ENVICON ceramic tube diffusers
EKR AeroMax

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Description:

Ceramic diffusers are used for continuous aeration and wherever required due to the composition of the wastewater (resistance to chemicals), for aerating in drinking water plants

and for aquacultures. A continuous air supply is required, as discontinuous operation would result in the pores becoming clogged and is not allowed.

ENVICON uses only high-grade, glass-sintered ceramics whose main constituent is silica-bonded aluminium silicate. The homogeneity of sintered mass and the material's grain structure allows defined and constant free cross-section of the diffuser elements, thereby providing the preconditions for exact quantification of the oxygenation values. The ceramic diffusers have a high mechanical strength and a good resistance against solvents and many chemicals.

The highly resistant glass-sintered ceramics guarantee particularly good regeneration characteristics of the elements. Regeneration can take place with the elements installed during plant operation by the addition of formic acid into the supply air. Severe organic soiling can be removed by burning out.

Technical data:

External diameter:	70 mm
Internal diameter:	40 mm
Material:	Fine ceramic
Colour	Ivory
Main constituent:	Silica-bonded aluminium silicate
Ferrous oxide (as Fe_2O_3):	Less than 1%
Annealing loss:	Less than 0.5%
Resistant:	Against hot and cold acids (except hydrofluoric acid and fluoric acid), alkalis up to pH9 and gasses up to 900 °C.
Spec. permeability:	380 x 10^{-13}/m²
Gas filter unit:	20 µm for fine-bubble aeration (other pore sizes down to ultra-fine-bubble aeration available on request)
Porosity:	35% - 45%

The EKR ceramic diffuser sets are available for square distribution tubes with dimensions 80 x 80 and 100 x 100 mm (standard) and with openings of Ø 37, 40 and 45 mm. Other tube dimensions on request.

The ceramic tube diffusers are available with a choice of stainless steel or PAGV end mountings:

Standard lengths:

EKR 1000: Set of ceramic diffusers with an effective total length of 1000 mm
EKR 1500: Set of ceramic diffusers with an effective total length of 1,500 mm
(Other lengths are available on request)

EKR sets are supplied in separate parts for assembly on site.

Operating range per set (Nm^3/h x m):

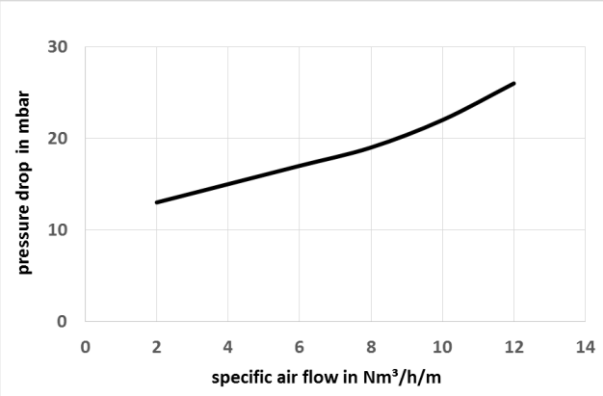
	EKR 1000	EKR 1500
Minimum (recommended)	2.0	3.0
Standard	6.0 - 8.0	9.0 - 12.0
Maximum (specified)	12.0	18.0

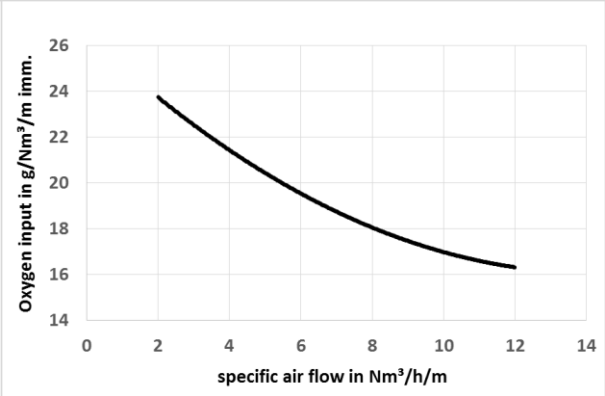
EKR Mono

The EKR sets are also available as prefabricated EKR Mono units for immediate installation. By default, the EKR Mono sets are available for 80 x 80 mm square distribution tubes and openings of Ø 40 mm. Connection is via double thread connectors with ¾" male thread.
EKR Mono 500: Ceramic tube diffuser with an effective diffuser length of 500 mm
EKR Mono 750: Ceramic tube diffuser with an effective diffuser length of 750 mm

Performance data:

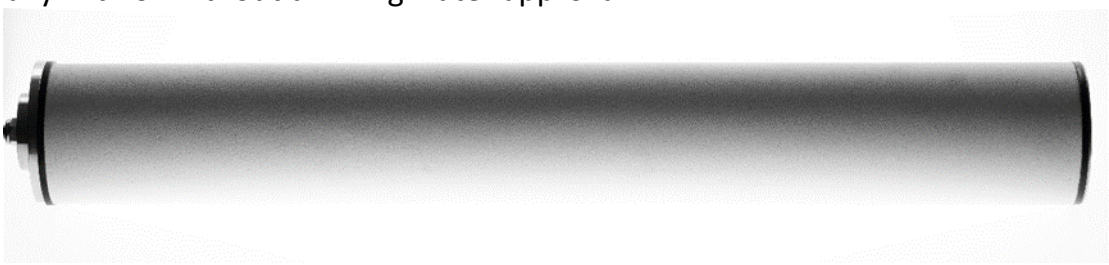
Measured according to work sheet ATV M209 under standard conditions (pure water, water depth = 4.0 m, density = 1.1 $m_{diff.}/m^2$)





EKR Ozone:

These ceramic tube diffusers that are suitable for ozonation consist only of ozone-resistant components such as 304 or 316L stainless steel, glass-bonded ceramics and EPDM seals, optionally with or without drinking water approval:



Tube side with centring device

Side facing away from tube

The EKR Ozone ceramic diffuser sets are available for square distribution tubes with dimensions 80 x 80 and 100 x 100 mm (standard) and with openings of Ø 37, 40 and 45 mm. Other tube dimensions on request.

Available versions are EKR Ozone 1000 (2 x 500 mm) and EKR Ozone 1500 (2 x 750 mm). They are usually installed in pairs to square tubes with continuous tie rod.

The ceramic components are available in various grain sizes down to “ultra-fine-bubble” with a mean pore diameter of 20 microns.

Preparation of the air supply ducts

The air distribution ducts and the ducts on the bottom of the basin are to be checked for good condition and cleanliness before the installation of the diffusers (blow out the complete pipe system, remove any moisture, dirt or rust).

The ENVICON ceramic tubes have a very low pressure loss. It is therefore important to lay the feed and distribution pipes on the bottom of the basin horizontally with a max. height difference of 5 mm. This ensures that the diffusers are also fitted at the same level and produce an even bubble pattern.

Storage and preparation for installation

The ceramic tubes and accessories are supplied in transport cartons on pallets. Unload and set down the units as near as possible to the place of use.

The ceramic tubes in the packaging must be appropriately protected from rain, breakage, dirt and dust.

ENVICON diffusers must be stored at the buyer’s premises according to DIN 7716, ideally in the packaging supplied by ENVICON. It should be unpacked only shortly before installation.

Avoid impacts and knocks when taking the ceramic parts out of their packaging and during installation.

Installation

Make sure to observe the enclosed assembly drawing. The tightening torque of the M10 self-locking nut is 10-12 Nm.

We recommend applying an anti-seize compound (e.g. LOCTITE LB 8009 or LB 8023) to the threads to prevent the nuts from seizing.

Caution: The temperature during installation should not differ greatly from the operating temperature, as the thermal expansion of the threaded rod can cause the fixture to loosen, resulting in malfunction. Should a temperature difference be unavoidable, we recommend retightening the nuts if necessary.

Make sure that the plastic threaded nipple is centred in the hole and that a seal is fitted between the plastic part and the stainless steel pipework. A seal must also be fitted between the centring device and the ceramic tube and between the ceramic tube and the (plastic or stainless steel) end disc.

Make sure that all parts are correctly centred. Finally, do not forget the seal between the end disc and the washer or self-locking nut.

Levelling the ceramic diffusers

Note that, in porous rigid aeration systems, the air supply must be switched on and remain switched on before filling the basin with water. Otherwise water will enter the system.

Having installed the diffusers, fill the basin with water (drinking water, ground water or clean river water) such that all diffuser tubes are just (approx. 5 cm) below the water level. Clarification basin water is not very suitable for bubble tests and leak tests because it tends to foam and any leaks may be difficult to detect.

To align the diffusers, first measure the water coverage of a diffuser that lies as low as possible. Then level the aeration grids by bringing the height-adjustable mounts to the same level with the screws. Align all diffusers in such a way that the greatest height difference between any two diffusers does not exceed 5 mm.

Bubble pattern check and fine tuning

All ceramic diffusers should now lie evenly about 5 cm below the water surface.

Because aeration is already switched on, you can now perform the leak test straight away. The air flow rate should not lie below 6 $Nm^3/(h \times m_{diffuser})$.

Check all diffusers for an even air discharge over the entire tube surface and for fault-free connection and edge sealing. The bubble pattern at the bottom of the basin should be checked from close up and not only from the gantry or the upper edge of the basin.

Causes for large bubbles or a large number of bubbles at some points and, consequentially poorly supplied and therefore insufficiently aerating points elsewhere are frequently:

Uneven air distribution and insufficient air at one of the aeration grids. Check the shut-off valve(s) and the system's levelling. If wastewater has entered, clean the ceramic parts.

Seals may be missing or screws may not have been firmly tightened or ceramic tubes may be broken. Check whether all seals (8 per set of ceramic diffusers) have been fitted, whether plastic parts, ceramic parts and seals are centred and correctly seated in their mounts everywhere and whether the nuts have been sufficiently tightened. Check whether the ceramic tubes are cracked or burst.

Ceramic tubes that continue to malfunction must be replaced.

Oxygenation test

Once installation is complete and the bubble pattern test has been completed, the diffusers must be in contact with water with the aeration in operation for a minimum of 7 days so that the diffusers adapt to the water. Preferably, the air supply should be intermittent (hourly change) with an air flow rate of at least 6 Nm^3 (h x $m_{diffuser}$).

The tests should be undertaken as per ATV instructions M209. In some circumstance the guaranteed values cannot be achieved if the instructions above are not followed.

Measures for delayed commissioning and decommissioning

If the system is not commissioned immediately after the run-in or is to be decommissioned, increase the water coverage of the diffusers to 1.0 m. Continually replace any water lost through evaporation.

At temperatures below freezing, the water coverage must be at least 10 % of the frost temperature (in metres). Example: At -20 °C, the water coverage must be 2 m. Do not use antifreeze.

Please note that the aeration system must be continually supplied with compressed air, as entry of soiled water and solids can clog the pores in the ceramic tubes.

Operating and maintenance instructions

Impression at the surface of the basin

The sewage works operator should carry out a regular visual inspection of the bubble pattern on the water surface. No large bubbles should be visible. In particular in basins with stirrers or with large water depths, however, there may be areas of high turbulence with increased quantities of bubbles, this situation is to be considered normal.

From time to time, the diffusers should be visually inspected. Check the diffusers for mechanical damage, loose mounts and defective seals.

Strain through deposits

The biological wastewater treatment in the aeration phase with its many processes and reactions can result in various levels of biological (fouling) and mechanical (scaling) deposits depending on the composition of the wastewater, the load and the process control. The substances that can deposit on the membranes include: calcium and carbonates, iron and aluminium salts, biological growth and polymers.

The level of fouling/scaling of the diffusers depends on the process conditions in the purification plant, its operating principle and the substances in the wastewater. These conditions cannot be influenced by ENVICON.

Deposits on the ceramics and, in particular, in the pores can cause increased pressure loss and a reduced service life of the ceramics parts (in some cases also a failure) as well as having a negative impact on the oxygen utilisation and must therefore be prevented at all cost.

An increasing pressure loss and falling oxygenation rate may be caused by dust, dirt, filter particles or oil having entered the ceramics via the compressed air pipes, or substances in the wastewater or algae may have deposited on the ceramic surfaces. Clean or, if necessary, replace the compressed air filters, drain and clean the tubes/pipes and blow the ceramic tubes free with air and, if necessary, clean them.

Remedy through load changes and flushing

In the early stages, process-related deposits on the ceramic parts can be easily removed. After commissioning, regularly perform flushing cycles. To do this, we recommend running the aeration at the maximum permissible air throughput for each diffuser for about

30 minutes at least once or twice a week. This is the minimum purging frequency and should be increased depending on local conditions, for example if a higher level of process-related deposits is expected (e.g. for simultaneous precipitation, wastewater from dairies or high water hardness).

Remedy through acidulation

We recommend to inject an acid into the compressed air that is adapted to the operating conditions and does not damage the aeration system, both to remove existing mineral deposits on the ceramics as well as in the pores and as a regular preventive measure to reduce pressure loss of the aeration system. This measure also helps to reduce energy consumption and increase the diffusers' reliability. The acid should be added in vaporised form during aeration.

If you do this, observe the following: Depending on the degree of soiling, add 0.5 to 1 litre of 85% formic acid per ceramic tube in small amounts of approx. 1 litre of formic acid per 100 Nm^3/h of air about twice a year.

The exact amount to add depends on the wastewater composition and the operating mode of the purification plant and can be determined only by trial and error.

Due to the risk of corrosion, we recommend injecting the formic acid into the pipes rather than the compressor.

Especially in plants with large volumes of calcareous wastewater, such as from dairies, treatment of this kind is essential.

The success of this measure depends on various factors and must be tested on site. The resistance of all parts that the acid comes in contact with must be checked and the pipes should, if necessary, be flushed after treatment through the injection of tap water.

Acid cannot be used to remove fouling and may even be counter-productive. In this case, mechanical cleaning may be the solution.

Remedy through cleaning the ceramic parts in an empty basin

Make sure that neither the ceramic tubes nor their mounts are damaged when walking or working in the basin, as this will result in further operating problems.

As far as possible, rinse the activated sludge off the diffusers with clear water. Note that an excessively strong water jet, e.g. from high-pressure cleaners, can, in extreme cases, even damage the ceramic parts. During and for some time after cleaning, apply the maximum air flow rate per diffuser to protect the pores from sludge ingress or to clear sludge out of them.

Should the use of cleaning agents be necessary, use only environment-friendly cleaning agents that do not damage the ceramics.

Due to the high quality of the ceramic tubes used, they can also be burned out multiple times. Because this cleaning measure is very time-consuming, it should be employed only as a last measure.

Inspecting the aeration system

These preventive measures alone do not reliably exclude the possibility of clogging due to operation. To ensure operational safety, the system pressure must be continually logged at comparable operating states (air flow rate, water level) and any required measures derived and specified from them.

Operating specifications

Air flow rates in operation and intake air

The drawn-in air must be free from oil, dust, condensate and solvents and must correspond to the TA (technical work instruction) for air. Dust filters for ambient dust **must** be fitted. The air temperature must not exceed the specified limit values for the diffuser and membrane materials.

During operation, at least 2 Nm^3 / (h x $m_{diffuser}$) and not more than 18 Nm^3 (h x $m_{diffuser}$) must be applied to the ceramic diffusers.

Flow accelerator and flow conditions in the basin

If a basin contains both stirrers and diffusers, a sufficient distance must be maintained between the two. This distance depends on the performance of the stirrers, the diffuser length and mounting, the type of pipes as well as the geometry of and flow conditions in the basin. We recommend that you consult with ENVICON and the stirrer manufacturer in good time.

Draining the pipes

At regular intervals and depending on the specific conditions in the purification plant, the low-point drains in the main lines and the drain lines of the distributor sections should be checked and the condensate blown out of the pipes through the condensate drain line.

Measures in the event of diffuser damage during operation

If irregularities occur in the bubble pattern during operation that seem to indicate damage to the ceramic tubes and are likely to cause ingress of wastewater into the aeration system, keep the air supply to the diffusers running at the highest permissible rate and for as long as possible to minimise the risk of wastewater or sludge ingress. This applies also when draining a basin. Avoid draining the basin under frost conditions.

Replacement

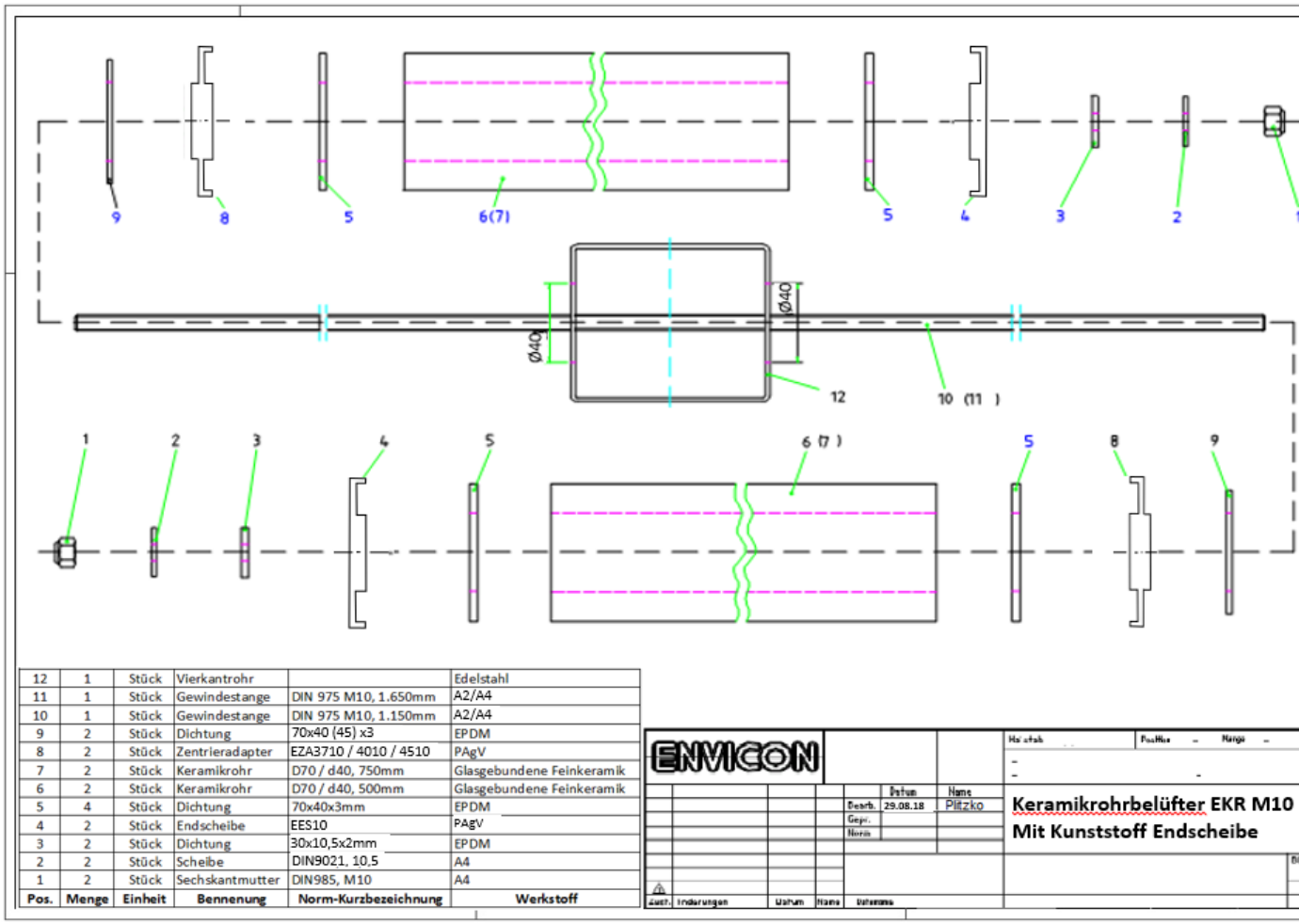
ENVICON ceramic tube diffusers are made of high-grade materials. Although the diffusers work for 15 years or more in many plants, experience has shown that after 7 to 10 years it is advisable to monitor them more closely and, if necessary, schedule their replacement.

If you are uncertain about this issue, we offer the assessment of a diffuser sent to us and the comparison of the values with the condition as delivered. You can then decide with certainty whether a replacement is advisable.

Please contact us.

Design:

Version with plastic end discs (exploded drawing)



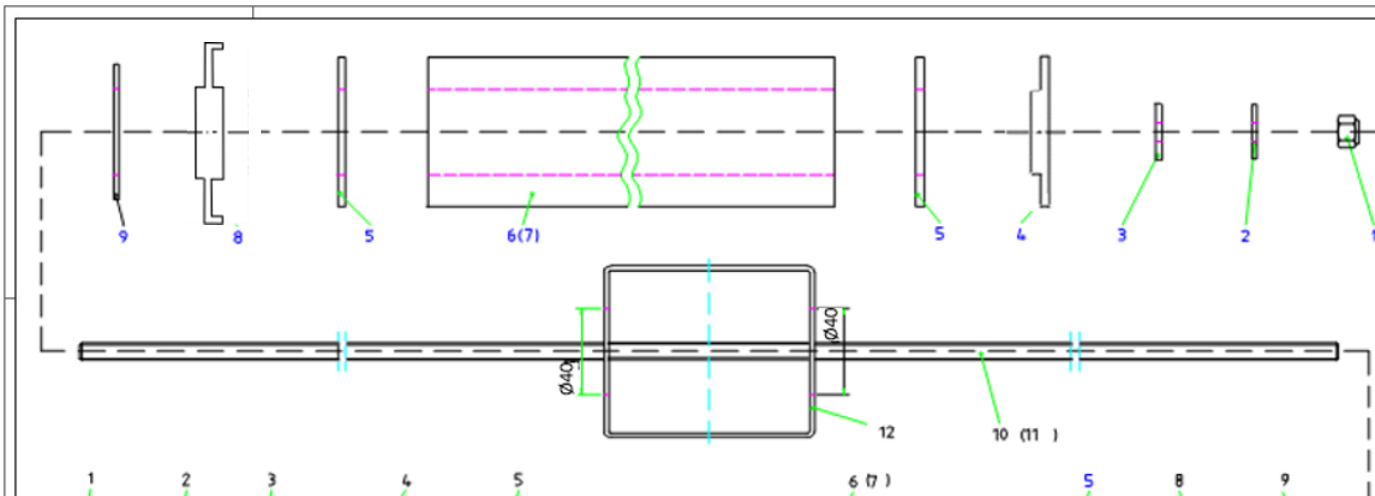
Pos.	Menge	Einheit	Bennenung	Norm-Kurzbezeichnung	Werkstoff
12	1	Stück	Vierkantrohr		Edelstahl
11	1	Stück	Gewindestange	DIN 975 M10, 1.650mm	A2/A4
10	1	Stück	Gewindestange	DIN 975 M10, 1.150mm	A2/A4
9	2	Stück	Dichtung	70x40 (45) x3	EPDM
8	2	Stück	Zentrieradapter	EZA3710 / 4010 / 4510	PAgV
7	2	Stück	Keramikrohr	D70 / d40, 750mm	Glasgebundene Feinkeramik
6	2	Stück	Keramikrohr	D70 / d40, 500mm	Glasgebundene Feinkeramik
5	4	Stück	Dichtung	70x40x3mm	EPDM
4	2	Stück	Endscheibe	EES10	PAgV
3	2	Stück	Dichtung	30x10,5x2mm	EPDM
2	2	Stück	Scheibe	DIN9021, 10,5	A4
1	2	Stück	Sechskantmutter	DIN985, M10	A4

ENVICON

Datum Name
Bearb. 29.08.18 Pitzko
Gepr.
Norm

Keramikrohrbelüfter EKR M10
Mit Kunststoff Endscheibe

Version with stainless steel end discs (exploded drawing)



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