / smontaggio / desmontaje



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

The feed (A.) is connected with the on site water source. It is important that the feed water line is able to cover the demand of the unit (see 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.



Especially at strong pressure fluctuations (water hammer) reduce the feed pressure to about 2 bar. Otherwise the housings may burst.



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.



The permeate pressure works against the membrane pressure: e.g. operation pressure = 8 bar, permeate pressure = 2 bar, membrane pressure = $8 - 2 = 6$ bar. If the water should flow in very long lines or to high points or should be provided with a high pressure an inline booster unit should be installed.



The permeate of a R.O. unit is not contaminated with bacteria. But in the permeate water lines biofilms can occur. 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 if all connections are done well. Make sure that all push fit fittings 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.



Check out if the unit gets minimum 1.5 bar pre-pressure.

Push the mains plug into a suitable plug socket secured with fuse and ground fault circuit interrupter.

If minimum and maximum level switch are in lower position (tank is empty) the inlet solenoid opens. The pump will start is enough pressure is in the system.

If minimum and maximum level switch reach the upper position the unit will shut down. Before the flushing valve rinses the unit for about 30 seconds.

If feed pressure is missing the pump will not start.

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 permeate flow is higher than 10% of the normal flow the operation pressure should be reduced by opening the membrane pressure valve (12.). If the water flow is too low close this 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 totally!**



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 (LED “flushing” of the control is not flashing).

Important! The unit is flushing every 24 hours for 30 seconds. A small amount of permeate is produced in that time. Make sure that the storing tank cannot flow over or is equipped with an emergency overflow.

8. Putting out of service

Shut down the water supply and push out the mains plug.

If the unit should rest for longer than 2 weeks, drain the system completely. Therefore shut down the water supply and start the unit (both level switches in lower position or pull the level connection) until the pressure is dropped (3.). Open the pre-filtration and drain the water. Open the membrane housing and drain the water.

9. Maintain the unit

The AquaCare reverse osmosis unit needs less maintenance. But some adjustments and the condition of the pre-filters should be monitored regularly.

9.1. Pre-Filter

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

For changing the cartridges you must stop the R.O. unit (see chapter „Putting out of service“).

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.

Our recommendation: change the cartridge every 6 - 12 months.

9.2. 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.

For detecting the permeate quality use a conductivity meter (option). (If a mixing valve is used close it totally.)

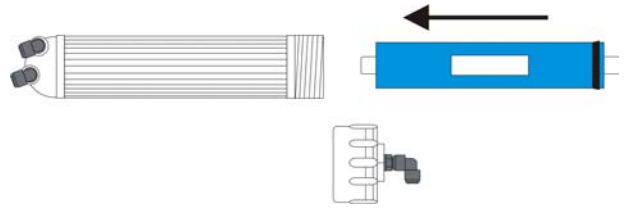
At recoveries of more than 50% the conductivity of the permeate must be below 15% of the feed conductivity; at recoveries below 50% below 10%.

Tip: the unit should run for minimum ¼ hour before doing the measurement.

9.3. 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.

For changing the membranes put the unit out of service and open the membrane housing (13.). Take out the membrane (14.) with the help of a water pump pliers. Push the new membrane into the housing.



Take a little bit silicon fat for the o-rings.

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

Put the unit into operation as usual.

10. Trouble shooting

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

10.1. 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.

C.

Ask AquaCare.

10.2. 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

10.3. Unit will not start

A.

The storing tank is full – the unit must not start.

B.

The inlet solenoid starts but not the main pump:

- Is enough pressure in the feed line? (feed pressure gauge must show minimum 1 bar)
- Is the pre-pressure switch (2.) right adjusted?

You may reduce the minimum pressure to 0.5 bar if necessary.

- Is the motor overload switch pushed? (at the right side of the BasiTech control housing)

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.

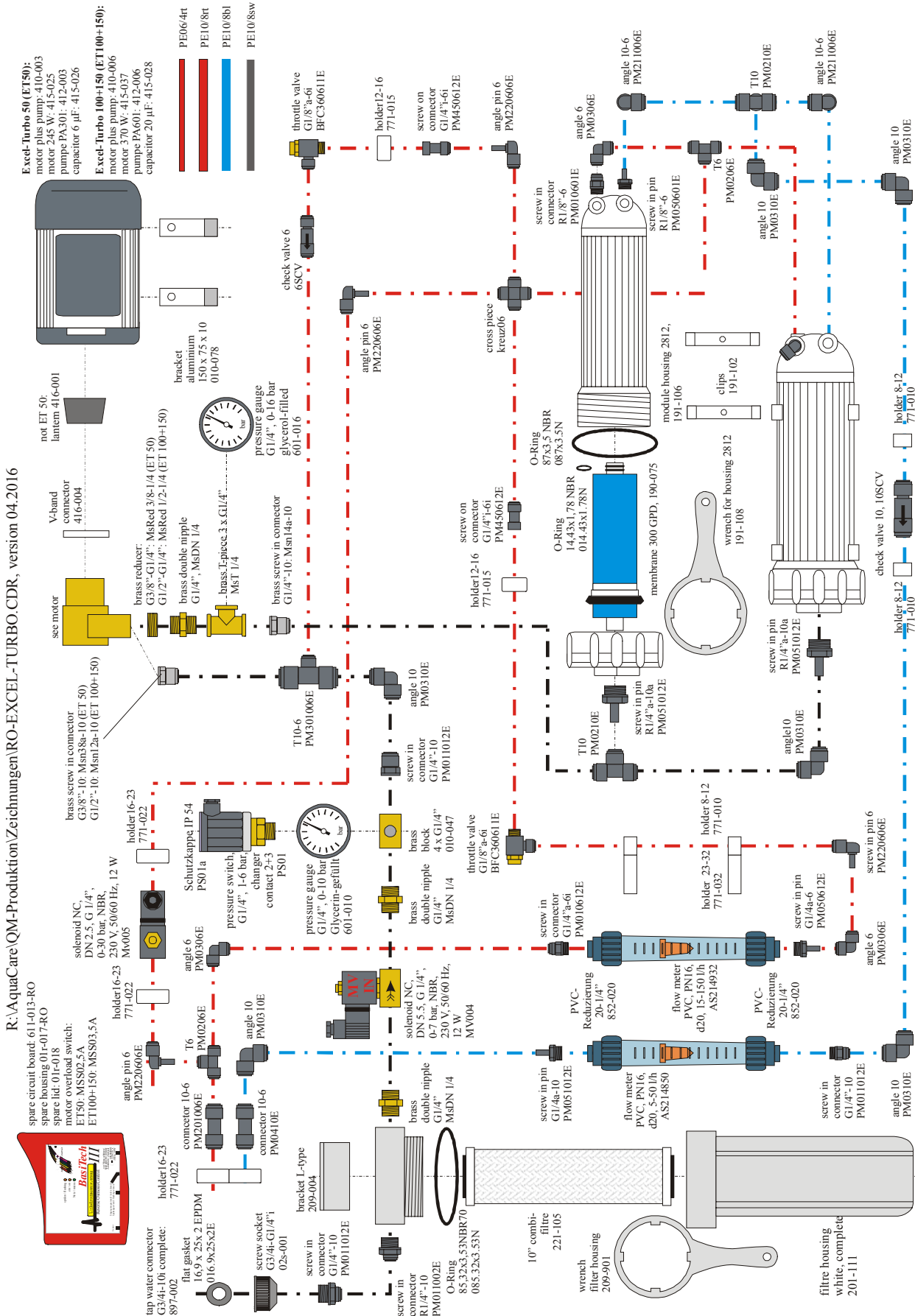
Minimum feed water quality:

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 $SDI_{15min} < 3,0$

11. Warranty

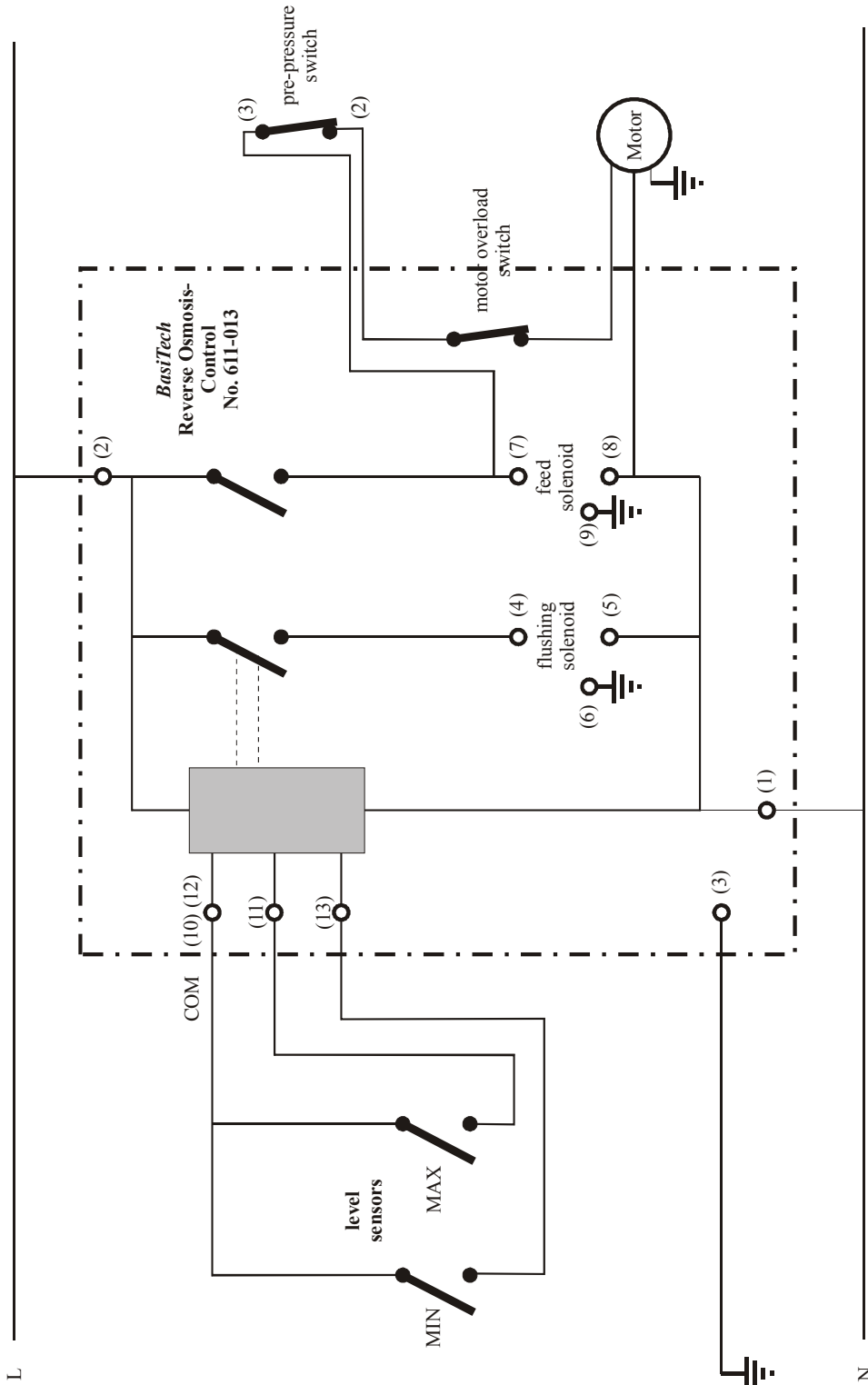
You have 24 months warranty on all AquaCare units excepts spare parts like pump bearings and

12. Appendix: Spare Parts



13. Appendix: Circuit diagram

RO-Anlage Typ <i>Excel Turbo 50-150</i>		AquaCare GmbH & Co. KG Am Wiesenbusch 11 D-45966 Gladbeck Germany phone: +49-2043-375758-0 fax: +49-2043-375758-90 email: info@aquacare.de
Circuit Diagram RO-EXCEL-TURO.CDR	Version 2: 14.04.16 B. Ramsch	Maßstab: -



14. Appendix: Protocol

15. Appendix: CE Declaration of Conformity

The undersigned

AquaCare GmbH & Co. KG
Am Wiesenbusch 12
45966 Gladbeck
Germany

hereby confirms that the units listed below fulfil the requirements of the EC Directives and harmonised EC Standards, national Standards and technical specifications listed below. In case of a modification of the equipment not co-ordinated with us this declaration loses its validity.

Reverse osmosis unit

Excel Turbo 50
Excel Turbo 100
Excel Turbo 150

EC Directives

Machinery Directive 2006/42/ES
Low Voltage Directive 2014/35/EUR
EMC Directive 2004/108/EC (pump)
RoHS Directive 2011/65/EU

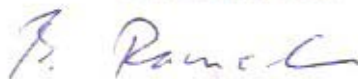
Harmonized Standards

DIN EN 809: 1998+A1:2009+AC:2010
DIN EN 60335-2-41:2003+A1:2004+A2:2010

The CE marking was applied in the year 2014.

The technical documents are available at: AquaCare GmbH & Co. KG.

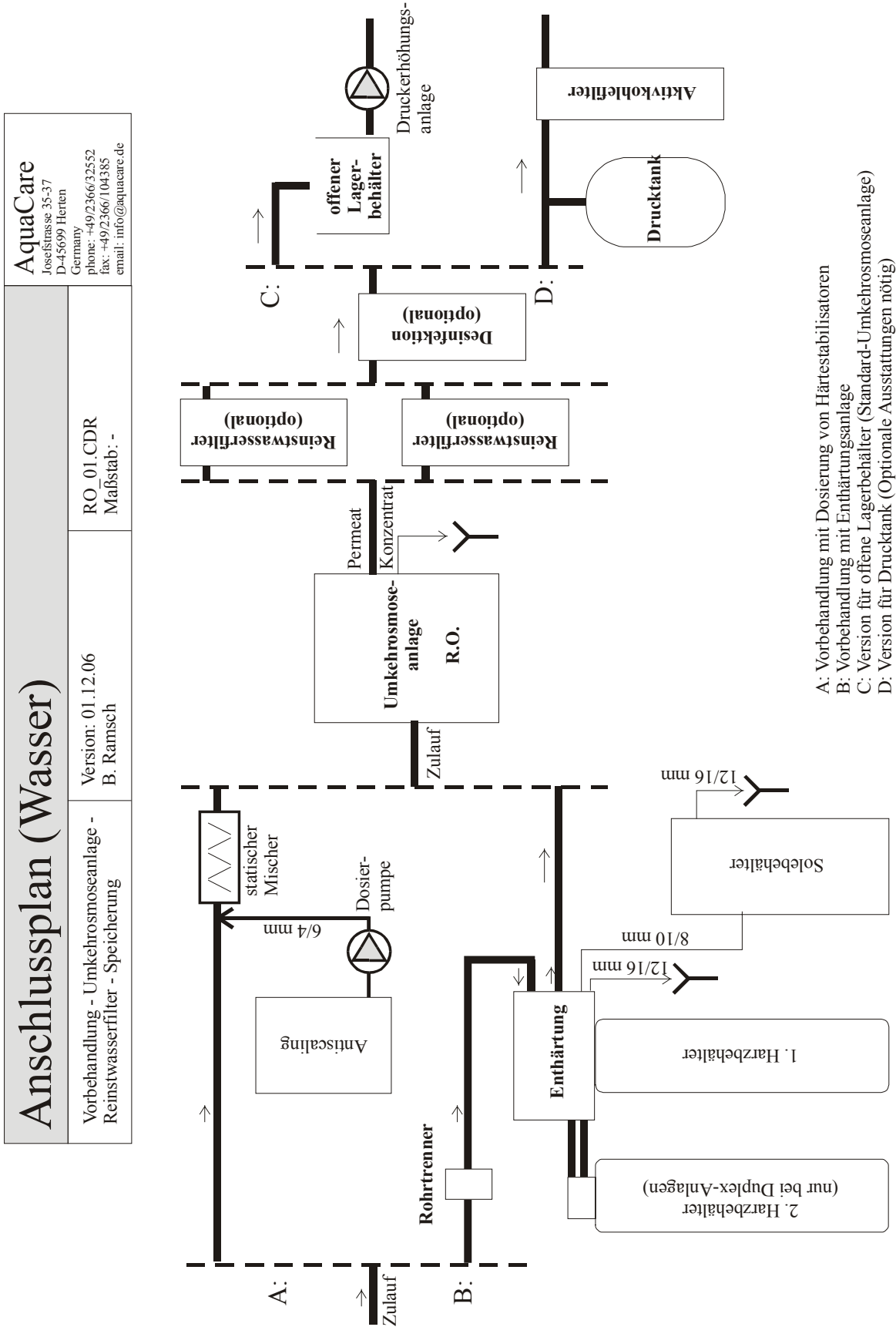
AquaCare GmbH & Co. KG
* Aquatic Systems Research *
INNOVA Park, Am Wiesenbusch 11
Tel.: 02043-375758-0 Fax: 375758-90
email: info@aquacare.de
D-45966 Gladbeck



Gladbeck: 10.12.2014

Authorized representative for issuing this declaration on behalf of the manufacturer.
Authorized representative for compiling the technical documents.

16. Appendix: Sketch (water) of additional units



Anschlussplan (Wasser)		AquaCare Josefstrasse 35-37 D-43699 Herten Germany phone: +49/2366/32552 fax: +49/2366/104385 email: info@aquacare.de	
Vorbereitung - Umkehrosmoseanlage - Reinstwasserfilter - Speicherung	Version: 01.12.06 B. Ramsch	RO_01.CDR Maßstab: -	

- A: Vorbehandlung mit Dosierung von Härtestabilisatoren
- B: Vorbehandlung mit Enthärtungsanlage
- C: Version für offene Lagerbehälter (Standard-Umkehrosmoseanlage)
- D: Version für Drucktank (Optionale Ausstattungen nötig)

17. Appendix: Membranes

17.1. 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).

17.2. Data of the membrane