1. Mixing and equalization basin
Mixing and equalization basins are generally used to balance waste water peaks (amount of waste water, BOD or CSB concentration, pH). The retention time of the waste water in a mixing/aeration basin should be 4 or 5 times the max. sewage per hour (daily equalization). The volume load is 1 kg BOD/m$^3$/d or lower.

Aeration avoids the rotting of waste water and the production of unpleasant smells. Moreover, it avoids the formation of build-ups at the basin bottom. A side effect achieved by aeration is a partial waste water biodegradation, with a degradation rate between 20 and 40%. This reduces the BOD load of the waste water, which is treated subsequently by the municipal waste water treatment plant; therefore, in general, no extra pollution fee is charged with the waste water fee bill.

Depending on basin size, aeration is provided by one or more FRINGS immersible aerators. Calculation of the necessary oxygen transfer rate is based on an OC load of 1 kgO$_2$/kg BOD or lower. During operation, an oxygen content of 0.5 mg/l is sufficient. A special kind of bacteria is “produced” which uses a large amount of organic substances for producing cell substance. The formation of activated sludge flakes is avoided; this means that no extra activated sludge is produced.
Dimensioning example of a mixing and equalization basin

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of waste water</td>
<td>400 m³/d (max. 40 m³/h)</td>
</tr>
<tr>
<td>BOD concentration</td>
<td>1.500 mg/l</td>
</tr>
<tr>
<td>BOD load</td>
<td>600 kg/d</td>
</tr>
<tr>
<td>basin volume - selected</td>
<td>200 m³</td>
</tr>
<tr>
<td>basin dimension - selected</td>
<td>Ø = 8 m, WT = 4 m</td>
</tr>
<tr>
<td>Volume load</td>
<td>600 / 200</td>
</tr>
<tr>
<td>OC load - selected</td>
<td>3 kgBOD/m³ x d</td>
</tr>
<tr>
<td>oxygen transfer rate - necessary</td>
<td>600 / 1,0</td>
</tr>
<tr>
<td></td>
<td>600 kgO₂/d</td>
</tr>
<tr>
<td></td>
<td>25 kgO₂/h (24h)</td>
</tr>
</tbody>
</table>

Aerator selection

1. **FRINGS Immersible Aerator 1200 TA**
   - Oxygen transfer rate max. 26.8 kg/h
   - power consumption max. 26.8 kW

2. **Single-Basin Plant (SBR plant)**
   A single-basin plant is used for further, partially biological waste water treatment, e.g. to relieve overloaded municipal plants for subsequent wastewater treatment, or to keep the waste water fee low.

   Both functions of a waste water treatment plant – sludge activation and secondary sedimentation – are combined in one basin. About two thirds of the basin volume are used as a waste water collection space, the remaining third is used as sludge deposit (incl. a safety zone of about 0.5 m height).

   The waste water / sludge mix is normally aerated over a period of 20 hours. Then, aeration is switched off by a time control for a period of four hours. The activated sludge contained in the waste water deposits sediments at the basin bottom. After one hour’s sedimentation time, an electric slide valve opens the drain, and the cleaned waste water drains off over a period of about 3 hours. Normally, the waste water drains off at night (e.g. between 1 and 4 am), as the municipal waste water treatment plant is not very busy at that time. A floating outlet is used to make sure that no sludge is drained off with the water.

   Depending on basin size, one or more immersible aerators are used. Calculation of the necessary oxygen transfer rate is based on an OC load of 1 kg BOD/m³ x d or higher. During operation, an oxygen content of 0.5 – 1 mg/l is sufficient. Full bio matter with activated sludge flakes is produced. The degradation rate is 80% and more. Excessive sludge accumulations must be removed from time to time by means of a separate drain-off pipe or by using a suction vehicle to remove the sludge directly from the basin. This sludge is stabilized and can be used e.g. in agriculture.
**Dimensioning of a single-basin plant**

Amount of waste water 400 m³/d  
BOD concentration 1.500 mg/l  
BOD load \(400 \times 1.500 \div 1.000\) 600 kg/d  
basin volume - selected \(\frac{2}{3} = \text{waste water space} = 400 \text{ m}^3\) \(+\frac{1}{3} = \text{sludge space} = 200 \text{ m}^3\) 600 m³  
basin dimension - selected \(\phi = 13 \text{ m}, \text{max. WT} = 4.5 \text{ m}\)  
Volume load \(600 \div 600\) 1 kgBOD/m³ x d  
OC load - selected \(1.5 \text{ kgO}_2 / \text{kg BOD}\)  
ox oxygen transfer rate - necessary \(600 \times 1.5\) 900 kgO₂/d 45 kgO₂/h (20h)

**Aerator selection**

1 FRINGS Immersible Aerator 2400 TA  
- Oxygen transfer rate max. 61.5 kg/h  
- power consumption max. 61.0 kW
3. **System advantages**

Compared to other aeration systems, FRINGS immersible aerators have a number of important advantages. The investment costs are only between 60 and 80% of the costs for comparable systems. The oxygen transfer rate adapts to the requirements of each water depth, i.e. a lower water depth causes a lower oxygen transfer rate. The same applies to power intake. Surface aerators have to float on the water surface, due to fluctuations in the water level. Therefore, they have a constant immersion depth, a constant oxygen transfer rate and constant power intake. By using a pole-changing motor, a switch between two different performance steps is possible; however, self-regulation cannot be achieved. The same applies to pressure aeration: In general only two blowers are installed, e.g. one for 50% one for 100% performance.