



**ENVIRONMENTAL  
SOLUTIONS**

REHAU Group



## REHAU AERATOR SYSTEMS 瑞好曝气系统

INSTALLER GUIDE 安装手册





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# 1. INSTALLATION 安装

## 1.1 GENERAL 概述

The following assembly instructions must be strictly adhered to in order to ensure that the aeration system functions properly and reliably. It forms the basis of the warranty. About REHAU product series please check product list.

为确保曝气系统能够有效地工作，必须严格执行以下安装指南，这是质保的基础。关于瑞好产品系列请查看产品清单。

### 1.1.1 TRANSPORTATION 运输

Transportation of aerator packages to project installation site should be carried out by professional transportation service provider. The aerator packages should be prudently arranged and secured to minimize damage during transportation. The delivery vehicle utilized should be well covered in order to protect the goods from harsh weather conditions.

曝气器应由专业的运输公司运往施工现场。包装搬运曝气器时应小心，应固定包装以减少运输过程中的损害。运输车辆应有必要的防护措施，以防止恶劣的天气条件对曝气产品造成不良影响。

### 1.1.2 STORAGE 存放

The aerators are to be stored in their original packaging, in a dry, ventilated room, in compliance with DIN 7716. Temperature should be maintained between 10°C and 25°C and humidity should be kept below 65%. If these storage requirements cannot be met, longer aeration time may be required to achieve uniform air bubble distribution during the initial trial start-up. Be mentioned: **Do not store the package in the open sunshine area!**

曝气器应当包装完整存放于干燥、通风的室内，符合DIN7716的规定。室内最佳温度应介于10~25℃，湿度应低于65%。如果不能满足以上要求，那么在初步调试阶段应该延长曝气时间以取得均匀的曝气效果。**注：禁止把曝气器存放在有阳光直射的露天场所。**

### 1.1.3 INSPECTION 检查

Every aerator should be inspected: especially the membrane must be not damaged, stainless steel single-ear clamps, EPDM/silicone flat seal or O-ring for pipe aerators also need to be checked missing or damaged.

必须检查每个曝气器：膜片是否有破裂，曝气管上的不锈钢卡箍、EPDM/硅胶垫圈和O形圈是否丢失和损坏。

### 1.1.4 INSTALLATION PREPARATION 安装准备

Care should be taken when opening the carton boxes using box cutter so that

the aerators will not be accidentally damaged. When the carton box is opened, aerators should not be poured onto the concrete tank base, or it may cause damage to the membrane.

使用划刀开启包装纸箱时需注意，确保曝气器不被刀片划伤。打开包装纸箱后，不能把曝气管倾倒在混凝土池底粗糙的地面上，否则会使曝气膜损坏。

Concrete tank base's level may differ at the extreme ends due to slope requirements. The level difference should be limited to 40 mm since the adjustable pipe clamp is not able to effectively level the air distribution pipe and its adjacent air distribution pipes once the tank base level difference exceeds 40 mm.

混凝土池底的水平可能受池底四周斜坡的影响会存在偏差。池底水平偏差不能超过40mm，这是因为一旦池底两个角落水平偏差超过40mm，只通过调整固定支架很难有效地保证相邻两个空气分配管的水平一致。

It is also important to ensure both the downpipe and above tank metal pipe flanges are levelled before aerator installation. This will allow both flanges to fit and seal properly when secured to one another.

在曝气器安装之前，应确保空气立管法兰和池上金属管道上对接法兰的水平。这样来确保法兰之间的对接及密封。

Due to safety concerns, all installation and commissioning related activities should take place during safe weather and working conditions i.e. provision of safe access such as secured ladders and safety railings. Work activities should be avoided during moderate to heavy showers and when temperature is below 10°C. The later (cold temperature) can result in connection problems when connecting UPVC pipes and fittings with solvent glue. For further details, please check with the respective UPVC pipe suppliers.

从安全的角度考虑，所有安装调试应在良好的天气及施工条件下并具备必要的安全措施，如安全梯，安全栏等；安装时尽量避免雨淋或平均气温低于10℃，低温会影响到UPVC管道系统的安装效果，具体参照UPVC供应商要求。

Before the air distribution pipes are connected with solvent glue, it is important to ensure that all predrilled holes along the adjoining pipes are aligned with one another.

在空气分配管用胶水粘接之前，需确保该管上预先钻的孔与相邻空气分配管上的孔相对齐。

### 1.1.5 CLEANING OF PIPE WORK 管道吹扫

Once the air distribution pipes are connected to the main header, the pipe work

is to be flushed for at least 10 minutes using compressed air in order to remove residues and dirt trapped in the pipe work.

空气分配管与主空气管道连接之后，需输入压缩空气吹扫大约10分钟以清除管道内的杂物。

Open all down pipe valves prior to start-up of the blowers and ensure that there is no obstruction in the pipe work. Provide an opening at the end of the air distribution pipes to allow air and foreign materials to be discharged from the system. The opening may be made at the end of the air distribution pipe by leaving the end cap off.

在启动风机之前预先打开通立管上的所有阀门，并确保管道通畅无阻塞。在空气分配管的末端需提供一个排气出口以将杂物排出系统。该管道的出口可先不用管帽封闭。

In order to increase the velocity of air through the header and air distribution pipes, it may be desirable to operate at maximum blower capacity. In addition, it may be necessary to close some of the isolation valves at the down pipes to achieve a high velocity through the balance of the air distribution pipes that are open to the atmosphere.

使系统在风机最大风量下运行，以提高空气分配管中的空气流速。也可关闭部分立管上的阀门，以提高其余立管连接空气分配管中的空气流速。

As air distribution pipes are consecutively cleaned, the isolation valves are operated in a manner that allows the remaining air distribution pipes to be cleaned by an air purge. Upon completion of the air purge, the blowers shut down, the air distribution pipes are capped and purge lines shut off. Aerators are then installed on air distribution pipes. All isolation valves are opened prior to filling the aeration tank with water.

开关空气分配管上的阀门可逐一吹扫剩余的空气分配管。在空气吹扫完成后，关闭风机并安装空气分配管的末端管帽。将曝气器安装到空气分配管上。在向曝气池注水之前，确保所有的阀门均打开。

Objects such as stones, pieces of wood, etc. are to be removed from the treatment tank. Also, no welding, painting, concrete sealing should be carried out after the aerators have been connected to the air distribution pipes. If such work cannot be avoided, all aerators have to be protected by a thick plastic sheet while the work is being carried out.

池中的石子，木片等杂物必须清除。同样，曝气器安装至空气分配管后，不能在曝气池内进行焊接，油漆，水泥密封等。如果此类施工无法避免，所有的曝气器必须用厚塑料膜覆盖进行保护直至上述施工结束为止。

1.2 INSTALLATION OF PIPE AERATORS 安装曝气管

1.2.1 INSTALLATION OF STANDARD PIPE AERATOR WITH M10 THREADED INSERT 安装带M10不锈钢螺杆的标准连接曝气管

An installation adaptor with a 1/2" square opening (Figure 1) is required for installing the standard pipe aerator. A screwdriver with a shaft diameter of between 5 and 6 mm can be placed in the slot in the opposite pipe aerator so that it does not rotate during tightening of the pipe aerator. Put the adaptor into the groove on the end of the pipe, then use a ratchet wrench with 1/2" square bit to tighten the aerator.

标准曝气管的安装需要使用一个特殊的有1/2"方孔的安装连接器(图1)。在紧固曝气管时，一端使用一个直径为5至6mm的螺丝刀杆卡住曝气管尾端的两个槽，这样拧紧时不会发生转动。另一端先将1/2方孔的安装连接器卡在曝气管尾端的两个槽内，再使用一个1/2"的有正方形接头的扭力扳手来旋紧曝气管。



Figure 1: Installation adaptor  
图 1: 安装连接器

1.2.1.1 CONNECTOR FOR THE INSTALLATION 连接螺杆

Depending on the size of the air distribution pipes, the threaded stainless steel rods (M10) as shown in Table 1 are to be used.

根据方形空气分配管的尺寸，使用表1中的M10不锈钢螺杆。

Article number / 产品编号	Thread rod length / 螺杆长度(mm)	Air distribution pipes/ 适用的空气分配管
314420	205	80 x 80
302503	225	100 x 100
314466	245	120 x 120

Table 1: Threaded rod lengths and corresponding size of square distribution pipes.  
表 1: 不锈钢螺杆长度和方形空气分配管



A pair of standard pipe aerators is to be installed as follows:  
一对标准曝气管的安装过程如下:

1. The threaded rod M10 is screwed into the female threaded insert of the pipe aerator until it is hand tight (about 1 cm deep) (Figure 2).

将M10螺杆旋入曝气管内的内螺纹插入口，直至手摇无松动感为止 (约1cm 深)(图 2)。

Do not apply lubricant to the seals! 密封垫表面不能使用润滑剂!



Figure 2: Threaded rod screwed into the pipe aerator female threaded insert  
图 2: 把螺杆旋进曝气管内螺纹

2. Once inserted into the female insert, the pipe aerator is tightened using a ratchet wrench equipped with the installation adaptor and a screwdriver as a counter-brace on the other end.

当螺杆旋进曝气管后，用带连接器的扭力扳手拧紧曝气管并在对称端用螺丝刀卡住。

The pipe aerator cannot be tightened by hand because the membrane will be twisted. This is not permissible.

不能用手紧握曝气膜片旋紧曝气管，以防膜片被扭曲。这样的安装方法是不允许的!

3. One pipe aerator is fixed in position by using a screwdriver (Figure 3). The screwdriver should be held in upright position.

使用螺丝刀固定住曝气管 (图 3)。螺丝刀必须处于垂直位置。

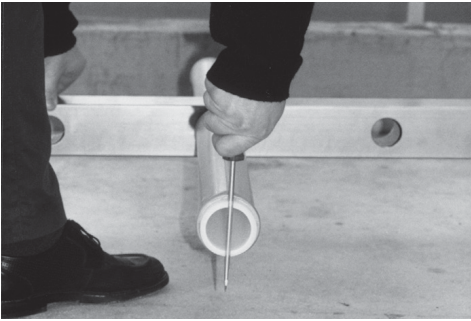


Figure 3: Align with screwdriver  
图 3: 用螺丝刀固定住曝气管

4. The other pipe aerator is to be tightened to a maximum torque of 35 Nm (Figure 4). This can be checked using a torque wrench.

使用扭力扳手旋紧另一侧的曝气管，其最大转矩为 35Nm (图 4)。



Figure 4: Check maximum torque with torque wrench  
图 4: 用扭力扳手上紧

5. Rotate the aerator in order to bring the membrane groove to an upright position. Meanwhile, maximum torque should keep 35 Nm.

调整曝气膜片中间凹槽的方向，使其处于竖直方向，同时达到35Nm的紧固力。

6. If the seal is not compressed evenly, the tightening process has to be repeated with a new seal.

如果EPDM密封垫压缩的不均匀，需要更换新的密封垫进行重新紧固。

1.2.1.2 CONNECTION TO EXISTING SQUARE AIR DISTRIBUTION PIPE(OPENING ALREADY BE DONE) 与现有的方型空气分配管（原有打孔）的连接

For direct connection of a pair of standard pipe aerators onto square air distribution pipe connection, hole size has to be 45 mm. If the diameter of the opening in the square air distribution pipe is not 45 mm, a PP adaptor ring with EPDM seal is to be added onto the standard pipe aerator to ensure that the connection to the air distribution pipe is tight. Depending on the size of the opening, the following adaptors will be required:

标准连接曝气管连接方型空气分配管上时，空气分配管上的开孔直径应为45mm。如果现有正方形空气分配管的开孔直径不是45mm，需要使用一个配有EPDM密封垫的PP连接器，以确保与空气分配管的连接的紧密。根据开孔尺寸的不同，适配接头的型号如下：

Article number / 产品编号	Material / 材质	Size of opening / 开孔尺寸 ( mm )
284550	PVC	35
225377	PP	40
284559	PVC	50
284560	PVC	55

Table 2: Product range of adaptor  
表 2: 适配器产品范围



Figure 5: Adaptor ring  
图 5: 适配接头

With the addition of such adaptor on each side of the air distribution pipe, the length of the threaded rod has to be increased by about 20 mm.

在空气分配管的两端增加以上连接器后，不锈钢螺杆的长度需增加大约20mm。

1.2.1.3 CONNECTION TO ROUND AIR DISTRIBUTION PIPE 与圆形空气分管的连接

To connect the standard pipe aerator to round air distribution pipe, a PP adaptor with EPDM seal is required (Figure 6 and Table 3). To install adaptor onto the round pipe, a set of openings with diameters 30 mm+0.5 and 5 mm+0.5 have to be predrilled onto each side of the round pipe. The spacing between the 30 mm opening and 5 mm opening has to be 25 mm +/-0.2. Care has to be taken to ensure that the set of holes are in line with each other, and the adjacent sets of holes. See Figure 7 for details on each set of openings. As a result of using the PP adaptors, the length of the threaded rod has to be increased as shown in Table 4.

标准连接曝气管连接圆管时，需要一个PP适配器和EPDM密封圈(图6和表3)。在圆管上安装适配器时,在管的两侧各开ø30mm+0.5以及ø5mm+0.5孔，间距为25mm+/-0.2(如图7)；开孔要求所有孔中心必须在同一水平线上。图7为开孔细节图。使用PP适配器后，不锈钢螺杆的长度必须增长（表4）。

Article number /产品编号	Pipe DN /管道公称直径
233511	80
233521	100
235936	125
235946	150

Table 3: Article numbers of adaptors for various pipe sizes  
表 3: 不同尺寸管道上用的适配器产品编号

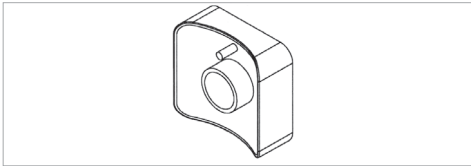


Figure 6: Adaptor for round pipe  
图 6: 适用于圆形空气分管的适配器

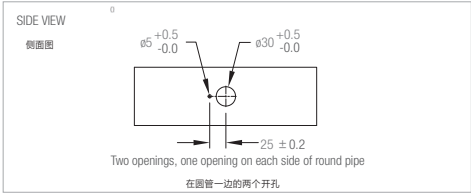


Figure 7: PP adaptor opening details for round pipe  
图 7: 安装适配器的圆管开孔

Article No./产品编号	Thread rod length / 螺杆长度	Pipe DN / 管道公称直径
279908	250 mm	90
350162	270 mm	110

Table 4: Threaded rod lengths and corresponding size of round distribution pipes  
表 4: 螺杆长度和相对应的圆形空气分管管

If round pipe is used as air distribution pipe, a pipe pressure rating of 16 bar (1,600 kPa) is required. This requirement is to ensure the pipe can withstand the compressive force exerted by a pair of installed pipe aerators tightened to a torque of 35 Nm.

必须采用压力等级为16bar(1600KPa)的圆形空气分管管道，以确保管道能够承受35Nm的紧固力。

1.2.INSTALLATION OF STANDARD PIPE AERATOR WITH ISO 7-3/4” NPT THREAD 安装连接ISO 7-3/4” 螺纹的曝气器

For STD pipe aerator that comes with ISO 7- 3/4” NPT internal thread, the installer has to ensure that the none- perforated zone is facing up and the pipe aerator connection is not over tightened when connected to the corresponding standard nipple.

对于安装ISO 7 3/4” 螺纹的曝气器，安装者应当保证未打孔的区域保持竖直并且在连接曝气管时不要过度拧紧。

1.2.3 INSTALLATION OF DUO PIPE AERATORS 安装 DUO 曝气管

Assembling the DUO pipe aerator onto a round distribution pipe is generally more straight forward as compared to the standard pipe aerator assembly.

在圆形空气分管上安装DUO曝气管比安装标准连接曝气管更加简易。

Prior to the assembly of DUO pipe aerator, openings 32 -0/+1mm are to be made on both sides of the air distribution pipe. The centre of both openings must be in line with each other (max. deviation: ± 0.5mm).Thereafter, the air distribution pipes are to be laid horizontal and adjusted to the same height. An even air bubble distribution depends on good leveling of the air distribution pipes.

安装DUO曝气管,需要在空气分管的两侧各开一个32-0/+1的孔。开孔必须是在同一轴线上（最大偏差为±0.5mm）。同时，空气分管应水平放置并且高度一致。精确调整空气分管道的水平高度可使曝气均匀。



Remove the DUO pipe aerator from the carton box, unfold and place it over the openings of the air distribution pipe (Figure 8). O-rings which are provided separately are to be inserted into the allocated slots of the connection saddle.

把DUO曝气管从纸箱中取出，然后把它展开放置于空气分配管的开孔处(图8)。每个O型圈都必须被嵌进连接鞍座的密封凹槽中。



Figure 8: DUO pipe aerator in opened configuration  
图 8: DUO曝气管展开状态

Straighten the DUO pipe aerator such that the centering rings of the saddle, lock into the openings of the air distribution pipe. (Figure 9)

展开DUO曝气管并将马鞍座上的孔中心伸进空气分配管的开孔中。(图9)



Figure 9: DUO pipe aerator in closed configuration  
图 9: DUO曝气管合拢状态

Place the fixed ends of the fastener in the recess of the saddle and press the other side down till it spans into position (Figure 10). Figure 11 shows the locked saddle.

把卡扣的固定端放入鞍座的凹口内，然后往下压卡扣另一端，

直到卡扣另一端入位 (图 10)。图 11是锁紧的鞍座。



Figure 10: Locking the saddle with a fastener  
图 10: 用卡扣将马鞍座锁死

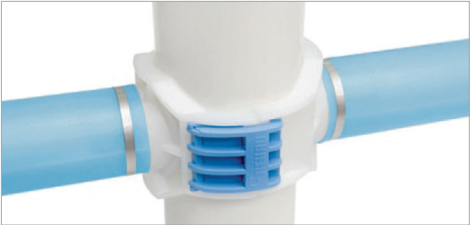


Figure 11: Bottom view of locked saddle  
图 11: 鞍座的底部

If round UPVC pipe is used as air distribution pipe, a pipe pressure rating of 10 bar (1,000 kPa) is required. This requirement is to ensure the pipe can withstand the compressive force exerted by the saddle when fastened. Table 5 shows saddle sizes available for the different air distribution pipe diameters.

当空气分配管是圆管时，管道压力等级要求不低于10bar（1000kPa），以确保能够承受马鞍座扣紧时的压力；空气分配管外径要求请参考表5。

Air distribution pipe diameter (mm)/空气分配管外径(mm)	
88.9	±0.2
90	<sup>+0.3</sup> <sub>0</sub>
110	<sup>+0.4</sup> <sub>0</sub>
114.3	±0.23

Table 5: Available saddle sizes for different air distribution pipe diameters.  
表 5: 空气分配管外径要求

1.2.4 PIPE AERATOR ARRANGEMENT 曝气管的布置

Pipe aerators installed on the same air distribution are usually spaced between 250 mm and 1000 mm. Air distribution pipes with pipe aerators installed are usually spaced between 3000 mm and 4000 mm. The spacing of pipe aerators and air distribution pipes are dependent on the design organic load. When arranging the pipe aerators, maintenance access requirement has to be considered.

曝气管的间距一般控制在250mm到1000mm之间，空气分配管的间距一般控制在3000mm到4000mm之间；曝气管和空气分配管的间距是依据有机负荷来设计确定，同时应考虑到检修维护工作空间。

1.2.4.1 IMPACT OF MIXERS AND RECIRCULATION PUMPS ON PIPE AERATOR ARRANGEMENT  
推进器和回流泵等水下设备对曝气管排布的影响

If mixers or recirculation pumps are used in aeration tanks, the resultant water currents may produce adverse pipe aerator oscillation. Pipe aerator to air distribution pipe connections may loosen over time. To minimize this effect, it is important to ensure that wastewater does not flow across the longitudinal pipe aerator axis at an angle of more than 45° (Figure 12).

当水池内安装有推进器，回流泵等能改变水流方向的设备时，水流方向的改变以及震动等原因会引起曝气管的松动而影响到曝气效果。为了减小这种影响，必须保证水流方向与曝气管之间的纵向夹角不大于45°（图12）。

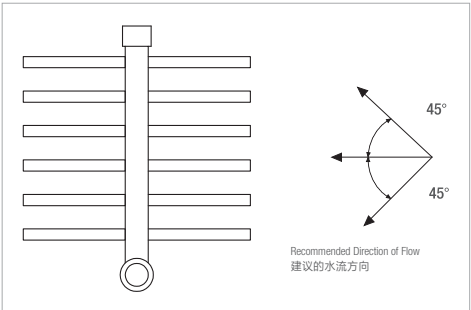


Figure 12: Arrangement of pipe aerator with consideration of flow direction.  
图 12: 曝气管与水流夹角  
In addition, adequate distance must be allowed between mixers or recirculation

pumps and pipe aerators. The wastewater flow velocity should be 0.3 m/s or less at installation locations. Flow velocity of between 0.3 and 0.9 m/s will require pipe aerator fixation (Figure 13). Pipe aerator should not be installed when flow velocity is above 0.9 m/s.

此外，曝气管必须与推进器或回流泵保持一定的距离；在安装区域，污水流速应小于0.3m/s。当流速在0.3到0.9m/s之间需要给管式曝气器加固（如图13）。流速大于0.9m/s时不应安装管式曝气器。

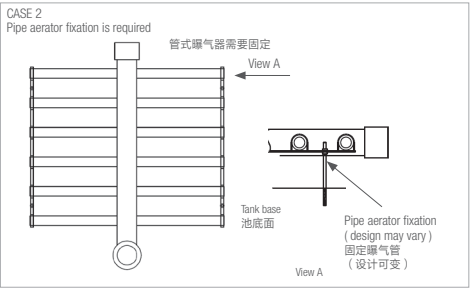


Figure 13: Pipe aerator support is required when velocity is between 0.3 and 0.9 m/s  
图 13: 当水流速度在0.3和0.9m/s之间时需要固定支撑

As a rough guide, clearance distance may be 2.5 times the mixer's impeller diameter or more. If adequate clearance is not possible, pipe aerator fixation may be required. Whenever possible, customer should seek the respective mixer or pump supplier's advice on the possible values of flow velocity induced by their product.

对于有水下推进器的场合，曝气管与推进器间的距离应为推进器叶轮直径的2.5倍以上，当现场无法满足这个要求时可以要求安装固定支架；客户也应该要求推进器供应商给出其产品参数以确定可产生的水流速度。

1.3 INSTALLATION OF DISC AERATORS 安装曝气盘

### 1.3.1 INSTALLATION OF DISC AERATORS WITH DISC SADDLE 安装卡扣型马座连接的曝气盘

Disc saddle can be installed onto pipes with outer diameter 88.9 mm, 90 mm, 110 mm and 114.3 mm having pipe pressure rating of 10 bar (1,000 kPa).

马鞍型连接盘式曝气器可以安装到外径为88.9mm,90mm,110mm以及 114.3mm，耐压等级为10bar的管道上。

All air distribution pipes must be levelled within  $\pm 5$  mm for proper function of the aerator. Vertical alignment of the hole has to be within  $\pm 3^\circ$  (Figure 14) and should be drilled in line with adjacent holes. Remove all internal debris from within the air distribution pipes with a water flush.

为了曝气盘的正常运行，所有的空气配管的水平偏差必须被控制在 $\pm 5$  mm内。各孔纵向偏差须在 $\pm 3^\circ$  内（图14）。所有孔必须要清除毛刺，然后用水冲洗管道以去除空气分配管内的所有残留物。

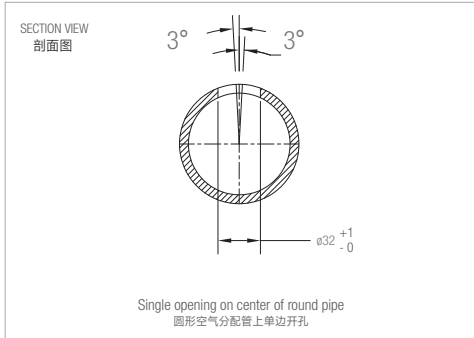


Figure 14: Hole opening details on round pipe for disc saddle connection  
图 14: 为了安装卡扣型马座而在圆管上开孔

Place disc saddle with threaded socket on top and in vertical position over the predrilled 32 -0/+1 mm hole (Figure 14) on the air distribution pipe and ensure

that the saddle and O-ring are firmly seated on the pipe before proceeding further (Figures 15 and 16).

将带螺纹的马鞍座部分放在竖直朝上开孔的空气分配管上，孔直径32-0/+1mm（图14）并确保O型圈嵌在马鞍座密封凹槽内（图15和图16）。



Figure 15: Install disc saddle onto pipe  
图 15: 安装马座

Install the blue fastener (Figure 15).  
安装蓝色卡扣（如图15）。

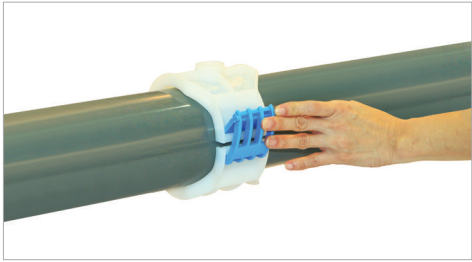


Figure 16: Install fastener onto disc saddle  
图 16: 安装马座卡扣

Install disc aerator onto the saddle by turning clockwise. Do not over tighten. 1 or 2 exposed threads should be seen. (Figure 17)

将盘式曝气器顺时针拧紧进马鞍座内，不应过量拧紧。应当能看见1到2圈外螺纹。（如图17）

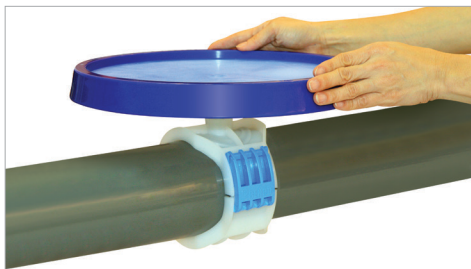


Figure 17: Install disc aerator onto the secured disc saddle  
图 17: 将曝气盘安装到马鞍座上

### 1.3.2 INSTALLATION OF DISC AERATORS WITH DISC WEDGE SADDLE 安装卡钩型马鞍座连接的曝气盘

Disc wedge saddle can be installed onto pipes with outer diameter 63 mm and 90 mm having pipe pressure rating of 10 bar.

卡钩型马鞍座可以安装在外径为63mm或90mm，压力为10bar的空气分配管上。

All air distribution pipes must be levelled within  $\pm 5$  mm for proper function of the aerator. Vertical alignment of the hole has to be within  $\pm 3^\circ$  (Figure 18) and should be drilled in line with adjacent holes. Remove all internal debris from within the air distribution pipes with a water flush.

为了曝气盘能正常运行，所有的空气分配管的水平度偏差必须被控制在 $\pm 5$  mm内。各孔纵向偏差须在 $\pm 3^\circ$ 内(图18)并与相邻的孔在一条直线上。所有孔必须要清除毛刺，然后用水冲洗管道以去除空气分配管内的残留物。

Place disc wedge saddle with threaded socket on top and in vertical position over the predrilled  $16 \pm 2/0$  mm hole (Figure 18) on the air distribution pipe.

Ensure the seal is seated firmly in saddle groove (Figure 19).

将带螺纹的马鞍座部分放在竖直朝上开孔的空气分配管上，孔直径 $16 \pm 2/0$  mm（图18）。O型圈应嵌进马鞍座的密封凹槽中（图19）。

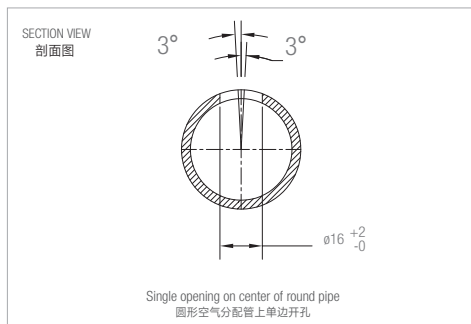


Figure 18: Hole opening details on round pipe for disc wedge saddle connection  
图 18: 为了安装卡钩型马鞍座而在圆管上开孔

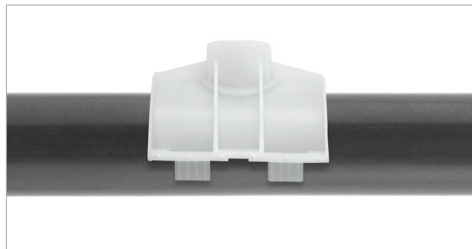


Figure 19: Install disc wedge saddle with threaded socket on pipe  
图 19: 将马鞍座带螺纹的部分放在管上

The stick of bottom half saddle and the groove of top half saddle form a hinge system as shown(Figure 20). Ensure that the hinge of bottom half saddle is

seated firmly on the top half saddle.

马鞍座上、下部分通过轴和槽形成铰链连接结构（如图20）确保下半部分的轴与上半部分完全连接。

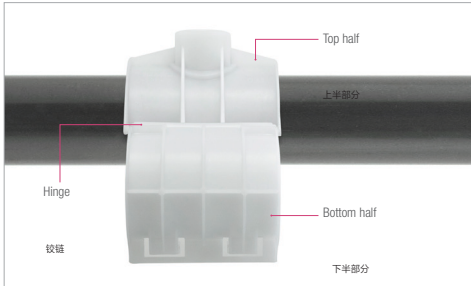


Figure 20: Back view of disc wedge saddle in open position.  
图 20: 张开的马鞍座的背面图

Close both saddle and ensure that they are secured to one another (Figure 21 and 22). Press the bottom half of the saddle onto the top half until the hooks snap into two openings in the top half.

将马鞍座合上并且确保它们紧密相连（如图21和图22）。将马鞍座下半部分的钩型插片插进上半部分的两个插口内。

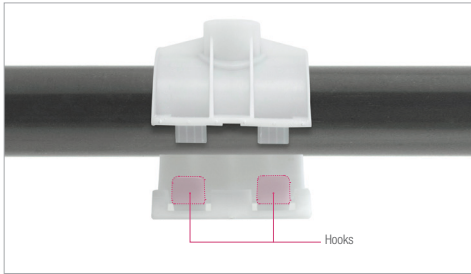


Figure 21: Front view of disc wedge saddle in open position.  
图 21: 张开的马鞍座的正面图

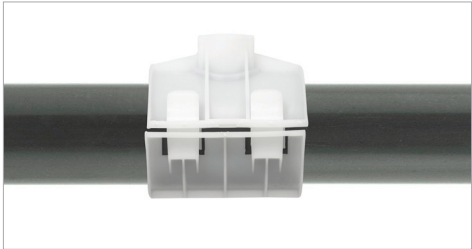


Figure 22: Disc wedge saddle in snapped position.  
图 22: 插片在插口内

Insert two wedges behind the hooks as shown. Ensure that they are in the right orientation and fully pushed in (Figure23 and 24).

将两个契型插片插到卡钩的后面。注意插片的方向并且要插到位（如图23和图24）。

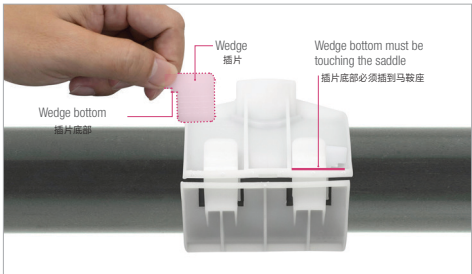


Figure 23: Installation of wedge.  
图 23: 放入契型插片

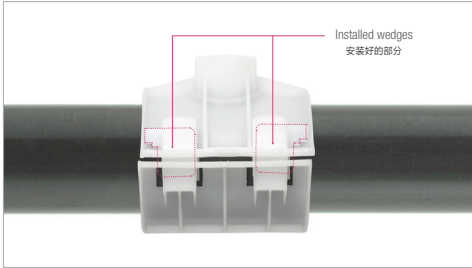


Figure 24: Disc wedge saddle installed onto pipe.  
图 24: 盘式卡钩型马鞍座连接

Install disc aerator onto the saddle by turning clockwise. Do not over tighten. For Disc DN200, 1 or 2 exposed threads should be seen. (Figure 25-1)

将盘式曝气器顺时针拧进马鞍座内，不应过量拧紧。  
对于200盘式曝气器应当能看见1到2圈外螺纹。（如图25-1）

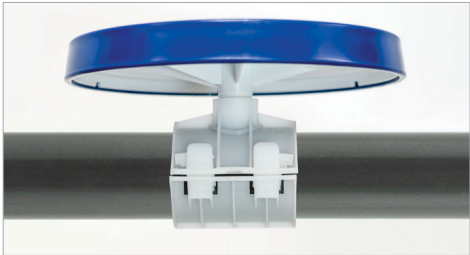


Figure 25-1: Disc 200 aerator installed onto disc wedge saddle  
图 25-1: 200盘式曝气器安装在马鞍座上

For disc 260 and disc 300, install disc aerator onto the saddle by turning clockwise to bottom. Do not over tighten. (Figure 25-2)

对于260和300盘式曝气器，需将盘式曝气器顺时针拧进马鞍座内，旋转到底即可，不应过量拧紧。（如图25-2）

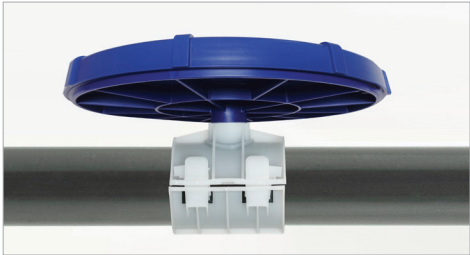


Figure 25-2: Disc aerator DN260/DN300 installed onto disc wedge saddle  
图 25-2: DN260/DN300盘式曝气器安装在马鞍座上

1.3.3 INSTALLATION OF DISC AERATORS WITH GROMMET 配双承接头的曝气盘安装

Instead of using disc saddle, grommet (Figure 26) can also be used as connectors between the disc aerator and the air distribution pipe. (refer to Table 6 for the available grommet program).

除了马鞍座连接，双承接头(图26也可用于连接盘式曝气器和空气分配管。（表6是可用的双承接头列表）。



Figure 26: Grommet  
图 26: 双承接头

Article no. 产品编号	PVC outer pipe diameter (mm) PVC管径(mm)	Required wall thickness 管径壁厚的要求(mm)	Nominal pressure 公称压力
351628	Ø88.9/Ø90	3.9 - 4.4	PN10
351629	Ø88.9/Ø90	6.4 - 6.9	PN16
351087	Ø110/Ø114.3	4.2 - 4.7	PN10
351086	Ø110/Ø114.3	6.5 - 7.0	PN16

Table 6: Standard PVC pipes with in the range of grommet' s program  
表 6: PVC管和对应的双承接头

Their size has to match the wall thickness of the air distribution pipes. All air distribution pipes must be levelled within  $\pm 5$  mm for proper function of the diffusers. In order to assemble the grommet onto holes in air lateral pipes, openings with diameter of  $32 \pm 0.15$  mm must be pre-drilled and the vertical alignment of the hole has to be within  $\pm 3^\circ$  (Figure 27).

双承接头的尺寸应与空气分配管的壁厚相对应。为了曝气盘能正常运行，所有的空气配管的水平度偏差必须被控制在 $\pm 5$ mm内。为能够将双承接头插入空气分配管中，需预先在空气分配管上开孔 $32 \pm 0.15$ mm。各孔纵向偏差须在 $\pm 3^\circ$ 内（如图27）。



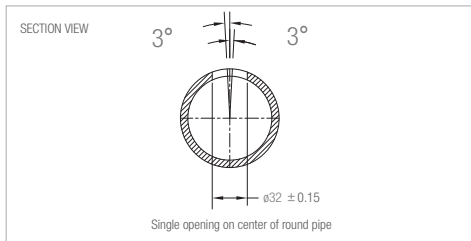


Figure 27: Hole opening details on round pipe for grommet connection  
图 27: 安装双承接头的空气分配管开孔要求

Each hole should be drilled in line with its adjacent holes and must be deburred. Remove all internal debris from within the air distribution pipe with a water flush. The grommets should be installed before the air distribution pipes are mounted to the tank base.

开孔应该在一条直线上并且要清除毛刺。然后用水冲洗管道以去除空气分配管内的所有残留物。双承接头安装到空气分配管，然后再固定到池底。

To ease installation, the grommet may be wetted with lubricant. Recommended lubricants are commercial-grade, water-based soap or regular household detergents. Do not use lubricants containing mineral oils or other hydrocarbons. The lubricant is applied onto the outer surface of the grommet from the bottom up to the rim. Other surfaces must not be in contact with lubricants. Press the grommet into the hole until it snaps into the opening. To ease installation, we recommend a rubber mallet (Figure 28).

为便于双承接头的安装，可使用润滑剂。建议使用商用级别的水溶肥皂，或家用清洁剂。不可使用含有矿物油或烯烃类物质的润滑剂。自下而上地将润滑剂涂抹在双承接头的外侧，不可接触到曝气盘的其它部位。用力将双承接头插入空气分配管的孔中。为提高工作效率，建议借助橡胶锤。(图28)



Figure 28: Grommet installation into a 32 mm hole using a rubber mallet  
图 28: 把双承接头安装在一个直径为32mm的孔上

Press the disc aerator's NPT threaded nipple into the grommet until it touches the thread in the grommet. Attention should be paid to a horizontal alignment of the disc aerator. Then turn the disc clockwise until the lower rim of the disc aerator touches the top of the grommet (Figures 29).

旋转曝气盘底部的外螺纹进入双承接头的内螺纹中。同时需注意曝气盘的水平度。然后，顺时针旋转曝气盘，直到曝气盘的底部与双承接头的顶部接触 (图29)。



Figure 29: Bottom view of installed disc aerator (disc aerator lower rim touches top of the grommet)  
图 29: 安装好的曝气盘底部 (曝气盘的底部与双承接头的顶部接触)

### 1.3.4 DISC AERATOR ARRANGEMENT 曝气盘布置

In order to maximise the uniformity of bubble distribution, spacing between disc aerators should be kept as even as possible. Depending on organic loading, disc aerator 200, disc aerator 260 and disc aerator 300 are usually spaced between 350-500 mm, 500-600 mm and 600-800 mm respectively.

为了使气泡分布均匀，曝气盘之间的距离需要尽可能均匀。根据有机负荷计算，通常将DN200、DN260和DN300曝气盘的间距分别控制在350~500mm、500~600mm、600~800mm之间。

#### 1.3.4.1 IMPACT OF MIXERS AND RECIRCULATION PUMPS ON DISC AERATOR ARRANGEMENT 推进器以及回流泵对曝气盘布置的影响

Similar to pipe aerators, disc aerators should be installed at a safe distance from submerged mixers and recirculation pumps, the flow velocity of wastewater should be 0.4 m/s or less.

与曝气管布置相类似，曝气盘的安装应与浸没搅拌器和回流泵之间有一定的安全距离，污水流速应小于等于0.4m/s。

### 1.4 ADJUSTMENT OF AERATORS & AIR DISTRIBUTION PIPE 调整曝气器和空气分配管

#### 1.4.1 ADJUSTMENT OF AERATORS 调整曝气器

##### Pipe aerator 曝气管

Air distribution through the pipe aerators is a function of the individual pipe aerator elevation. For proper system operation, REHAU recommends a levelling tolerance of  $\pm 20$  mm between the two ends of each pipe aerator 1 m long. If the pipe aerators are mounted with excessive elevation deviation, the airflow distribution in the system will be adversely impacted.

曝气管内的空气分配会受到曝气管的水平度的影响。为确保系统正常运行，瑞好建议每对曝气管(单管1m长)的末端水平度偏差为  $\pm 20$ mm。如果曝气管安装的水平度偏差过大，系统的空气分配会受到不良影响。

##### Disc aerator 曝气盘

Ensure that the grommet or disc saddle is firmly installed on the air distribution pipe and the disc aerator is firmly seated onto the installed grommet or disc saddle. The membrane surface of the installed disc aerator should be parallel to the tank base.

确保双承接头或马鞍座被牢固地安装在空气分配管上以及曝气盘被稳固地安装在双承接头或马鞍座上。已安装曝气盘的膜片表面应该与池底相平行。

#### 1.4.2 ADJUSTMENT OF AIR DISTRIBUTION PIPE 调整空气分配管

Due to possible unevenness of the tank base, each individual air distribution pipe has to be adjusted vertically through adjusting the stainless steel pipe clamp so that the air distribution pipe can be horizontal. REHAU recommends a levelling tolerance of  $\pm 10$  mm between both ends of each air distribution pipe.

由于池底可能不平整，每一根独立的空气分配管的高度需通过可调整的不锈钢固定支架进行调整，以确保空气分配管尽可能水平。瑞好建议每根空气分配管的头部至尾部两端的水平度偏差为  $\pm 10$ mm。

## 2. COMMISSIONING 试运行

### 2.1 GENERAL概述

These instructions cover the general commissioning requirements for the aeration system. Special commissioning requirements outlined in the Engineer's specifications and contract documents shall be supplementary to or take precedence over these general instructions. Make sure all products have been installed before commissioning.

以下说明包含了曝气系统调试通常所需的要求。在工程师规范和合同文件中的特殊调试要求必须被作为附件或替代这些通常说明。调试前必须确保产品安装到位。

### 2.2 TRIAL 调试

A trial of the aeration system should be carried out as soon as possible after installation of the aerators. Start filling the aeration tank with clean water up to the level of the aerators. Ensure all aerators are parallel with the water level.

曝气器安装完成后必须立即进行曝气系统的试用。开始向曝气池中注入清水至曝气器的高度。确保所有曝气器的平面与水平面平行。

Continue filling the aeration tank with water until the water level is about 20 cm above the aerators. Activate the blower and introduce air to the aeration system, starting with low airflow rate of around the lower airflow limit of the aerator. Check pipe work and aerator joints for leaks. If there is a major leak in the pipe work or connection between air distribution pipe and aerator, drain water to a level, which allows the leak to be exposed and carry out repair. Thereafter, repeat the checking procedure by increasing the water level back to 20 cm above the aerator. When no major leak is detected, cut off the air supply to each individual air distribution pipe by closing the isolation valve at the down pipe one at a time and look out for rising of air bubble from the pipe aerator joints. If bubble comes out, then repair again until no bubbles.

继续向曝气池中加水直至水面高于曝气器大约20cm。启动风机向曝气系统供气，开始时用低空气输送量，约为曝气器气量的下限值。检查空气管道和曝气器的连接处有无泄漏。如果空气管道发生泄漏或空气分配管与曝气管连接处有泄漏，将曝气池中的水排放到一定高度，以使泄漏点露出水面并进行修补。其后，重新向曝气池中注水至高于曝气器20cm再进行检查。如果无主要泄漏，关闭主管上的阀门以停止向空气分配管供气，观察曝气器连接处有无气泡冒出。如有气泡，则继续修补，直到不会泄露为止。

It is common for the air bubble distribution to be uneven at start up condition specifically during leakage checks, which require the air blower to run at low airflow rate. This uneven air bubble distribution is primary due to stickiness occurring along perforated slits in membranes induced by extended storage period. This temporary condition should not be of a concern as the air bubble distribution will gradually improve once operated at design to maximum airflow rate for a period of time. Depending on the membrane condition, the period required to flex the membrane can be from 4 hours to a couple of days. Wastewater should be channelled into the aeration tank only after the air bubble distribution achieves acceptable uniformity.

在初次调试的时候（尤其是在用低气量运行时）曝气气泡分布不均匀是一种比较常见的现象。这是由于前期存储期较长，膜片具有一定的粘性使得微孔无法立即张开；这种临时的现象是无需担心的，因为当曝气器以设计的最大通气量运行一段时间后气泡均匀性将逐渐改善。根据膜片的情况，通过大气量曝气来改善气泡均匀性的周期通常是4个小时到几天时间。只有在曝气气泡基本均匀后，才能放污水进曝气池。

## 2.3 IDLE TIME, PRIOR TO CONTINUOUS OPERATION 开始连续运行前的空置时间

If the aerators are not taken into operation immediately following the commissioning of the aeration system, 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 put into operation. Ensure that the water level does not drop significantly as a result of evaporation.

如果曝气系统在调试结束之后没有立即投入使用，则需将系统的水位升至高于曝气器1m处。必须保持此水位高度直至系统最终投入运行前。确保水位高度不会因为水被蒸发而下降。

If there is frost, the depth of water above the aerators must be at least 10% of the minus temperature of the water. Example: At -20°C, water height above the pipe aerators is 2 m.

在霜冻情况下，曝气器淹没深度（m）的数值至少应为环境空气最低温度(°C)的数值的10%。例如：在气温为-20℃，曝气器上面的水深为2m。

## 2.4 REQUIREMENT OF PURGELINE 冷凝水排空管的要求

Purge line is basically a 1" - 1½" pipe with one end connected to the air distribution pipe and the other to a ball valve. Requirement of purgeline is not mandatory for operation but it facilitates activities during commissioning and maintenance.

冷凝水排空管一般采用1" - 1½" 的管道，一端连接空气分配管，另一端连接一个球阀；冷凝水排空管主要是为方便调试以及维护，对于运行而言，不是强制要求。

The benefits of having purge line are as follows:

1. During start up, purgeline provides the avenue for dust and pressure with in the system to escape.
2. It allows purging of condensate from the system resulting in less pressure built up within aerator pipework over time.
3. It helps with the trouble shooting of aerator problems in particular the ingress of wastewater into the aerator grid.

优点如下：

1. 在启动时可以通过此装置排出部分灰尘以及管道内压力；
2. 排除管道内的冷凝积水，避免空气管道内压力增加；
3. 有助于对曝气器故障的诊断，尤其是污水倒灌进曝气器的情况。

# 3. OPERATION 运行

## 3.1 GENERAL 概述

The aeration system is normally designed to provide uniform distribution of air without requiring adjustment of the isolation/ throttling valves on the down pipes with the exception in situations where water level variation exists. These valves are typically provided for direct control of airflow distribution on large aeration systems or for process control.

曝气系统通常用来提供均匀的空气，立管上的阀门用于直接控制大面积曝气系统气流分配或控制工艺过程，当由水位造成的曝气不均匀，建议调节立管上的阀门，控制出气大小。

The aerators require very little maintenance for long-term operation. REHAU recommends that the air supply to the aerators be maintained at all times for optimum performance. Continuous application at high airflow rate, greater than that allowed for normal operation may result in physical damage to the membrane. Under no circumstances should the airflow indicated as maximum be exceeded unless approval is given by the REHAU Competence Team.

曝气器长期运行仅需少量的维护。瑞好建议曝气器保持最佳运行效果的气流量。长期运行过高的曝气量可能导致膜片被损坏。除非由瑞好技术部门许可，否则不可超过最大供气量。

NOTE: Exercise caution when adjusting several lateral throttling valves in the same piping system. This procedure can result in elevated airflows in sections of the aeration system, which may exceed the maximum allowable airflow to each pipe aerator.

注意: 在调节几个同一管路系统的支管阀门时，必须避免因阀门开闭带来的气量突然增加，否则可能导致部分曝气系统的气流量超过最大许可气流量而损坏产品。

## 3.2 AIR SUPPLY 空气供应

The air supply system has to be free of oil, dust and solvent and must include a filtration system. Dust filters for ambient dust are to be designed to achieve 90% filtration in conformity with EN 779, filter class G4. Air temperature at inlets may not exceed 80° C. Higher temperatures may be permitted in consultation with REHAU Competence Team.

供气系统内应该无油、无尘、无溶剂，并且应含有一个过滤系统。环境灰尘过滤器的设计值达到90%的过滤效果，符合EN779标准，过滤等级G4的要求。进口处最高空气温度不能高于80℃。只有经瑞好技术部门确认后才能应用于更高的温度。

## 3.3 NORMAL OPERATION OF THE AERATION SYSTEM 曝气系统的日常运行

The following procedures should be followed on a regular basis to assure consistent and satisfactory performance of the aerator system: 1) The airflow rate to the system may be adjusted to maintain the desired dissolved oxygen levels in the aeration tank. 2) When adjusting the airflow rate, the aerators should be operated within the operating airflow range. Excessive airflow rates will result in high-pressure loss across the aerators and reduced oxygen transfer performance. Airflow rates lower than the recommended minimum operation airflow may result in incomplete utilization of the aerators and uneven air distribution.

为确保曝气系统能保持令人满意的曝气效果，气流量的调整应该遵循以下基本规则：1) .调节曝气池的气流量到刚好保持所需溶解氧的量，2). 调节气流量时注意不得超过曝气器的一般供气量范围。过大的气流量将增大膜片压力损失并降低氧转移效率，气流量低于建议值将导致曝气器利用率降低而产生曝气不均的现象。

The recommended operating airflow ranges for REHAU aerators are as follows: 瑞好曝气器建议的运行气流量范围如下：

Type of aerator 曝气器类型	Specific airflow rate range 一般通 气量范围	Recommended design specific airflow rate range 推荐设计 通气量范围	Max specific airflow rate 最大通气量
64mm pipe aerator	2 to 12 Nm³/h.m	4 to 10 Nm³/h.m	20 Nm³/h.m
92mm pipe aerator	3 to 19 Nm³/h.m	6 to 16 Nm³/h.m	32 Nm³/h.m
Disc aerator 200	0.5 to 5 Nm³/h.m	1.5 to 3.5 Nm³/h.m	7 Nm³/h.m
Disc aerator 260	1 to 7 Nm³/h.m	2 to 5 Nm³/h.m	10 Nm³/h.m
Disc aerator 300	1.5 to 11 Nm³/h.m	4 to 8 Nm³/h.m	16 Nm³/h.m

Max airflow is used only during maintenance with a duration limit of 10 minutes per day.  
最大气量仅用于维护，每日持续时间在10分钟内

Positive dissolved oxygen concentrations should be present throughout the entire system during normal operation. A dissolved oxygen profile analysis may be used to confirm the performance of the aeration system. Typically, the dissolved oxygen levels are measured at the inlet, the outlet, and the midpoint locations of each aeration tank to determine the aeration system performance. In regulating the system airflow to control dissolved oxygen levels, the aerators should be operated within their minimum and maximum airflow limits.

在正常运行过程中，整个曝气系统应该有多余的溶解氧。溶解氧的测量可以确定曝气系统的性能。通常采用测量曝气池入口、出口和中心位置处的溶解氧量可确定曝气系统的性能。在调节系统气流量来控制溶解氧量时，注意不能超出曝气器的最高和最低曝气量。

For special cases where there is not enough biological loading, the wastewater load should be directed into one or two aerobic trains. The operation should be executed in such a way that trains in the plant will take turns to idle and operate. However, a more effective method would be to commission the aerobic trains in phases or on demand to avoid low biological loading condition.

对于特殊的项目，例如有的项目没有足够的生物负荷，废水应该直接进入一个或两个好氧池。该污水处理厂的运行应该按如下方法进行，即：好氧池的停置和运行应该轮流执行，更有效的方法是阶段曝气或者按需曝气以避免低生物负荷环境。

### 3.4 VARYING WATER LEVEL OPERATIONS 水位高度差异的操作

In applications where water level variations may exist between aeration tanks supplied by a single blower, the isolation valves may need to be adjusted to maintain adequate airflow distribution. This normally requires throttling back the air to the aeration tank with the reduced water level. It is important to confirm the operating airflow range of the aerators before throttling back any isolation valve. Damage could result to the aerator if airflow is supplied for a long period of time above the recommendations enclosed herein. Please consult REHAU Competence Team to confirm operating at airflow rate higher than the maximum recommended value.

在某些应用中，同一风机供气的几个曝气池的水位高度存有差异，此时需要调节阀门以保证适当的气流分配。通常的方法是找到水位较低的曝气池，调小其阀门的气量。重要的是在调小阀门前需确认曝气器的曝气量。如果曝气器长期处在高于推荐的曝气量的状况下运行，可能会导致曝气器损坏。需要在高于最高推荐曝气量下运行前，请先咨询瑞好技术应用部门。

### 3.5 TROUBLE SHOOTING 问题解决

Periodic visual inspection of the system should allow the operator to determine if the system is performing at optimum levels.

定期对系统进行检查有助于操作人员判断系统是否处于最佳工况下运行。

Below are symptoms and actions to remedy situations if inspection of the aeration system reveals abnormal operating characteristics:

- a. Large volume of air in localized area
- Possible causes:
- Connection between aerator and air distribution pipe is loosened
  - Pipe aerator membrane is damaged
- Actions:
- Drain tank to access area in question
  - Inspect pipe joint and membrane for loose connection and damage respectively. Repair as required. See Section 4.

以下是曝气系统表现出的非正常运行特征及其处理方法。

- a. 局部气量大
- 可能的原因:
- 曝气管和空气分配管的连接处松动
  - 曝气膜破裂

措施:

- 排空出现问题的水池
- 逐个检查连接处是否松动和曝气膜是否破裂，如发现问题立即维修，参考本手册第4部分



b. Decreased air bubble distribution and increased pressure loss noted at blower

Possible causes:

- Membranes have fouled
- Reduced blower discharge air volume
- Restriction in air distribution pipe

Actions:

- Drain tank to access aerators
- Inspect for external fouling. Clean or replace membrane when required
- Check blower operating point and speed
- Check isolation valve position on down pipe
- Check pressure gauge (min. sensitivity of 10 mbar or 1 kPa is required)

b. 气泡分配量减少并且观察到鼓风机的压力损失升高。

可能的原因:

- 膜片被阻塞
- 鼓风机的气量被减少
- 空气分配管道被节流

措施:

- 排空出现问题的水池。
- 检查曝气膜表面是否堵塞。如有必要，清洁或更换膜片。
- 检查鼓风机运行状况。
- 检查各个立管上的截止阀。
- 检查压力表（最好采用精确度为10mbar或1KPa的压力表）

c. Dissolved oxygen profile not satisfactory throughout basin

Possible causes:

- Increased loading to system
- Reduced blower discharge air volume
- Improper distribution of air in system
- Air leak in system

Actions

- Check loading to system
- Check blower operations
- Refer to sections 3.5 a. and b.

c. 曝气池各处的溶解氧不满意

可能的原因:

- 系统处理水量增加。
- 鼓风机的气量被减少。
- 空气分配系统不合适。
- 系统漏气。

措施:

- 检查系统处理水量。
- 检查鼓风机的运行状况。
- 参照前两个问题的措施的 3.5 a 和 b。

### 3.6 SHUTDOWN OF AERATION SYSTEM 曝气系统关闭

If an interruption in air service is experienced and positive displacement blower units restarts, follow blower suppliers recommended procedures. If the PRV releases air for an extended period of time, the relief setting should be checked.

供气被中断后需要恢复供气时，重新启动鼓风机时，请遵循鼓风机供应商推荐的操作程序。如果排气阀排气时间过长，应该检查排气设定。

If the aeration tank is to be idle for a prolonged time period, the aeration tank should be drained and cleaned. If the draining of the aeration tank takes more than a day, the minimum airflow to the system should be maintained during the draining of the aeration tank.

如果将长时间停用曝气池，应该排空并清洁水池。如果排水时间超过一天，排水期间应该保持最小通气量的曝气。

Once the tank is drained, the aerators should be quickly cleaned using high pressure hosing in order to remove sludge deposit from the membrane surface. Leaving the sludge deposit on the membrane surface will cause it to dry up quickly, especially under hot weather condition. Such dried sludge will adversely affect the performance of the membrane when it is put into operation again.

曝气池排水完成后，尽快用高压水冲洗曝气器以清除曝气膜表面的淤泥。尤其是在高温天气状况下，淤泥残留在曝气膜表面会导致淤泥迅速干燥，这些干淤泥会在日后系统再次运行时影响曝气膜的曝气效率。

Care should be exercised when removing sludge from the tank base in order to prevent damage to the aerators. Stubborn sludge close to the aerator should be dislodged using high pressure hosing and removed using suction pump. Avoid using shovel or other sharp tool to remove sludge near the pipe aerators that can cause accidental damage to the aerators.

在清除池底淤泥时应小心，防止曝气器损坏。靠近曝气器处不易清除的淤泥应使用高压水枪冲洗并用抽水泵清除。避免使用铁铲或其他锐利的工具清除曝气器旁边的淤泥，否则可能导致曝气器意外损坏。

When the aerators and aeration tank base are cleaned, fill the tank to a depth of 1 m with water so as to prevent accidental damage to the aerator.

当清理完曝气器和曝气池底后，向曝气池内注入1m深的水，以防止曝气器被意外损坏。

If the aerators are left idle for a long period, then maximum air flow rate is to be applied for a period of approximately 20 minutes, every week.

如果长时间停用曝气器，应保证每周1次以最大供气量向曝气器供气并保持约20分钟。

Stagnant wastewater should not be kept in the tank for more than 2 weeks. It should be recycled at least once every 2 weeks. When possible, checks on the aerators should be done after a long period of idle prior to reinstating normal operation.

剩余污水一般不应在水池内存放超过2周。污水至少每两周循环一次。若条件允许，当曝气系统长时间停置后，在重新启动运行前需对曝气器进行检查和调试，以确保曝气器能正常运行。

## 4. MAINTENANCE 维护

### 4.1 GENERAL 概述

The aerator is a fine bubble aeration device that offers maximum benefits for oxygen transfer and mixing. Proper operation and maintenance of the aerator can provide years of long-term performance with minimum energy and maintenance cost. For all fine bubble aerators, it is necessary to follow preventive maintenance procedures to sustain peak or optimum performance, prolong equipment life, and avoid emergency situations or a system failure. Proper maintenance procedures will also minimize the frequency of system interruptions. The following guidelines should be referenced in maintaining the aerator system:

曝气器是一种微孔曝气装置，能提供最佳氧转移率和搅拌效果。正确的操作和维护可延长曝气器的使用寿命，能降低耗电量和维护成本。预防性的维护措施可以使微孔曝气器长期保持良好的性能，延长设备的使用寿命，防止紧急情况发生或系统失效。正确的维护也能降低系统意外中断的可能性。维护曝气系统时应遵循以下规定：

The membrane should be protected from organic solvents, such as aromatic hydrocarbons. Contact with such substances will cause the membrane to swell.

防止橡胶膜片与有机溶剂，如芳香烃等接触，此类化学物质会导致曝气膜片的膨胀。

Some evidence of increased head loss through the aerators may be experienced over a long period of operation. This increase in pressure loss is often the result of biological and/ or inorganic materials build-up on the membrane surface. The rate at which the pressure loss increases depends on the type of wastewater and the specific operating conditions of the treatment process.

曝气器长时间使用后压力损失会明显增加，这种压力损失的增大常常是因为膜片表面滋生的微生物或无机物沉积所造成的，此压力损失的增加速度取决于处理的污水水质和污水处理工艺的运行条件。

### 4.2 MAINTENANCE OF THE AERATORS 曝气器的维护

REHAU recommends that the pressure loss of the aerators to be monitored and documented in plant records on a regular basis once the aeration system is put into operation so that an appropriate cleaning cycle can be established. The pressure loss should always be measured at a constant airflow rate as it is directly proportional to airflow rate. It is advisable to clean the aerators regularly and whenever the increase in pressure loss reaches 30 mbar. The pressure gauge can be a permanent or temporary installation but it has to be able to measure pressure between 0.1 - 0.8 bar to an accuracy of 1 mbar (for wastewater depth up to 6 m). Depending on the design of the aeration system, the aerators can be accessed by draining the aeration tank or lifting the aeration grid out of the aeration tank. If draining of the aeration tank takes more than one day, the minimum airflow to the system should be maintained during the draining of the aeration tank.

瑞好推荐在第一次运行时记录曝气器的压力数值以便确定清洗周期。日后在相同的气流量下记录压力损失。建议经常清洗曝气器，在压力损失超过30mbar时应清洗曝气器。通常压力表应能测量0.1~0.8bar的压力，压力敏感度也应为1mbar（污水水深6m）。根据系统设计的不同，采用排空曝气池或采用提升曝气栅格将曝气器提升至水面之上的方法对曝气器进行维护。如果排水周期超过1天，需要在排水同时保持以最小通气量供气。

The following items may be helpful in servicing the aerators during maintenance:

- High-pressure hosing equipment.
- Ladder to access the aeration tank.
- Protective gloves and clothing.
- Long-handle bristle brush for cleaning aerators.
- Special REHAU pliers and single-ear clamps (for pipe aerators).
- Spare membranes.

下面是维护曝气管时所需的物品：

- 高压水枪
- 梯子
- 防护手套和防护服
- 清洁曝气器的长柄毛刷
- 瑞好单耳卡箍钳和单耳卡箍（适用于曝气管）
- 备用膜片

#### 4.2.1 IN SITU CLEANING OF MEMBRANES 在现场清洗曝气器膜片

Depending on the wastewater characteristics and specific operating conditions of the treatment process, the frequency of cleaning the membranes will vary from plant to plant. Membranes require cleaning because of two common types of surface build-up; sludge deposit with biological fouling and inorganic scaling. The recommended cleaning methods are detailed below.

根据不同工厂处理的污水的水质和污水处理工艺的运行条件，不同处理厂有不同的清洗膜片的频率。因为微生物淤泥或无机物沉积这两种常见的物质会附着于膜的表面，所以需要清洗橡胶膜。下面是详细的清洗方法。

##### 4.2.1.1 SLUDGE DEPOSIT/BIOLOGICAL FOULING 淤泥沉积/微生物附着

The recommended cleaning procedure is to physically remove the sludge deposit/fouling by using suitable industrial high pressure hosing equipment, the pressure should not damage the aerator. The pressure required for hosing depends on the amount of sludge/fouling and how long they are left on the membrane in the open. During hosing operation, maintain airflow rate of 4 to 5 Nm<sup>3</sup>/h-m pipe aerator for the Ø64 mm pipe aerator, 5-7.5 Nm<sup>3</sup>/h-m pipe aerator for the Ø92 mm pipe aerator, 1.5-2 Nm<sup>3</sup>/h-disc aerator for DN 200 disc aerator, 2-3 Nm<sup>3</sup>/h-disc aerator for DN260 disc aerator and 3-4 Nm<sup>3</sup>/h-disc aerator for DN 300 disc aerator. The water pressure should be gradually increased to suit the actual condition. The length of time required to remove sludge deposit/fouling is dependent on the type of problem, water pressure and distance from aerator, etc. Typically, 10 to 15 seconds and 5 to 10 seconds are required per pipe aerator and disc aerator respectively.

建议使用压力适当并且可调节的工业高压水枪清除膜表面沉积物，水压不可以过大损害曝气器。所需的水压取决于沉积物量和其停留在膜片上的时间。在冲洗期间，对于ø64mm曝气管，应保持4-5 Nm<sup>3</sup>/h-m的供气量；对于ø92mm曝气管，应保持5-7.5 Nm<sup>3</sup>/h-m的供气量，对于DN200的曝气盘，应保持1.5-2 Nm<sup>3</sup>/h-aerator的供气量，对于DN260的曝气盘，应保持2-3 Nm<sup>3</sup>/h-aerator的供气量，对于DN300的曝气盘，应保持3-4 Nm<sup>3</sup>/h-aerator的供气量。在冲洗期间，视情况逐渐增大水压。冲洗持续时间取决于沉积物的性质、水压、距离曝气器的高度等，通常为每根曝气管10-15秒，每个曝气盘5-10秒。

#### 4.2.1.2 INORGANIC DEPOSITS 无机物沉积

Inorganic deposits are characterized by a granular mineral like precipitate that can form on the membrane surface as a result of process-related deposit such as calcium or ferrous deposits. If brushing of membrane surface or hosing the membrane does not remove the scaling, 85% formic acid can be used since it is sufficiently strong to dissolve most of the inorganic deposit. It is biodegradable and does not interfere with the biological process. Also, it does not damage air distribution pipes made of PVC, PP or stainless steel. Large quantities of acid combined with prolonged exposure may, however, attack galvanized air distribution pipes.

无机物沉积主要表现为钙或铁等矿物颗粒沉积在膜片的表面。如果使用毛刷或高压水枪等方法也无法清除，可以使用浓度为85%的甲酸来溶解大部分的无机物沉积。它们是可以生物降解的，不会影响生化工艺。同时，甲酸对PVC、PP和不锈钢空气分配管没有腐蚀。大量长时间接触甲酸可能腐蚀镀锌空气分配管。

As 85% formic acid is a potent and easily volatile acid, it burns the skin. Its vapour can irritate the eyes and mucous membranes and is also dangerous when inhaled. Therefore, it must always be handled in a well-ventilated space. If necessary, a respirator should be worn. To protect one-self from splashes, use protective goggles and gloves made of natural rubber. Formic acid may not be kept near an open flame or other sources of heat. Ignited formic acid can be put out with a powder or carbon dioxide extinguisher. Workers should be briefed on the safety aspects before proceeding with handling of formic acid. Safety instruction and first aid must be available at the work site.

85%的甲酸是一种易挥发的酸，它对皮肤有伤害。甲酸气体刺激眼睛和呼吸道粘膜，吸入时很危险。所以，必须在开阔的环境下进行。应该配戴呼吸面罩。为防止溅到皮肤上应该佩戴护目镜和橡胶手套。甲酸应远离火源或其他热源。扑灭燃烧甲酸可用干粉或二氧化碳灭火器。进行甲酸清洗前应该让工人知道其安全须知。现场必须具备安全须知和急救措施。

During cleaning the airflow rate should be as close to the maximum as possible so that the mixture of air and formic acid effectively penetrates through the membranes.

The recommended dispensing quantities and rates (Table 8) for various types of clogging are as follows:

清洗过程中，以最大供气量供气，才能让甲酸在空气里混合，使其有效地通过膜孔。

下面是各种不同的沉积物所需量和持续时间（表8）：

	g HCOOH/m <sup>3</sup> of air g 甲酸/m <sup>3</sup> 空气	Duration (min) 持续 时间(分钟)
Calcium deposits 钙结垢	20	5 ~ 10
Ferrous deposits 铁结垢	50	30 ~ 60

Table 8: Recommended chemical dispensing rate  
表 8: 不同的沉积物所需量

The cleaning process should be divided into several short dosing duration of about 2 minutes for each aeration grid. If each aeration grid is thoroughly cleaned at one go, air will escape via the aerators that have already been cleaned. This may cause the cleaning of the aerators in the last aeration grid not to be effective as the amount of air supplied is too low. The supply of formic acid should be carried out using a dosing pump, which regulates the flow rate.

采用短时多次冲洗，每组持续2分钟。如果采用长时一次冲洗，空气会仅通过先被疏通的膜孔。而其他膜孔因为气流量不足而不能被清洗。甲酸应该由加药泵输送以控制其用量。

Before cleaning the aerators, drain any condensed water from the air distribution pipes by opening the drain valve. Clean the nozzle on the down pipe before connecting the acid feeding hose to it with care. Ensure that air enters the acid container during the dosing of acid into the down pipe so that it does not vaporise.

在清洗曝气器之前，打开分配管的排水阀排空空气分配管中的凝结水。连接加酸软管前清洁立管接口。加酸过程中，让空气进入酸槽以防止甲酸蒸发。

4.2.2 REPLACEMENT OF STANDARD PIPE AERATOR 标准曝气管的更换

If it becomes necessary to remove standard pipe aerator from the air distribution pipe, the general procedures outlined below should be followed:

1. Shut off air supply to the particular air distribution pipe.
2. Remove pipe aerator from air distribution pipe using recommended tools such as screwdriver, ratchet wrench.
3. Replace the used EPDM/Silicone flat seal with a new set (Figure 30).
4. Re-install the pipe aerator following installation details as described in 1.2.1.

如果需从空气分配管上拆除标准型曝气管，必须遵循下列基本步骤：

1. 停止相应的空气分配管上的供气；
2. 用螺丝刀和扭力扳手拆下曝气管；
3. 更换新的EPDM/硅胶密封圈（图30）；
4. 按照1.2.1中的安装要求重新安装曝气管。



Figure 30: Replacing flat seal  
图 30: 更换密封垫

4.2.3 REPLACEMENT OF DUO PIPE AERATOR 马鞍座曝气管的更换

If it becomes necessary to remove DUO pipe aerator from the air distribution pipe, the general procedures outlined below should be followed:

- 1. Shut off air supply to the particular air distribution pipe
- 2. Release the fastener
- 3. Unfold the saddle
- 4. Replace EPDM/Silicone O-ring with a new set (Figure 31)
- 5. Reinstall the saddle following installation details as described in 1.2.3.

如果需要从空气分配管上拆除DUO曝气管，必须遵循下列基本步骤：

- 1. 关闭相应的空气分配管供气
- 2. 拆下卡扣
- 3. 折叠鞍座
- 4. 更换新的EPDM/硅胶密封圈（如图31）
- 5. 按照1.2.3中的安装要求重新安装曝气管。



Figure 31: Replacing O-ring of DUO pipe aerator  
图 31: 更换O型密封圈

4.2.4 REPLACEMENT OF PIPE AERATOR MEMBRANE 更换曝气管膜片

If inspection reveals the need to replace the rubber membrane, the following guidelines should be followed:

如果检查后认为需要更换新的管式膜片，需要遵照以下步骤：

- 1. Remove the stainless steel single-ear clamps. This is easily accomplished by bending back the small tab on the clamp with hand pliers (Figure 32). Pull the silicone membrane off the PP support pipe.

使用卡箍钳可以轻易翘起卡箍上突起的小齿从而拆下单耳不锈钢卡箍（图32），从PP支撑管上抽出橡胶膜。



Figure 32: Removing single-ear clamp from pipe aerator  
图 32: 去掉单耳卡箍



2. Clean the PP support pipe. Insert a new membrane onto the PP support pipe and align it in such a way that only non-perforated membrane section is positioned over the air outlet openings (Figure 33). To secure the membrane firmly on the PP support pipe, use only unused stainless steel single-ear clamps. The single-ear clamps must be aligned in such a way that the clamp ear is positioned exactly over the membrane groove. For standard pipe aerators the first single-ear clamp should be located between the small protrusion at the edge of the support pipe and rib on PP support pipe, next to the air outlet (Figure 33), and the second single-ear clamp about 2 to 4 mm away from the slots found at the free end of the support pipe (Figure34).

清洗PP支撑管。把新膜片套在PP支撑管上，膜的无打孔部分对准支撑管的出气口（图33）。用未用过的不锈钢单耳卡箍将膜片固定于PP支撑管上。卡箍的单耳必须正好对准膜片的凹槽。对于标准曝气管第一个卡箍装在支撑管出气开口端与支撑管突环间(图33)，第二个装在距离支撑管末端2-4mm处(图34)。

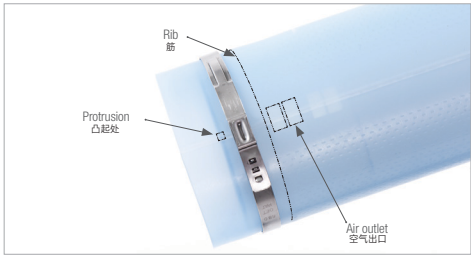


Figure 33: Positioning of one-ear clamp at standard pipe aerator's connection end  
图 33: 标准连接曝气管上的单耳卡箍位置

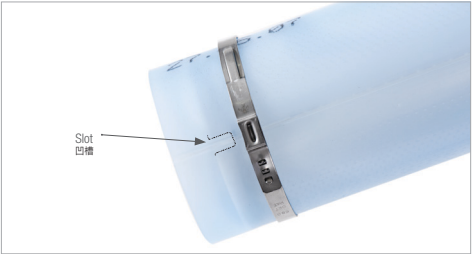


Figure 34: Positioning of single-ear clamp at standard pipe aerator's free end  
图 34: 安装在标准连接管尾端的单耳卡箍

Ensure that the clamp does not cover the slots or the perforated section of the membrane. For DUO pipe aerator where there are no slots required for installation adaptor connection, the first single-ear clamp is to be installed approximately 12mm from the free end of pipe aerator (Figure 35), and the second single-ear clamp is to be installed 1-2mm from the connecting end rib near the saddle (Figure 36).

卡箍不能装在支撑管安装槽或打孔的膜上。对于马鞍型连接曝气管，其尾端没有用于安装连接头的安装槽，尾端一侧的单耳卡箍应被安装在距离曝气管尾端边缘大约12mm处(图35)，另一个卡箍安装在距离马鞍座边缘1-2mm处（图36）。

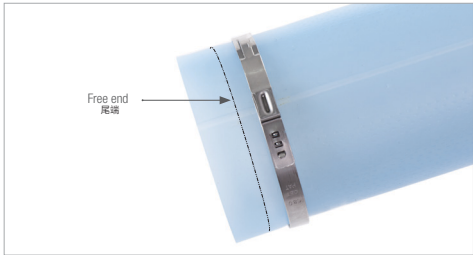


Figure 35: Positioning of single-ear clamp at DUO pipe aerator's free end  
图 35: 安装在马鞍座式连接的曝气管尾端的卡箍位置

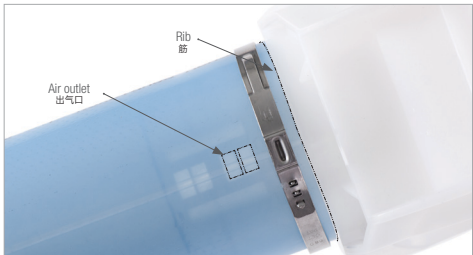


Figure 36: Positioning of single-ear clamp at DUO pipe aerator's connection end  
图 36: 在马鞍座边缘安装的单耳卡箍

3. The positioned single-ear clamp should be fully compressed using special REHAU pliers. The crimping force applied must be high enough to ensure that the clip is firmly seated and the connection is unable to leak. In the crimped state, dimension "x" must be less than 2.0 mm.(Figure 37)  
必须用瑞好专业手动卡钳夹紧卡箍。用力夹紧卡箍以保证连接处不泄漏。夹紧处 'x' 必须小于2.0mm。（图37）

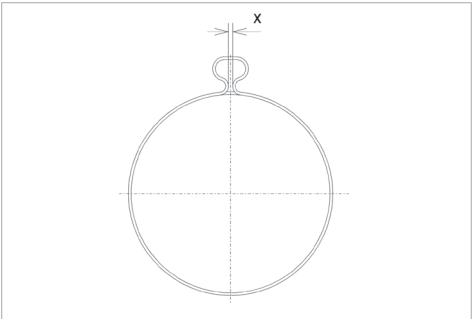


Figure 37: An installed single-ear clamp  
图 37: 夹紧的单耳卡箍

Note: The non-perforated portion of the membrane should be installed at the top/bottom of the support pipe and centred over the air outlet holes to provide check valve action.

注意: 膜片无打孔部分应该朝上/下并正对支撑管出气开口以起到止回阀作用。

4.2.5 REPLACEMENT OF DISC AERATOR 更换曝气盘

If it becomes necessary to replace disc aerator from the air distribution pipe, the general procedures outlined below should be followed:

如果需要从空气分配管上更换曝气盘，必须遵循下列基本步骤：

- 1. Shut off air supply to the particular air distribution grid.  
关闭相应的空气分配管组供气。
- 2. Remove the existing disc aerator by turning it anti- clockwise.  
通过逆时针旋转来拆下现有曝气盘。
- 3. Re-install the new disc aerator by placing it on the grommet or disc saddle and turning it in the clockwise direction. See 1.3 for more details.  
把新的曝气盘重新安装原位（具体详见 1.3）。

4.2.6 REPLACEMENT OF DISC SADDLE 更换曝气盘马鞍座

If it becomes necessary to remove disc saddle from the air distribution pipe, the general procedures outlined below should be followed

如果需要从空气分配管上拆除马鞍座，必须遵循下列基本程序:

- 1. Shut off air supply to the particular air distribution grid.  
关闭相应的空气分配管组供气。
- 2. Remove the disc aerator. 拆除曝气盘。
- 3. For disc saddle, release fastener by pulling top section of the fastener away from the saddle. For disc wedge saddle, remove wedges and unhook saddle.  
对于卡扣型马鞍座，打开马鞍座上卡扣。对于卡钩型马鞍座，取掉插片并打开卡钩。
- 4. Remove saddle. 取下马鞍座。
- 5. Re-install new saddle and disc aerator following installation details as described in 1.3.  
重新安装马鞍座和曝气盘，参考1.3中安装描述。

4.2.7 REPLACEMENT OF DISC GROMMET 更换曝气盘双承接头

If it becomes necessary to remove grommet from the air distribution pipe, the general procedures outlined below should be followed

如果需要从空气分配管上拆除双承接头，必须遵循下列基本程序:

- 1. Shut off air supply to the particular air distribution grid.  
关闭相应的空气分配管组供气。
- 2. Remove the disc aerator. 拆除曝气盘。
- 3. Pull out the grommet and clean the hole opening.  
拔出双承接头，清理开孔处。
- 4. Re-install new grommet and disc aerator following installation details as described in 1.3.  
重新安装新的双承接头和曝气盘，参考1.3中安装描述。

Note: O-rings, Flat seals and grommet must not be reused. New seals and O-rings should replace old ones once aerator is removed from the air distribution pipe.

注意：所有的O型圈以及EPDM垫圈以及双承接头均不可重复使用！在曝气器更换过程中，旧的密封圈和O型圈应被更换。

When properly operated and maintained, the RAUBIOXON PLUS and RAUBIOFLEX aerator systems will provide years of high efficiency treatment with minimum attention from the operator. Questions regarding RAUBIOXON and RAUBIOFLEX aerator systems operation, maintenance, etc. should be forwarded to your local REHAU sales office.

在合理的操作和维护保养状态下，RAUBIOXON PLUS和RAUBIOFLEX曝气器系统无需额外的养护就能提供数年高效运行。关于RAUBIOXON PLUS和RAUBIOFLEX曝气器系统运行、维护等相关技术信息，请联系当地的瑞好销售办公室。

## 5. AFTER SALES SERVICE STATEMENT 售后服务说明

Please read this statement carefully to ensure the correct and effective way of use and maintenance of our products. This statement is legally binding and all terms and conditions in it apply to you, unless otherwise specific statement in the contract.

请仔细阅读售后服务说明，确保正确、有效地使用和维护产品。本说明具有法律约束力，除非合同另有书面约定，本说明中的全部条款和条件均对您适用。

Aerator warranty period (for pipe/disc aerator):

- For municipal wastewater the warranty period is 24 months after the aerators are put into operation or 27 months after delivery (whichever occurs earlier);

- For industrial wastewater the warranty period is 12 months after the aerators are put into operation or 15 months after delivery (whichever occurs earlier);

曝气器（特指曝气管/曝气盘）质保期为：

- 城市生活污水处理厂曝气器质保期为设备投入运行后24个月或发货后的27个月（以先到日期为准）；

- 工业废水处理项目曝气器质保期为设备投入运行后12个月或发货后的15个月（以先到日期为准）。

Aeration installation system warranty period: 12 months after the clean water trial or 15 months after delivery (whichever occurs earlier)

曝气系统单元安装工程质保期为：曝气系统安装清水调试验收后的12个月或发货后的15个月（以先到日期为准）。

Requirement of response to customer in warranty period: Rehau technical service team should make response to customer as soon as possible after receiving maintenance notice in writing by user or customer. Rehau technical engineer should provide technical support on site after time appointments between two sides, the relative installation condition must be well prepared on site. The user or customer must make preparations as follows, including but not limited to: lifting, cleaning, power supply, water supply, air supply, ladders, ventilation etc.

质保期内售后响应约定：接到用户或客户书面维修通知，瑞好售后服务团队及时给予响应，在现场具备相关条件及双方协商约定的时间内指派技术工程师至现场提供支持，现场具备相关条件包括但不限于用户或客户提供起吊、清池、供电、供水、供气、爬梯、通风等条件。

Troubleshooting in warranty period:

- In the warranty period, Rehau provide repairing or replacement of aerators or parts for user or customer if aerators quality problems occur.

- In the warranty period, if quality problems of Rehau aeration installation system occur, Rehau provides installation repairing work, and user or customer provides relative tools or preparations for repairing, including but not limited: lifting, cleaning, power supply, water supply, air supply, ladders, ventilation etc.

质保期内故障处理约定：

- 在质保期内如因瑞好曝气器产品质量问题，瑞好提供曝气器或部件材料用于用户或客户维修或者更换；

- 在质保期内如瑞好曝气系统安装工程出现质量问题，瑞好负责提供安装工程的维修，用户或客户负责提供方便维修的条件，包括但不限于用户或客户提供起吊、清池、供电、供水、供气、爬梯、通风等条件。

Service exceeds the warranty period, For any aeration products problems or installation problems Rehau will provide paid technical services.

质保期后服务约定：超过质保期之后如曝气器或者安装工程出现任何问题，瑞好提供合理的有偿技术服务。

Aerator is consumable product and should be carried out in accordance with product installation guide during installation, commissioning, operation, maintenance and using. Users should read carefully the product technical information, installation guide, after sales service statement or consult Rehau technical engineers to avoid improper storage, improper installation or improper using products, improper maintenance or using in not applicable conditions\* etc., these problems are not in warranty\*\*.

曝气器属于周期性消耗产品，在安装、调试、操作、维护和使用时应遵循产品安装手册进行。用户在使用瑞好曝气器前应仔细阅读产品技术手册、产品安装手册、售后服务说明，或咨询瑞好技术工程师，避免出现不当存储、不当安装或使用曝气器、维护不当或不充分、在产品不适用的条件下使用等情况，由此造成的产品问题不在保修范围之内\*\*。

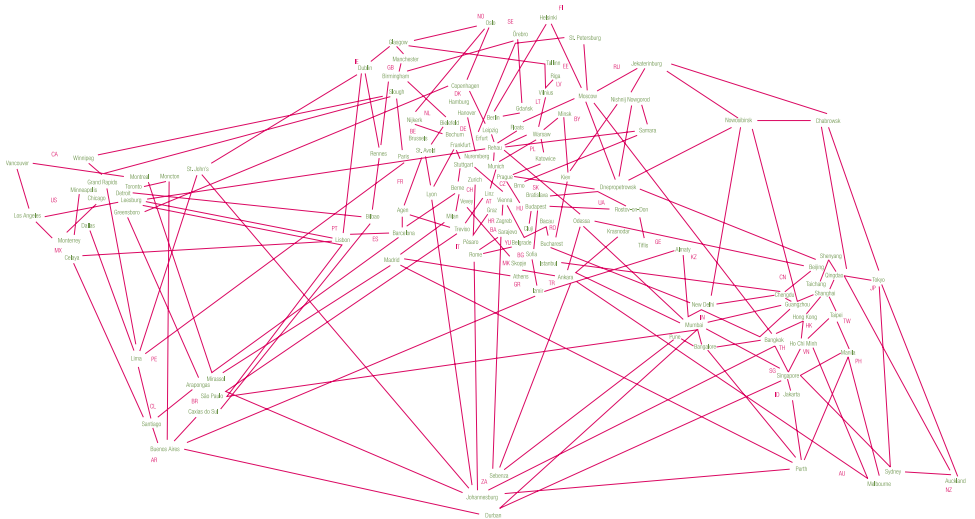
\*The suitability of the product shall be determined by the user or the contractor under the experience or actual application, and the manufacturer may provide corresponding support and reference information.

产品的适用性应由用户或承包商根据经验或实际应用条件下进行检测确定，制造商可提供相应支持和参考信息。

\*\*Neither party shall be liable to the other under this Order for any indirect, special, or consequential damages or lost profits hereunder. Seller shall be only responsible for direct damages due to aerators/aeration installation system capped at the Total Net Value amount of this Order.

根据此订单任何一方均不对其他人承担任何间接，特殊或者后续的损失或利益损失。卖方仅对本订单总净值金额的曝气器产品/曝气系统安装工程的直接损失负责。





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本安装手册所提供的语言、文字、资料、数据、图标等信息仅供参考使用。手册的技术咨询是基于我们的经验和良知，并不保证手册信息的准确性和完整性。读者将随时补充、更正和修订手册中的有关信息，但不保证及时发布。瑞好对于未遵循手册相应的工作环境、条件或其他说明的使用导致的任何直接的或者间接的损失不承担任何责任。手册使用者在使用本手册前应当仔细阅读本手册的版权与免责声明，应当使瑞好产品是否适用于所拟定的使用目的；对瑞好产品的应用或加工已超越本手册范畴，手册使用者应当自行承担责任。如果必须考虑责任问题，则任何赔偿将仅限于我们所提供的并且其所使用的商品之价值。任何有关瑞好产品的质量担保，应依据瑞好供货与付款条件处理（附随合同或订单，也可向瑞好人员索取）。

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