

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,
laboratoires et traitements d'eau



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Instruction Manual

De-nitrification filter ADN

size 400 (-a, -i) and larger



modification possible

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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.

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.

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

3. Designated use

AquaCare de-nitrifying filter are only made for aquaria and aqua culture units. The water in these tanks should never exceed 35,000 TDS. Other purposes are only allowed after consultation with AquaCare. If water temperatures are below 15°C the filter must be dimensioned bigger.

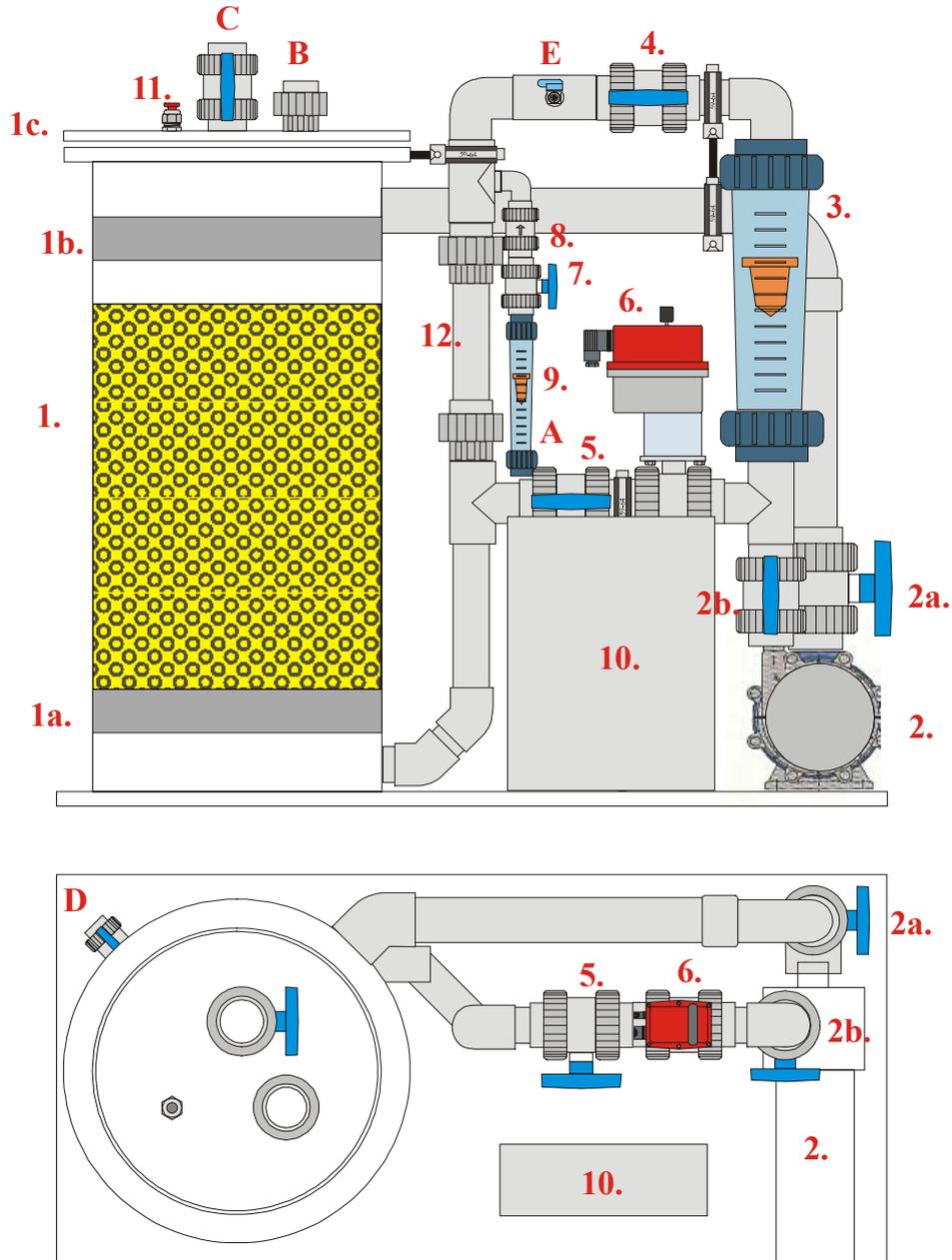
4. Configuration

The AquaCare de-nitrifying filter AND is completely equipped. The unit has to be connected to the water tank and to the power supply. Please control the delivery if it is complete and not broken.

The models “-a” are equipped with an automatic flushing system including the triggering of the circulation pump.

The models “-i” are equipped with an injector for soaking in the inlet water by itself.

4.1. Basic equipment



The unit is mounted on a rigid PVC-U mounting plate and consists of:

1. filter housing with sulphur granules (filter bed), 1a. lower strainer, 1b. upper strainer with filter foam, 1c. filter cap;
2. circulation pump, 2a. inlet ball valve, 2b. outlet ball valve;
3. flow meter for filtering mode;
4. ball valve for filtering mode;
5. ball valve for flushing mode;
6. automatic ball valve (only model “-a”)
7. ball valve for feed water;
8. check valve for feed water;
9. flow meter for feed water;
10. electric box (only model “-a”);

11. connector for ORP sensor;
12. injector (only model “-i”)

- A. feed (from aquarium);
- B. outlet (to aquarium);
- C. drain (during additional flushing mode);
- D. drain

4.2. Options

As an option following parts are possible: automatic flushing system (model „-a“) and injector for soaking in the feed water without an extra pump.

5. Principle of function

The filter bed granules made of sulphur serve as growth bodies for bacteria. As the same time the sulphur is food for these specialized bacteria. Is any oxygen in the filter the bacteria are able to take nitrate as an oxygen source. During this process gaseous nitrogen is generated (forming small bubbles). This process is called denitrification. The ADN filter does not need additional food in form of a C-source and therefore any expensive ORP control is necessary.

As a by-product gypsum (white coating) and bacteria agglomeration can be produced. Both substances are harmless in the produced concentrations.

The whole unit should be flushed either manually or automatically (model „-a“). The flushing process looses the filter bed to prevent blocking and channel forming that minders the efficiency of the biological process. Additional excessive bacteria will be washed out.

The outlet water should flow back ideally into the feed flow of a skimmer. Therewith the water gets back the lost oxygen and the organic substances (residues of bacteria) produced by the ADN filter will be flotated by the skimmer.

Because the ADN filter works with autotrophic growing bacteria - likewise nitrifying bacteria (oxidation of ammonia and nitrite to nitrate) – the biological start up time can need 1-10 weeks

6. Installation

6.1. Assembly



To guarantee a faultlessly operation of the filter the unit should be erected on an even and stable ground. Uneven parts of the floor must be flattened with floor pavement or a suitable base.



If the operation location is over 1000 meter over the sea level the motor must be larger dimensioned to protect it against overheating.

6.2. Water connectors

To operate the unit you must install water and electrical connections.



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

Connect the feed water (A.) with a inlet pump or a bypass (e.g. from a skimmer). The feed water volume is noticed in the chapter “technical data and protocol”. The model “-i” is able to soak the water without an extra pump.

Connect the outlet water (B.) with the aquarium or ideally with the inlet of a skimmer. Water cannot flow back because of the built-in check valve (8.).

The ball valve (C.) is an extra outlet for the intensive flushing process. If you use this connection washed out bacteria and dirt will be drained directly without polluting the aquarium water circuit.

You can take samples for analyzing the nitrate concentration at the sample valve (E.) during operation.

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 electrical supply must be conform with the data at the rating plate. The filter and the pump must be protected with fuses.



The main pump of the filter (model “-a”) is equipped with a motor protection circuit-breaker.

The main pump of the basic model should be protected with a motor protection circuit-breaker to avoid faults.

If the power supply is not stable a voltage guard may be installed. If the phase are not stable a phases guard should be installed.



The rotation direction of the pump must be conform with the arrow at the pump body. If the pump runs in the wrong direction faults can occur. The change the direction of rotating two phase must be interchanged.

6.4. Filling up with sulphur granules

If the ADN-filter is not delivered with the sulphur granules before starting up you must fill the filter bed. The sulphur must be very pure: minimum 99,5%, the granulation between 3 and 10 mm.

Open the filter by loosening the plastic screws of the cap (1c.). Just as well do it with the upper strainer (1b.). Now take out the upper strainer and the blue filter sponge.

Make sure that the lower strainer (1a.) is placed correctly and fixed with the plastic screws. The tube in the middle must sit tight in the central locator.



Now fill in the filter granules as far as the mark "maximum filling". Take only proper material (e.g. AquaCare sulphur granules).



Put filter sponge and upper strainer back into the filter and fix them with the plastic screws. Never forget these both components. Otherwise the pump soaks granules into the inlet and get damaged.

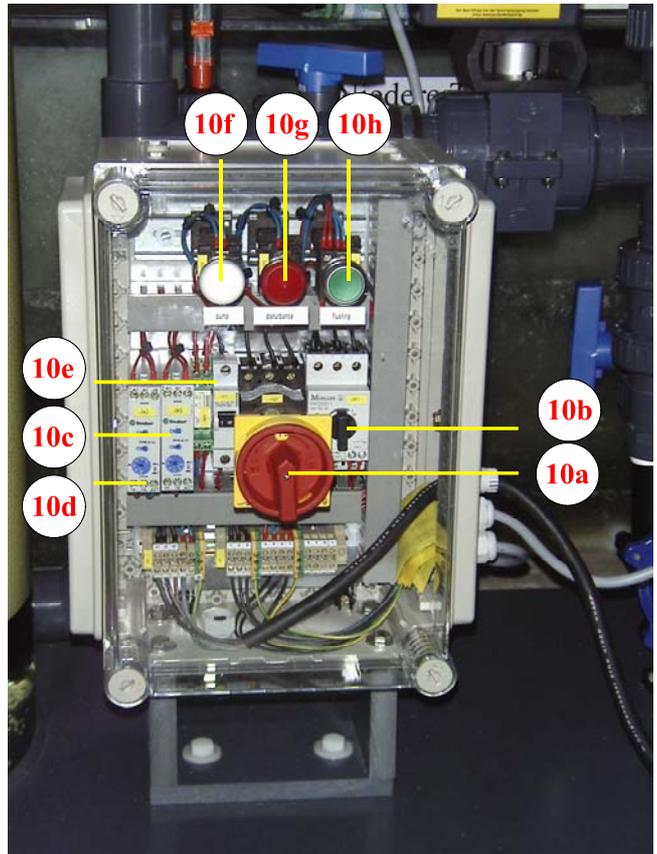


Tighten the plastic bolts with maximum 3 Nm. Higher forces destroy screws and the threads.

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.



Electric box (only model "-a") with:
10a: main switch
10b: motor protection circuit-breaker
10c: timer "flushing time"
10d: timer "interval"
10e: fuse of control
10f: operation display pump
10g: Fault display pump
10h: pushbutton and display for flushing process



Check out if the electrical connection is made correctly.

7.1. Filling up with water

Now fill up the system with water by opening the ball valve (7.) an the inlet (A.). The models "-i" must be filled, too. Therefore fill water directly into the outlet connection (B.) or the auxiliary ball valve (C.). To open the cap (1c.) of the filter is possible, too.

For filling up the system completely with water open the sample valve (E.) until water comes out.



To exhaust the air completely from the pump the flushing valve (5.) must open. The automatically driven ball valve (6.) can be opened by shutting down the motor protection circuit-breaker (10b.) to zero. Then switch on the main switch (10a.). Now push the pushbutton

(10h.) for the flushing process: the automatically driven ball valve is opening. If it is fully opened switch off the main switch to zero.



Not before the filter is filled up completely with water you may start up the unit. Throttle the ball valves (4.) to 45° and close ball valve (5.). Switch on the motor protection circuit-breaker (10b.), close the cover of the electric box (10) and switch on the main switch (10a.): the main pump is starting.

7.2. Adjusting the water flows

Open the ball valve (4.) for filtering mode in that way that the sulphur granules are just not moving. The water flow for the filtering mode can be seen at the flow meter (3.). The flow should correspond with the numbers in the above table. Because of the specific weight with sea water the values are a little bit lower. The inlet water flow affect the water flow, too.

ADN size	400	600	1000	1500
circulation water flow in m ³ /h	10	22	53	130

The water flow for automatically flushing can be adjusted only if the flushing process is active. Therefore push the pushbutton (10h.). If the automatically driven valve is opened totally you can open the ball valve (5.) carefully. The sulphur granules may move a little bit. But do not open the valve too far so that the granules are pressed against the upper strainer (1b.).

The flushing volume of manually driven ADN-filters is individually adjusted at each flushing process with ball valve (5.).

If the filter granules are covered with bacteria you must correct the water flows.

7.3. Adjusting the times for flushing and interval (only model “-a”)

You can adjust the times for flushing and interval: the timer (10d.) is for the flushing time and the timer (10c) of the interval.



Take care that the time for interval is never below 1 minute. Otherwise the automatically driven ball valve can collapse.

Adjust the times in the start up phase to 1 hour for the interval and to 1 minute for the flushing time.

In biological stable filter the times may corrected: a lower interval time and a longer flushing time depending on the structure of the granules.

7.4. Adjusting the feed flow during the starting phase

To adjust the feed flow use the ball valve (7.) and read the water flow meter (9.).

Start the ADN-filter with the lowest water flow shown at the flow meter (see below table).

ADN size	400	600	1000	1500
feed water flow in l/h	100	250	600	1500

During the start up phase measure the nitrate concentration in the ADN-filter every week, please. You can take water sample at the sample valve (E.).

If the nitrate concentration trends towards zero double the feed water flow. During the start up time nitrite can accrue. These concentrations are not dangerous because on the one hand the feed flow (outlet flow) of the ADN-filter is only a small part in the allover conventional filter flow volume and on the other hand the nitrite will be oxidizes very fast by the bio-filter or ozone driven skimmers.



The start up time takes 1 to 10 weeks, sometime longer. This time depends on the fact if the specializes sulphur oxidizing bacteria are available in the aquarium water or not. To accelerate the process it is possible to inoculate bacteria of an already running ADN-filter. Put the bacteria covered old granules into the new filter. Bacteria grown in conventional driven denitrifying filter are not suitable for the ADN. Conventional filters are fed with organic source like alcohol, organic acids, sugar, PHB.

Another parameter for estimating the efficiency of the filter is the ORP. To measure it the AND-

filter is equipped with an ORP connector in the filter cap (1c.). Open the union nut of the sensor connector (11.) and pull out the red plug. Instead of the plug push an ORP sensor into the connector. Fix the union nut. You can use every ORP sensor with a diameter of 12 mm.



Pay attention to the manual of the ORP sensor and the ORP measuring device. An ORP value is meaningful only after 1 to 2 days. Biologically activated AND-filters have a negative ORP value.

The low the ORP the lower the nitrate concentration.

7.5. Adjusting the right feed flow during normal operation

The definite inlet water flow for the ADN-filters depends on several factors:

- a) **Total volume** of the aquarium: the bigger the tank the higher the inlet flow.
- b) **Total organic load** of the aquarium: the more food you take in the higher the inlet flow.
- c) The lower the **water change rate** the higher the water inlet flow.
- d) The worse the **biological filtration** the higher the water inlet flow.
- e) The higher the **water temperature**, the higher inlet water flows are possible.
- f) The higher the **TDS** (total dissolved solids) the lower the possible maximum water inlet flow.

After the starting phase you can increase the inlet water flow step by step to that value that a significant fall of the nitrate concentration is visible in the aquarium.

If the nitrate concentration in the aquarium is below 5 mg/l the efficiency of the ADN-filter should be lowered. A nitrate concentration about 0 mg/l is not good for the animals and the ADN can produce hydrogen sulfide.

7.6. Important parameters during operation of the ADN filter



Measure the Carbonate hardness (KH, alkalinity, buffer capacity) of the aquarium water once per month. If the KH is falling below 3°dH the ADN must shut down or you must add alkalinity to prevent very low pH values in the aquarium.

For enriching KH, calcium and magnesium AquaCare offers chemicals and units in hobby and technical sizes.

8. Shut down the unit

If you want to shut down the ADN, e.g. if too less nitrate is in the aquarium, please follow the above steps.

1. Flush the ADN thoroughly (see chapter "maintenance: flushing time").
2. Stop the water inlet flow by closing the inlet water valve (7.).
3. Stop the main circulation pump: with type „a“ switch off the main switch (10a.) with manual type disconnect the pump.
4. Drain the water by opening the drain (D) and the sample valve (E), too.



If the ADN stand still with water for more than one day the bacteria will die and hydrogen sulfide is produced. Hydrogen sulfide is toxic.

9. Maintain the unit

The ADN is a unit that need less maintenance. But for a long and stable function some steps are important.

9.1. Flushing time

A high efficiency is only possible if the filter bed has a loose filling and any water channels and blocking exists. Therefore you must flush the filter bed regularly.

With a manual ADN the filter bed should be flushed minimum once a day (see „Adjusting the water flows “). Automatically driven systems (type “-a”) take over this work.

If the filter bed is very tight you must loosen it again (see „trouble shooting: the filter bed is blocked).

If blocking is common you must flush more often and longer.

9.2. Circulation pump

The circulation pump should be cleaned once per year. Therefore shut down the system (main switch 10a to zero or disconnect the pump with manual system). Close both ball valve 2a. and 2b. Now the pump is disconnected if you unscrew the lower union nuts of the ball valves.



Never run the pump with closed or reduced ball valve in the soaking side (2a.).



Never start the pump if the whole system is not completely filled with water.

9.3. Refilling the sulphur granules

If 1/3 of the granules are consumed fill up the filter again. Therefore shut down the filter (see chapter “shut down the unit” and drain 1/3 of the water by opening the drain ball valve (D.). Fill up the granules as described in chapter “Installation: filling up with sulphure granules”.

9.4. ORP sensor

Clean the ORP sensor as described in its manual. The sensor will be overgrown very fast in an denitrification system – so the sensor should be cleaned more often.

10. Trouble shooting

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

10.1. The filter bed is blocked

If the ADN system is stressed or too less flushing is realized the filter bed can block.

A. Flush the system intensively by opening the flushing valve 5 resp. by pushing the pushbutton 10f. The produced particles and too much bacteria can be flushed out of the system by opening the auxiliary water outlet (C). Do not stop the water inlet.

B. Open the filter (shut down the unit before and drain a part of the water) and take out the upper strainer with filter foam. Loosen the filter bed by pricking with a thin plastic stick.

10.2. Pump shuts down / malfunction

If the motor of the pump stops during operation (motor protection circuit-breaker is off and red indicator lamp 10b is flashing) it consumes more power than normal. Cause may be chalk crusts inside of the pump. Clean the pump precisely and start up the unit again.

10.3. Nitrate is not eliminated

There are many reasons why nitrate will not be eliminated.

1. **Starting phase is not completed:** depending on the already existing bacteria flora in the aquarium the starting phase can last a long time. Everything comes to him who waits. - If available inoculate the ADN system with active bacteria from a running ADN system.
2. **Inlet flow is too high:** at bad operation conditions like low temperature, varying salt concentrations the maximum efficiency cannot be reached. Calibrated the inlet water flow in that way that a significant nitrate reduction is realized.
3. **Filter bed is blocked:** In a blocked filter bed water channels are forming and the major parts of the filter granules are not supplied with circulation water and the de-nitrification rate decreases. Clean the filter bed thoroughly and increase subsequently the flushing time.

4. **Bacteria inhibiting substances are in the water:**

If you use medicine or other substances that affects bacteria negatively the ADN should be taken out of operation before the treatment starts. After treatment and filtering out the substances with e.g. activated carbon you can start the ADN-filter again.

10.4. The outlet water stinks of hydrogen sulfide

If the outlet water stinks of hydrogen sulfide the mode of operation must be changed.



Hydrogen sulfide is toxic. Ventilate the room and leave it at once.

Hydrogen sulfide is formed if any nitrate is in the circulation water of the ADN. Increase the water

inlet to the ADN to make sure that the outlet water contains a little bit of nitrate.

If very less nitrate is in the aquarium water (below 5 mg/l) you must shut down the ADN system (see chapter “shut down the unit”).

To reduce the efficiency of the ADN filter it is possible to take out a big part of the filter bed.

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.

12. Technical data and unit protocol

Kundennr. / customer no.: Tel./phone: Fax: Email: Kom.	 <p>AquaCare® Aquatic Systems Research</p> <p>AquaCare - Aquatic Systems Research e.K. 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</p>
Anlagentyp / Type of unit	ADN400-a
Anlagennr./unit no.	2-2006-000
Abmessungen L×H×B / Dimensions L×W×H	× × m
Leergewicht / empty weight	kg
Transportgewicht / transport weight	kg
Betriebsgewicht / operation weight	kg
max. Arbeitsdruck / max. working pressure	1,0 bar
max. Zulauf / max. feed flow	
Arbeitstemperatur / operation temperature	4...40°C
Umgebungstemperatur / ambient temperature	4...45°C
Hauptpumpe / main pump Hersteller / manufacturer Typ / type Nr. / No. minimale Fördermenge / minimum flow	Magnetisch gekoppelte Kreislumpumpe / magnetic coupled circulation pump IWAKI MX400CV5E m ³ /h
Motor: Hersteller / manufacturer, Nr. / No. Anschluss / electrical connection, No.	
Steuerung / control: Hersteller / manufacture Einstellungen im Auslieferungszustand / parameter in delivery condition	maj Spülzeit / flushing time: 1 min; Spülintervall / flushing interval: 1 h
Ventil / valves Spülen / flushing valve	Sibo KH
Wasseranschlüsse / water connections	Zulaufwasser / feed water: DN15, d20 PVC Ablaufwasser / outlet water: DN32, d40 PVC Zusatzablauf / additional drain: DN32, d40 PVC Ablass / drain: DN15, d20 PVC Probe / sample: DN4, d6 Schlauch / tube
Dichtigkeitstest / leakage test	48 Stunden / hours

Betriebstest / running test:	Testbedingungen / test conditions	Normleistung / normal conditions
Elektrische Daten / electrical data:		
Spannung / voltage L1-L2	390 V	400 V ± 10%
dito L1-L3	390 V	.
dito L2-L3	391 V	.
dito L1-N	221 V	230 V ± 10%
dito L2-N	228 V	.
dito L3-N	225 V	.
Strom / current L1	24,0 A	0 A
Strom / current L2	24,3 A	.
Strom / current L3	23,5 A	.
Strom / N	0,52 A	0,8 A

Datum / date:03. February 2006

AquaCare: Herr B. Ramsch

Kunde / customer:

Unterschrift / signature:

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13. Appendix: switch board

14. Appendix: pump

15. Appendix: motor