Checklist – diffuser selection

OTT GROUP

Since 1986 we have been working with operators, planners and plant owners from the public and industrial wastewater treatment sector. Our products are installed in more than 10,000 wastewater treatment plants around the world. Our experience shows us that there is no standard solution that fits every wastewater aeration situation.

However, if you want long lasting, trouble-free and efficient operation, there are parameters to consider when selecting piping and diffuser materials:

O_2 Sufficient oxygen supply

Achieving the oxygen transfer necessary to sustain the process is the core task of a diffuser system. The amount of oxygen introduced into the wastewater depends on tank geometry, water depth, characteristics and quality of the wastewater, and the diffuser system design/capacity. It is often not sufficient to rely on performance values supplied in catalogues when calculating the oxygen transfer capacity of a diffuser system.
We recommend that our customers always request project-specific system performance reports from the manufacturers and have them checked in oxygen transfer tests.

Mixing of the tanks

The goal of modern diffuser design layouts is usually to maximize oxygen transfer efficiency so that the required oxygen transfer is achieved with as little air as possible. However, when efficiency requirements are so high, insufficient diffused air volume can result in an inability of the system to induce proper mixing within the tank. If the mixing energy from the delivered air volume is not high enough, the sludge can fall out of suspension, resulting in sludge deposition.

Therefore, we recommend to take the energy required for mixing into account along with the operating efficiency of a diffuser system. Because regardless of whether the wastewater is mixed by means of air or agitators, energy is always required. Strategically, one must decide whether it makes sense to install an agitator or to introduce a little more air at the expense of efficiency to ensure sufficient mixing energy in the system is maintained.

Temperature resistance

Depending on tank depth, air volume and ambient temperature, the air temperature at the inlet to the down pipe can be up to 140▯ C (285▯ F). The air along cools down in the submerged section of pipe, resulting in different elements being exposed to different temperatures along the diffuser system.
Blower manufacturers can accurately calculate the air temperature at the blower outlet based on the air volume, system pressure and outside temperature.

The following calculation serves as a rule of thumb:

Ambient temperature + system pressure in mbar/10 + 15°C process heat of the blower = air temperature

at the blower outlet
Example:
Outside temperature = 30°C,
system pressure = 690 mbar
→ 30°C + 69°C (690 mbar/10) + 15°C = 114°C

When selecting distribution piping and membranes, one should always consider the temperature resistance of the selected materials and to have their suitability confirmed by the manufacturers for the actual air temperatures they will be exposed to.

UV resistance

The diffuser system is exposed to UV radiation during installation, maintenance work in the tank, and when a tank is temporarily taken out of operation. Depending on the exposure duration and the UV stability of the materials, UV radiation can negatively impact the mechanical properties of the exposed components.
When planning projects in hot regions with high UV exposure, we recommend that the UV resistance is carefully considered with the equipment manufacturer.

Adjustability

In our experience, the operation of a biological wastewater treatment plant is very rarely a static process. Fluctuating wastewater volumes, rainfall and process-related events mean that the oxygen demand varies. When calculating the size of a diffuser system, we think it is equally important that consideration is given to low load conditions along with conditions having a significantly higher wastewater load. Only then can the diffuser systems be properly designed to provide reliable and trouble-free operation during these operating conditions.
We recommend to always have oxygen transfer requirements to satisfy different biological load cases simulated by the suppliers. In this way, one can ensure that sufficient oxygen can be introduced for high load conditions and that no „starvation“ of mixing and aeration activity takes place in low load conditions, causing the sludge to settle on the bottom of the tank.

Deposits on the membranes

Oxygen transfer from diffusers to wastewater membranes is largely determined by the nature and condition of the membrane. Any biological or mineral substances depositing on the membrane surface can cause clogging and fouling of the membranes. As this occurs, the bubble pattern and performance change accordingly. To guarantee long lasting operation and low maintenance of the diffuser system, it is crucial that the membranes are as resistant as possible to such deposits. If it is important that the system performance remains close to the level of new membranes over periods exceeding three years, we recommend requesting evidence of long term performance experience from expert opinions, references, and scientific reports.

Maintenance

The performance of a diffuser system is determined by the quality of the membranes. Deposits on the membranes and hardening of the material are the most common reasons for performance deterioration during operation. Deposits can be removed quite well by cleaning the membranes. Hardened membranes lose their elastomeric properties and must be replaced.
Cleaning and replacement of membranes are both time consuming and expensive. Therefore, when selecting the membranes, pay particular attention to the long term experience in operation and maintenance requirements. Ask for references. Also consider that membrane materials containing plasticizers to obtain their elastomeric properties (such as EPDM and PU) will lose their shape and age harden over time, thus limiting their useful life.