



RAUBIOXON PLUS

PIPE AERATOR SYSTEMS

TECHNICAL INFORMATION 316610 EN



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ADVANTAGES OF RAUBIOXON PLUS PIPE AERATORS

Patented membranes

- High tensile strength formulation
- Antimicrobial design
- Low pressure loss increase

High energy cost saving

- No hardening/embrittlement
- Low plate-out
- Suitable for industrial wastewater treatment plants
- Suitable for intermittent operation
- High level of oxygen saturation
- Optimum bubble size
- Quick and easy to assemble
- Inexpensive upgrading of existing systems

For long-term operation

- Permanently elastic
- Resistant to extreme temperatures
- Plasticiser-free
- Low plate-out
- Weathering and ozone-resistant
- Oil-resistant
- Antimicrobial
- High resilience
- Ageing-resistant
- Low-buoyancy aeration unit
- No sewage water ingress when air is switched off



1 SCOPE AND APPLICATIONS

This Technical Information is applicable to the RAUBIOXON PLUS pipe aeration systems which are used for the fine-bubble aeration of mixtures of waste water and activated sludge in biological waste water treatment plants.

RAUBIOXON PLUS materials are pure, ecologically harmless and recyclable.



2 MATERIALS

2.1 Support pipe

D = 63 mm

Material: Polypropylene RAU-PP 236

Colour: White

Density	0.91	g/cm ³	DIN 53479
Tensile strength	30	N/mm ²	DIN 53455
Elongation at break	≥ 300	%	DIN 53455
Modulus of elasticity	1200	N/mm ²	DIN 53457

2.2 Pipe membrane 64 x 1.5 mm

d = 64 mm; s = 1.5 mm

Material: Silicone elastomer RAU-SIK 6605,
plasticiser-free, high tensile strength,
antimicrobial

Colour: Blue-transparent*

Density	1.19	g/cm ³	DIN 53479
Hardness	60 ± 5	Shore A	DIN 53505
Tensile strength	≥ 9	N/mm ²	DIN 53504 SII
Elongation at break	≥ 600	%	DIN 53504 SII
Tear strength	≥ 45	N/mm	ASTM-D624 B

* Note:

The activity of the antimicrobial substance may result in colour changes, in particular in case of long-term storage. These colour changes have no bearing on the function and service life of the membranes.

2.3 Fastener

Material: POM

Colour: Blue

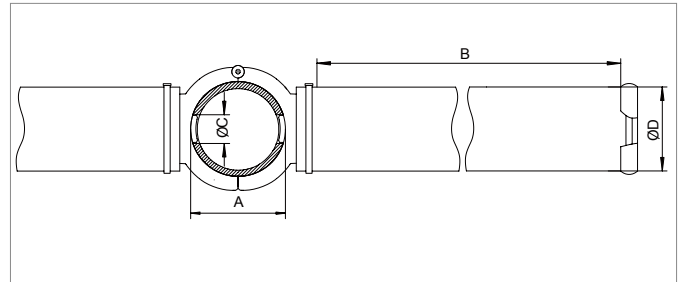
Density	1.41	g/cm ³	ISO 1183-1
Tensile strength	63	MPa	ISO 527
Elongation at break	13	%	ISO 527
Modulus of elasticity	2800	N/mm ²	ISO 527

3 PRODUCT RANGE

3.1 RAUBIOXON DUO PLUS pipe aerator for round PVC-U pipes

3.1.1 RAUBIOXON DUO PLUS

Support pipe $D = 63 \text{ mm}$
 Connection hole $C = 30 \text{ mm}$
 O-ring EPDM
 Fastener included in delivery



Mat. no.	Air distributor A [mm]	Usable length B [mm]	Weight [kg]
14133221005	90	2 x 500	1.75
14133321005	90	2 x 750	2.45
14133421005	90	2 x 1000	3.00
14133821005	110	2 x 500	1.80
14133921005	110	2 x 750	2.50
14134021005	110	2 x 1000	3.05

3.1.2 RAUBIOXON DUO PLUS with check valve

Support pipe $D = 63 \text{ mm}$
 Connection hole $C = 30 \text{ mm}$
 O-ring EPDM
 Fastener included in delivery

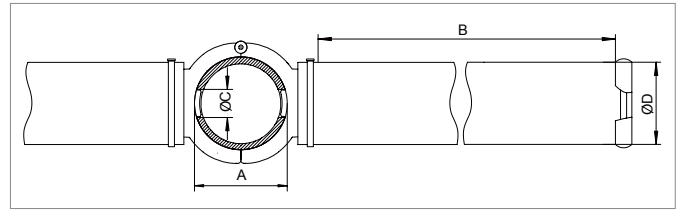


Mat. no.	Air distributor A [mm]	Usable length B [mm]	Weight [kg]
14133521005	90	2 x 500	1.75
14133621005	90	2 x 750	2.45
14133721005	90	2 x 1000	3.00
14134121005	110	2 x 500	1.80
14134221005	110	2 x 750	2.50
14134321005	110	2 x 1000	3.05

3.2 RAUBIOXON DUO PLUS pipe aerator for round stainless steel pipes

3.2.1 RAUBIOXON DUO PLUS

Support pipe $D = 63 \text{ mm}$
 Connection hole $C = 30 \text{ mm}$
 O-ring EPDM
 Fastener included in delivery



Article no.	Air distributor A [mm]	Usable length B [mm]	Weight [kg]
14144091005	88.9	2 x 500	1.75
14144191005	88.9	2 x 750	2.45
14144291005	88.9	2 x 1000	3.00
14143791005	114.3	2 x 500	1.80
14143891005	114.3	2 x 750	2.50
14143991005	114.3	2 x 1000	3.05

3.2.2 RAUBIOXON DUO PLUS with check valve

Support pipe $D = 63 \text{ mm}$
 Connection hole $C = 30 \text{ mm}$
 O-ring EPDM
 Fastener included in delivery

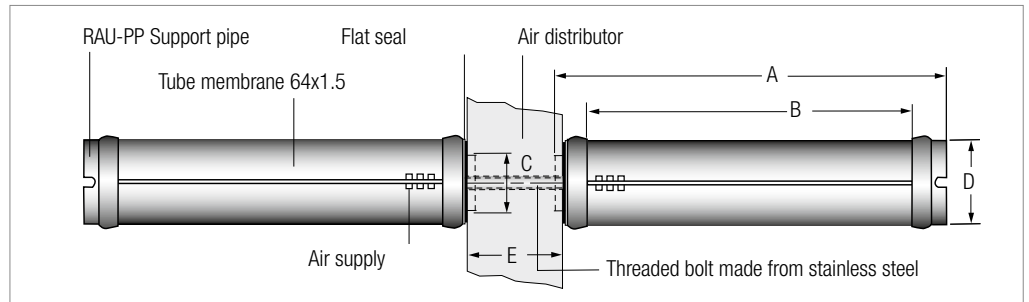


Article no.	Air distributor A [mm]	Usable length B [mm]	Weight [kg]
14101471005	88.9	2 x 500	1.75
14101571005	88.9	2 x 750	2.45
14101671005	88.9	2 x 1000	3.00
14101331005	114.3	2 x 500	1.80
14101341005	114.3	2 x 750	2.50
14101371005	114.3	2 x 1000	3.05

3.3 RAUBIOXON DUO PLUS pipe aerator for square stainless steel pipes

3.3.1 RAUBIOXON DUO PLUS

Support pipe D = 63 mm
 Connection hole C = 45 mm
 Flat seal: Silicone



Mat. no.	Total length A [mm]	Usable length B [mm]	Weight [kg]
12947021005	550	500	0.9
12947121005	800	750	1.2
12947221005	1050	1000	1.5

3.3.2 RAUBIOXON DUO PLUS with check valve

Support pipe D = 63 mm
 Connection hole C = 45 mm
 Flat seal: Silicone



Mat. no.	Total length A [mm]	Usable length B [mm]	Weight [kg]
12917161005	550	500	0.9
12917261005	800	750	1.2
12917361005	1050	1000	1.5

3.4 Accessories

Tube membrane 64 x 1.5 mm for RAUBIOXON DUO PLUS



Mat. no.	Total length [mm]	Usable length [mm]	Weight [kg]
18511481006	545	500	0.22
18511581006	795	750	0.32
18511681006	1045	1000	0.42

Tube membrane 64 x 1.5 mm for RAUBIOXON PLUS

Mat. no.	Total length [mm]	Usable length [mm]	Weight [kg]
18511231006	560	500	0.22
18511331006	810	750	0.32
18511431006	1060	1000	0.41

O-ring for fastening to round pipes

Mat. no.	d x s [mm]	for Air distributor A [mm]
13517281001	Ø 60 x 4	110
13517271001	Ø 62 x 4	90



Single-ear clip

Material: 1.4301

Mat. no.
12404521001



Hand pliers

For the fitting of single-ear clips

Mat. no.
12482171001



Threaded bolt M10

Material: 1.4301/AISI 304



Mat. no.	Length [mm]	for air distributor width E [mm]
12798881001	210	80
12798981001	230	100
12799081001	250	120

Fastener for RAUBIOXON DUO PLUS

Mat. no.
13517261001



Assembly adapter

Material: 1.4301

Square adapter 1/2"

Mat. no.
12482871001



Locking piece for connection hole Ø 45 mm (incl. seal)

Material: RAU-PP 2371

Flat seal: Silicone

Mat. no.

12918581001



Adapter ring (without seal)

Material: RAU-PVC

Mat. no.

12845501001

for drill hole [mm]

35

12841571001

40

12400731001

50

12845601001

55



Flat seal for adapter rings

Material: EPDM

Mat. no.

12844491001

Note: When using adapter rings, a 20 mm longer connector is to be used.

Flat seal for pipe aerator

Material: Silicone

Mat. no.

12247041001



3.5 Air distributor systems

The cross-section and length of the air distributor and also the drill hole spacing vary according to the specific requirements. The air distributors are therefore designed and produced individually for each order.

3.5.1 Air distributor stainless steel square profile for aerators with a lateral connection

Materials 1.4301 / AISI 304 (standard), other materials on request
Dimensions 80x80, 100 x 100, 120 x 120 mm
Wall thickness 2 or 3 mm



3.5.2 PVC-U air distributor pipes for aerators with a saddle connection

Material: RAU-PVC 1100, plasticiser-free, according to DIN 8061/62
Dimensions: d90 and d110
Colour: Grey (RAL 7011)



Floor fixture for PVC-U pipes

Werkstoff: 1.4301/AISI 304

Mat. no.	for pipe diameter [mm]
12367041001	90
12367141001	110



3.5.3 Stainless steel air distributor pipes for aerators with a saddle connection

Material: 1.4301/AISI 304

Dimensions: d88.9 and d114.3



Floor fixture for stainless steel pipes

Material: 1.4301/AISI 304

Mat. no.	for pipe diameter [mm]
13360011001	88.9
13360001001	114.3



4 DESIGN

4.1 General points

The purpose is to carry the required amount of oxygen into the mixture of waste water and activated sludge according to the parameter conditions. The problem is to be solved using the most economical means possible and taking into account not only the cost of the initial investment **and** operating costs.

The design is based on characteristic values for the aeration of pure water under standard conditions (1013 mbar, 20 °C); graphs 1-3. The characteristic values are adjusted on the basis of calculated and empirically determined factors to reflect the actual conditions. Factors that need to be considered include for example the waste water

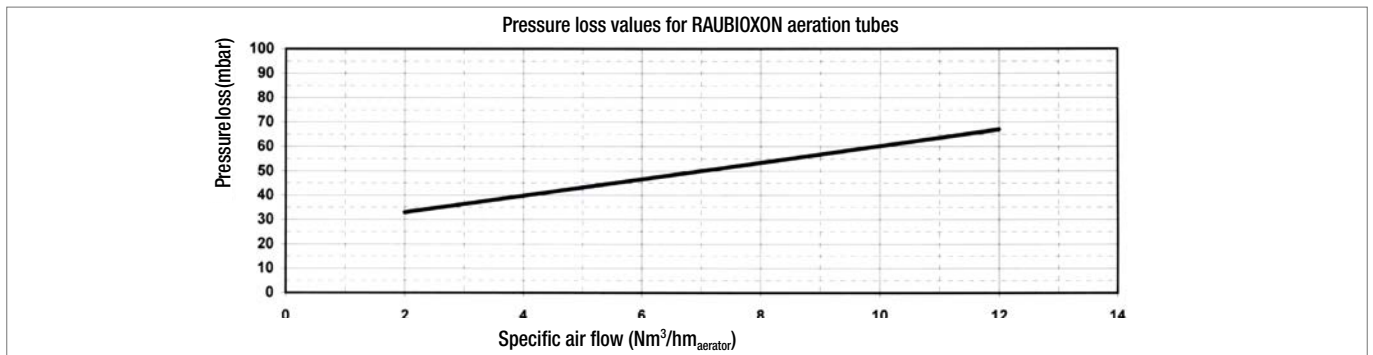
temperature and the air pressure, which affect the oxygen saturation concentration, increased concentrations of dissolved salts or surface active substances (surfactants), currents, and the position and size of non-aerated regions. Please provide REHAU with details of your particular requirements.

In section 7 you will find a project questionnaire which contains the relevant parameters.

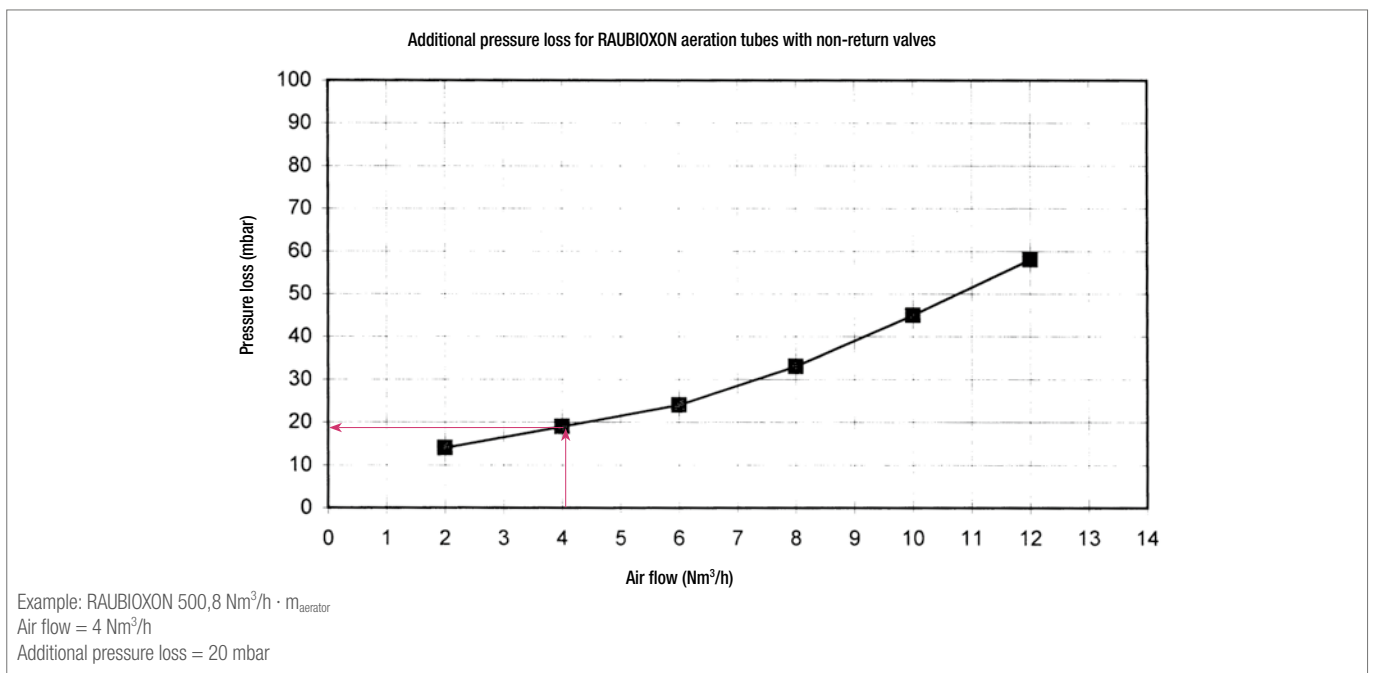
Graph 1 shows the aerator pressure loss plotted against the specific air pressurisation in the new condition on delivery.

Graph 2 shows the additional pressure loss that has to be taken into consideration depending on the air throughput when using RAUBIOXON pipe aerators with check valves.

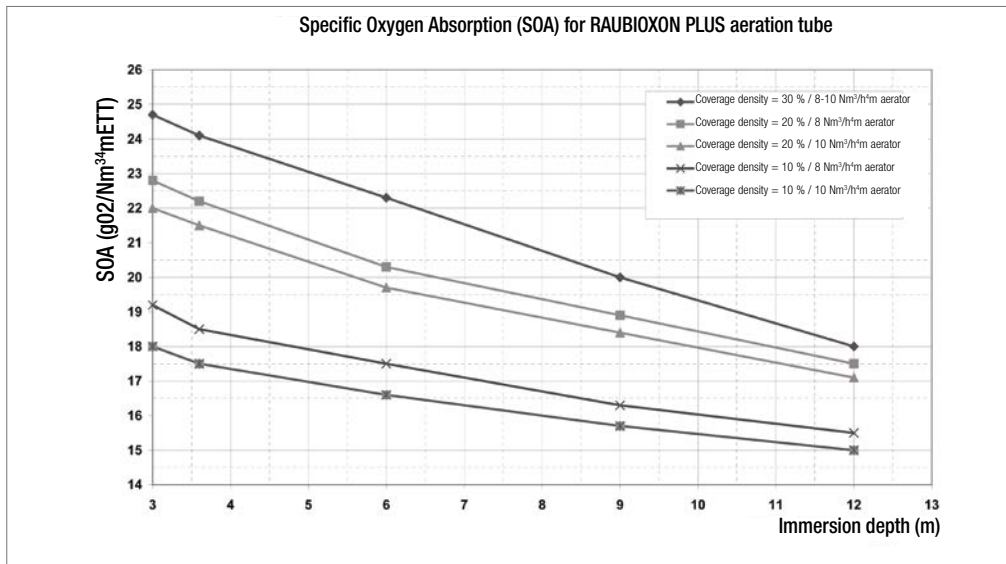
4.2 Graphs



Graph 1



Graph 2



The graphs for the specific oxygen absorption are based on measurements taken in tanks containing pure water under standard conditions with a uniform 2-dimensional aerator layout and a tolerance of $\pm 10\%$.

Graph 3

4.3 Oxygen absorption trials

Oxygen transfer capacity and yield frequently need to be determined by testing. In almost all cases the oxygen uptake measurements are taken in pure water using the absorption method.

The first step is to add chemicals to remove all the oxygen from the water. Oxygen is then added again using the aeration system; the concentration increases from zero to maximum saturation.

The resulting concentration curve is used to calculate the oxygen transfer capacity. This is correlated with the power consumption of the compressor in order to calculate the specific energy consumption, which is known as the oxygen yield.

In Germany, oxygen uptake measurements are regulated by DIN EN 12255-15.

However, it is still necessary for certain parameters such as, for example, the permissible tolerances to be explicitly agreed between the supplier and the customer.

5 FITTING AND OPERATING INSTRUCTIONS

The strict adherence to our assembly and operating instructions is a prerequisite for the proper and reliable operation of the aeration system. It is also the basis of our warranty.

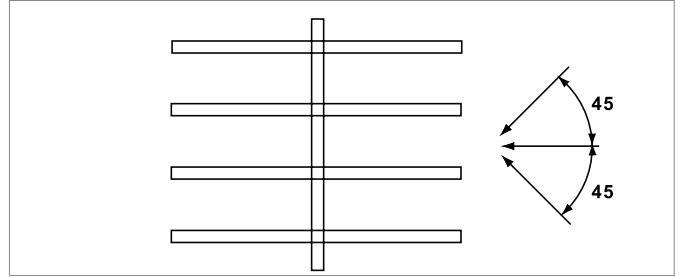


Figure 1: Layout RAUBIOXON pipe aerators

5.1 Fitting

5.1.1 General points

5.1.1.1 Storage

The aerators have to be stored in their original packaging in a dry, ventilated room according to DIN 7716.

Do not store outside!

5.1.1.2 Checking

Each aerator, particularly the tube membrane, must be checked for damage and to ensure that the tube clips are firmly seated.

5.1.1.3 Fitting preparation

Once the air supply pipes have been installed and the air distributors have been connected to the supply but the aeration pipes have not yet been installed, the pipe system is to be flushed for 10 mins. using compressed air in order to remove any residues and impurities. Any foreign matter such as stones, pieces of wood etc. are to be removed from the treatment tank.

5.1.1.4 Aerator positioning

If agitators are used in treatment tanks, the resultant water currents may produce adverse aeration tube oscillation. To minimise this effect, it is important when planning the aeration pipe system to ensure that water does not flow across the longitudinal aeration tube axis at an angle of more than $\pm 45^\circ$.



Figure 2: Fitting adapter

In addition, an adequate distance must be allowed between agitators and aeration pipes.

5.1.2 RAUBIOXON PLUS pipe aerator for square air distributors (stainless steel)

5.1.2.1 Design and positioning of air distributors

In order to fit the RAUBIOXON PLUS pipe aerator, the square distributor pipe is to be drilled with 45 mm (-0/+1 mm) holes situated opposite to one another. The holes must be aligned along a single axis (max. deviation ± 0.5 mm)!

The distributor pipes are basically to be adjusted horizontally and to the same height. Even outgassing of the aerators depends on precise adjustment.

5.1.2.2 Fitting to the air distributor

A fitting adaptor (fig. 1) with a 1/2" square connection is required for installing the RAUBIOXON PLUS pipe aerators (which screw into one another). A screwdriver with a shaft diameter of 5 to 6 mm may be used as a counter bracket.

Connector for screwing pipe aerators.

Depending on the width or nominal bore of the air distributors employed (see Point 3.5), the connectors supplied (threaded rods M10) are to be used in the lengths given below.

Rectangular pipe

Air distributor width [mm]	Connector length [mm]
80	210
100	230
120	250



Figure 3: Screwing the connector into the pipe aerator

Assembling a pair of RAUBIOXON PLUS aerators:

- The M10 threaded rod (connector) is screwed into the threaded aerator, hand-tight (Fig. 3).

Do not apply lubricant to the sealing surfaces!

- Once inserted into the hole, this unit is screwed into the other aerator. This is achieved using a torque wrench equipped with the assembly adapter (Fig. 4), plus the counter bracket (screwdriver)



Figure 4: Fitting with counter bracket



Fig. 5: Fitting with torque wrench

Note:

The pipe aerator must not be tightened by hand, because the membranes would twist on the supports. This is not permitted!

- An aerator is fixed in position as per Fig. 3 using the counter bracket (screwdriver). This is the case if the handle on the screwdriver is in a vertical position
- The other aeration tube is installed with the torque wrench using a torque of 35 Nm (Fig. 5)
- This RAUBIOXON PLUS pipe aerator is tightened further until one of the grooves of the tube membrane is precisely vertical. The membrane may only be rotated by a maximum of half a turn once the torque wrench has engaged.

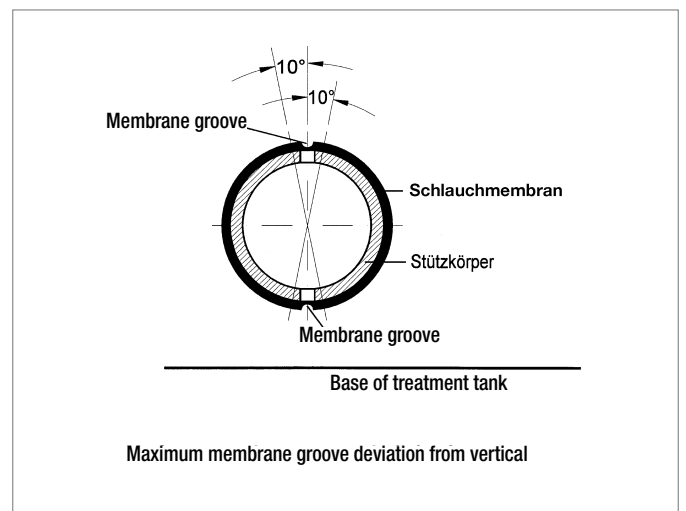


Figure 6: Aerator positioning

Note:

An imaginary line between the two aerator grooves may only deviate from the vertical by max. $\pm 10^\circ$ (Fig. 6).

5.1.3 RAUBIOXON DUO PLUS for round air distributors (PVC-U and stainless steel)

5.1.3.1 Design and arrangement of air distributors

In order to fit the RAUBIOXON DUO PLUS pipe aerator, the distributor pipe is to be drilled with 30-0/+1 mm holes situated opposite to one another. The holes must be aligned along a single axis (max. deviation: ± 0.5 mm).

The distributor pipes are basically to be adjusted horizontally and to the same height.

Even outgassing of the aerator is dependent, amongst other things, on precise alignment.

5.1.3.2 Assembly of air distributors

After opening the box check that the o-rings are situated in the correct position in the corresponding grooves.

The RAUBIOXON DUO PLUS pipe aerator is removed from the box and laid open across the holes in the air distributor pipe (Fig. 1).

The aerator is then closed with a snap in such a way that the centring shoulder projects into the connecting saddles drill holes in the air distributor (Fig. 2).

The free ends of the fastener provided separately are hooked into the depressions provided in the saddles. The fastener is closed by applying pressure to the centre (Fig. 3).

Fig. 4 shows the complete connection from below.



Fig 1:



Fig 3:



Fig 2:



Fig 4:

5.1.4 RAUBIOXON tube membranes

RAUBIOXON membranes are largely compatible with other makes of support pipes. Their suitability must first be verified by REHAU in all cases.

Standard RAUBIOXON membranes require a support pipe diameter of 62.5 - 63.0 mm. On request, special membranes can be manufactured for other diameters.

The support pipe must not exhibit any sharp corners, edges or burrs that may cause damage to the tube membrane.



Sewage treatment plant Bayernoil-Raffinerie, Ingolstadt

5.1.5 Fitting of the tube membranes

The membrane is pushed onto the support pipe and aligned in such a way that only **non-perforated** tube sections are positioned over the air outlet openings in the support pipe.

If any longitudinal air distributor groove is present, one of the two membrane grooves must be centred directly over it.

To attach the pipe aerators to the air distributor, proceed as described in Section 6.1.2, selecting assembly adapters, connectors and seals suitable for the type of support pipe being used. It is particularly important to ensure that the tube grooves point in the right direction.

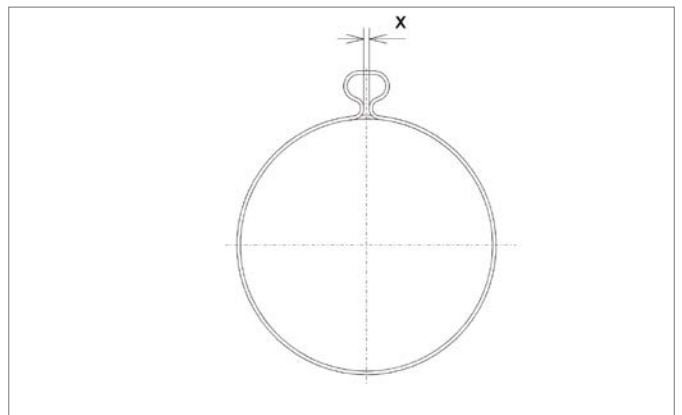
To secure the tubes in place, it is only permitted to use **single-ear clips** which are smooth on the inside. Worm drive tube clips must not be used!

The clip is to be aligned in such a way that the clip ear is positioned exactly over a tube groove.

The clamping force applied must be high enough to ensure that the clip is firmly seated and the connection is unable to leak. In the clamped condition, dimension "x" must be less than 2.0 mm.



Sewage treatment plant Gerwisch/Magdeburg, 420000 population equivalent



Single-ear clip

5.2 Commissioning

5.2.1 Trial run

A trial of the system should be carried immediately after assembly, with the tank filled with clean water. The system is to be checked for leak-tightness at a max. depth of 20 cm of water above the disc aerators. Leaks are revealed when, after a brief period, the air supply is switched off. Air bubbles then rise where the seal is poor (depending on system excess pressure).

Work that could cause damage to the aerators (such as painting, welding, concrete sealing, etc.) must not be carried out in the area of the treatment tank.

5.2.2 Oxygen absorption measurements

Prior to taking oxygen transfer measurement, the aerating process is to be continued for a period of at least 48 hours with a specific air flow of at least $8 \text{ Nm}^3/\text{h}\cdot\text{m}_{\text{aerator}}$.

This guarantees optimum outgassing of the aerator. Otherwise the latest regulations of the „Association of Wastewater Engineering“ ATV M209 shall apply.

5.2.3 Idle time prior to commissioning

If commissioning does not take place immediately following the trial run, then the depth of water above the aerators is to be increased to 1 m. This depth of water must be maintained until the equipment is finally commissioned.

Keep an eye on water evaporation!

If there is frost, the depth of water above the aerators must be at least 10 % of the temperature in °C.

Example:

At -20 °C , water depth above aerators equals at least 2 m.

5.3 Operation

5.3.1 General points

The water temperature must be between 5 and 30 °C. Higher temperatures may be possible, but prior consultation with the manufacturer is required.

5.3.2 Air supply

The air supply system has to be free of oil, dust and solvent. The intake air must meet the guidelines of the TA (Technical Work Instruction) Air. Dust filters for ambient dust are to be designed to achieve 90 % filtration to DIN EN 779, filter class G4.

The air temperature at the inlet to the aerators must not exceed 80 °C. The aeration tubes can be operated with a specific air feed of $2\text{-}12 \text{ Nm}^3/\text{h}\cdot\text{m}_{\text{aerator}}$.

5.3.3 Maintenance/Cleaning

If the treatment tank is drained or the aerator lines are taken off, care is to be taken that the deposits on the aerator hoses do not dry out. I.e. the aerators are to be cleaned immediately. Dried on deposits will impair the function of the aerators.

Occasionally, there might be process-related deposits which can be removed in their initial stages. It is therefore necessary to check for such deposits regularly right from the start and to determine appropriate cleaning intervals for the tube membranes.

Membranes can be cleaned mechanically by washing them down using a pressure cleaner at a water depth of approx. 10 cm. The air flow rate is to be set to $4\text{-}5 \text{ Nm}^3/\text{h}\cdot\text{m}_{\text{aerator}}$ during this process.

5.4 Warranty

The latest version of the REHAU warranty terms shall apply.



Sewage treatment plant Kleve, 180000 population equivalent

6 PROJECT QUESTIONNAIRE/INTERNET

Design data

Sender

Name:

First name:

Company:

Post code/Town:

Telephone:

E-mail:

Sewage treatment plant/Project:

Building proposal:

Client:

Street:

Post code/Town:

Telephone:

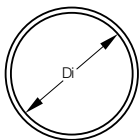
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Size:

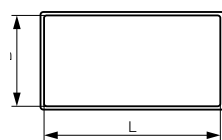
Population equivalent

Tank geometry

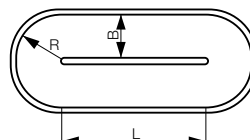
- Circular tank



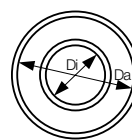
- Rectangular tank



- Circulatory tank



- Combination tank



Tank dimensions:

Water depth [wt]:

m

External diameter [Da]:

m

Radius [R]:

m

Internal diameter [Di]:

m

Width [B]:			m
Length [L]:			m
Number of tanks:			St.
Oxygen demand:	min:	max:	kg/h in pure water
	min:	max:	kg/h in waste water
Industrial discharger	<input type="checkbox"/> yes, please specify <input type="checkbox"/> no		
Existing/proposed compressor			
<input type="checkbox"/> Blower type	<input type="checkbox"/> Rotary piston		
max. intake volume: m ³ /min:			m ³ /min
max. operating pressure:			mbar
Manufacturer/Type:			Number:

Comments:

Reply details

Please give the address to which you would like the reply sent. For the fastest possible response, please indicate an e-mail address.

By e-mail

Reply address

Company:

Name:

Postcode Town:

Tel:

E-Mail:

Further REHAU product ranges



AWADUKT PP SN10



AWASCHACHT PP DN 1000



AWADOCK Connection system



Biogas-Anlage

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