Submerged Mechanical Aerator/Agitator

AQUARATOR

Ministry of Construction (Current Ministry of Land, Infrastructure, Transport and Tourism)
Technology Assessment (Assessment No. 81102)
The Most Advanced Aerator and Agitator in the World
Hanshin Aquarator

The Hanshin Aquarator is the original aerator and agitator and it is also
the pinnacle of the technology.

Since the invention of the world’s first, energy conserving
aerating/agitating equipment in 1975, Hanshin has continued to provide
technological innovations to pioneer a new future for people and water.
The Hanshin Aquarator is the embodiment of these ideas and technology
at their highest levels.

AQUARATOR.
Proven deliveries of 10,000 units to 1000 processing locations.

The Aquarator has advanced the benchmark value of aerator/agitator equipment in Japan through its use in numerous locations.
Ideas that don’t change with time, technological advancements that are ahead of their times.
The true ideals of aerator/agitator equipment can be seen in the Hanshin Aquarator.

*Proven deliveries to sewage treatment plants, night soil treatment plants, and rural community sewage treatment facilities (as of March, 2010)*
The highest standards and performance in the industry

By separating the power sources for the aerating and agitating functions, the Aquarator can easily conform to any changes in load, eliminate wasteful energy consumption and has made possible drastic reductions in water processing costs.

**Aeration over long distances and wide areas with an oblique flow discharge**

By lowering the discharge angle, the discharge is now an oblique flow discharge. Thanks to this, the microbubble compound liquid can be carried further, the water flow circulation is increased, and has made possible aerating in even the deepest sections of water.

**Increased discharge strength through petal-shaped segmentation**

By segmenting the water discharge route into petal shapes, discharge strength has been significantly increased.

**Bottom inflow increases the time air bubbles are contained within the tank**

The natural flow of air and water dramatically increases power efficiency. In addition, by generating bottom inflow strength, water is sucked into the bottom of the tank without separation and surfacing of the air bubbles, and forces entrainment with the water flow. Through this, the time the air bubbles are contained within the tank is increased.

**Realization of extremely high energy efficiency**

By separating the power sources for the functions of supplying air and aeration/agitation to create rational submerged equipment, energy efficiency is drastically increased by being able to arbitrarily control both functions at the same time, or each function separately.

**Easy maintenance**

Due to its simple design, maintenance can be performed on-site. This also dramatically decreases the time required for maintenance. In addition, because the Aquarator is simply placed along a guide pipe, water draining is not required when installing or removing the Aquarator.

**Accommodates various processing methods**

By separating power controls, the Aquarator can act as a submerged agitator for both aerobic and anaerobic agitation, as well as accommodating various processing methods such as aerobic and anaerobic activated sludge process. Reliable solid-liquid separation in the final sedimentation tank can be performed.

**No clogging**

Age related deterioration is eliminated by using HANSHIN ENGINEERING's proprietary Air Dispersing Rotor with an air miniaturization mechanism that doesn't clog. This provides stable functioning over a long service life.

**Freedom from clogging**

Age related deterioration of performance is eliminated through an air miniaturization mechanism that doesn't clog.

**High air miniaturization through proprietary technology**

The volume of water passing through the body has been increased, and the diffusion strength of the air bubbles has been strengthened by centrifugal force. At the same time, the contact area of the air bubbles has been increased through air bubble miniaturization.

*Agitation functions have been improved through design changes.*
A submerged aerobic and anaerobic aerator/agitator that accommodates numerous processing methods

The Aquarator can flexibly accommodate numerous processing methods. Freely choose installation methods depending on the provided environment. The Aquarator can change shape according to the shape of the tanks and consistently provides the highest level of performance.

Overall configuration

Transitioning from traditional aeration equipment

The Aquarator can flexibly accommodate different tank shapes and operational methods for reliable processing. The Aquarator, which is for both anaerobic and aerobic use can not only act as aeration equipment, but its capabilities also fully shine as an agitator as well. The Aquarator can solve various problems such as low levels of DO (Dissolved Oxygen) in the tanks as well as reduced functionality due to accumulation of sediment and clogging.

Transition from Surface Aerators

Accurately and reliably supplies oxygen to efficiently aerate the tank and improve tank DO levels.

Since aeration is performed in the water, there is no need to worry about water spray, noise or foul smells.

Uniform agitation within the tank as well as the surface is possible. There is also no accumulation of sediment.

The Aquarator also has no problems with deep tanks that surface aerators find difficulty with.

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Transition from Diffuser Pipes, Diffuser Tubes, and Diffusion Plates

Reliable aeration and agitation with the Aquarator

High power aeration and agitation even at the bottom of the tank so that there is no accumulation of sediment

Turbulent flows are generated by the strong outlet flow from the Aquarator. Larger amounts of oxygen can be dissolved since the air bubbles last longer.

Clogging does not occur because of stoppage of aeration in intermittent processes or when the volume of air decreases.
High rigidity that supports unsurpassed aeration/agitation functions and a body that produces superior water flow

**Custom developed air miniaturization mechanism, the “Air Dispersing Rotor”**

**Exterior engineering drawing**

**An extensive lineup to accommodate various environments**

**Exterior measurements**

<table>
<thead>
<tr>
<th>Model</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>E (mm)</th>
<th>F (mm)</th>
<th>G (mm)</th>
<th>H (mm)</th>
<th>I (mm)</th>
<th>J (mm)</th>
<th>Specified weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-15</td>
<td>800</td>
<td>1,123</td>
<td>1,259</td>
<td>1,099</td>
<td>500</td>
<td>600</td>
<td>160</td>
<td>970</td>
<td>910</td>
<td>1,200</td>
<td>50A 295</td>
</tr>
<tr>
<td>F-22</td>
<td>800</td>
<td>1,184</td>
<td>1,259</td>
<td>1,099</td>
<td>500</td>
<td>600</td>
<td>160</td>
<td>980</td>
<td>910</td>
<td>1,200</td>
<td>65A 310</td>
</tr>
<tr>
<td>F-37</td>
<td>1,000</td>
<td>1,340</td>
<td>1,430</td>
<td>1,220</td>
<td>640</td>
<td>760</td>
<td>210</td>
<td>1,230</td>
<td>1,150</td>
<td>1,500</td>
<td>80A 460</td>
</tr>
<tr>
<td>F-55</td>
<td>1,220</td>
<td>1,490</td>
<td>1,617</td>
<td>1,362</td>
<td>780</td>
<td>920</td>
<td>255</td>
<td>1,470</td>
<td>1,370</td>
<td>1,750</td>
<td>100A 690</td>
</tr>
<tr>
<td>F-75</td>
<td>1,420</td>
<td>1,762</td>
<td>1,865</td>
<td>1,565</td>
<td>910</td>
<td>1,080</td>
<td>300</td>
<td>1,750</td>
<td>1,630</td>
<td>2,050</td>
<td>125A 1,100</td>
</tr>
<tr>
<td>F-110</td>
<td>1,720</td>
<td>1,916</td>
<td>2,040</td>
<td>1,680</td>
<td>1,110</td>
<td>1,310</td>
<td>360</td>
<td>2,070</td>
<td>1,920</td>
<td>2,350</td>
<td>150A 1,650</td>
</tr>
<tr>
<td>F-150</td>
<td>2,000</td>
<td>2,125</td>
<td>2,430</td>
<td>2,005</td>
<td>1,290</td>
<td>1,530</td>
<td>425</td>
<td>2,400</td>
<td>2,250</td>
<td>2,750</td>
<td>150A 2,450</td>
</tr>
<tr>
<td>F-220</td>
<td>2,380</td>
<td>2,550</td>
<td>2,670</td>
<td>2,155</td>
<td>1,560</td>
<td>1,840</td>
<td>515</td>
<td>2,910</td>
<td>2,710</td>
<td>3,250</td>
<td>200A 3,300</td>
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<td>F-300</td>
<td>2,600</td>
<td>2,850</td>
<td>2,980</td>
<td>2,380</td>
<td>1,810</td>
<td>2,110</td>
<td>600</td>
<td>3,400</td>
<td>3,150</td>
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| Rating and Performance | | | | | | | | | | | |
|------------------------| | | | | | | | | | | |
| Power (kW) | Voltage (V) | Frequency (Hz) | Water volume (m³/min) | Air flow volume (m³/min) | Oxygen transfer rate (L/H) |
| 1.5          | 220  | 50 | 200 | 50 | 6.5       |
| 2.2          | 240  | 60 | 220 | 60 | 9.3       |
| 3.7          | 240  | 60 | 220 | 60 | 16.1      |
| 5.5          | 380  | 60 | 240 | 60 | 24        |
| 7.5          | 380  | 60 | 240 | 60 | 33        |
| 11           | 420  | 60 | 380 | 60 | 49        |
| 15           | 420  | 60 | 380 | 60 | 49        |
| 22           | 420  | 60 | 380 | 60 | 97        |
| 30           | 420  | 60 | 380 | 60 | 132       |

*Please note that dimensions, weights, specifications and exterior design are subject to change without notification.

*The dissolved oxygen transfer rates are for when the reference installation water depth is 5.0m.

*Please consult HANSHIN ENGINEERING for specifications other than those above.
Unparalleled standard performance, realizing stable aeration performance

When selecting a model, the number of units and air flow volume, both the agitation and the oxygen supply capacities within the tank needs to be satisfied. In regards to oxygen supply capability, the design requirements for Actual Oxygen Requirement (AOR) of the compound liquid within the tank is calculated at 20°C and adjusted for freshwater condition values. The Standard Oxygen Transfer Rate (SOTR), required by the submerged aeration/agitation equipment, is then determined and an appropriate model with the appropriate air flow volume is selected from the capability chart.

Regarding agitation capability

Agitation capability refers to the water flow generation capability required to sustain the mixed suspension of activated sludge. The required power output for each tank is calculated and the smallest appropriate model is selected.

Case A

\[ V = L \times W \times H \text{ (m}^3\text{)} \]

<table>
<thead>
<tr>
<th>L/W</th>
<th>Design standard value ( \text{RE} ) 1</th>
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<tbody>
<tr>
<td>1.5 and under</td>
<td>0.002</td>
</tr>
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<td>2 and under</td>
<td>0.003</td>
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Required power output \( P \geq \frac{O}{V} \times V (\text{kW}) \)

*1 Design standard values are for sewerage/reaction tanks.
*2 Deep tanks are those with draft tube specifications.

Example 1 Standard tank

Model: F-22 Aquatorator (2.2kW)
Tank size: 9m (length) \times 9m (width) \times 6m (depth) (\text{P}_{\text{O}_{2}}=4.5W/\text{m}^3)

Example 2 Deep tank

Model: F-37 Aquatorator (3.7kW)
Tank size: 9m (length) \times 9m (width) \times 10m (depth) (\text{P}_{\text{O}_{2}}=4.6W/\text{m}^3)

Oxygen transfer capability chart

The following charts illustrate oxygen transfer rates during commercial operation (freshwater 20°C, MLDO=0mg/L).

*When selecting air flow volume, please do so while including some leeway as oxygen transfer rates can fluctuate approximately 15% depending on water temperature, tank shape/size and inflowing water substrates.

*The standard installation water depth is based on the distance from the water surface to unmoving parts of the equipment (bottom of lower casing).

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For an excellent water environment

**Regular maintenance and repair**

Due to its simple design, maintenance can be performed on-site and time required for maintenance can also be drastically reduced. Because the Aquarator is basically placed along a guide pipe, there is no need for water drainage when installing or removing the Aquarator. Appropriate maintenance cycles vary slightly depending on usage conditions. Please refer to the chart below and use them as a guide to perform maintenance according the cycle, ahead of schedule if possible. Please note that pulling up the Aquarator from the tank approximately once a year and performing a visual inspection is highly effective in preventing malfunctions and maintaining its lifespan.

<table>
<thead>
<tr>
<th>Part to be replaced</th>
<th>Recommended replacement cycle</th>
<th>Pertinent part to be replaced</th>
<th>Submerged drive mechanism schematics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water seal cassette (for output shaft)</td>
<td>Every 3 years</td>
<td>1st time 2nd time 3rd time 4th time</td>
<td>1 Water seal cassette (for output shaft)</td>
</tr>
<tr>
<td>Oil seal cassette (for motor shaft)</td>
<td></td>
<td></td>
<td>2 Oil seal cassette (for motor shaft)</td>
</tr>
<tr>
<td>Bearings for motor shaft</td>
<td></td>
<td></td>
<td>3 Motor shaft bearings</td>
</tr>
<tr>
<td>O-ring for joints</td>
<td></td>
<td></td>
<td>4 Lubrication gear oil</td>
</tr>
<tr>
<td>Lubrication gear oil</td>
<td></td>
<td></td>
<td>5 Gears inside gear reducer</td>
</tr>
<tr>
<td>Gears inside gear reducer</td>
<td>Every 6-9 years</td>
<td></td>
<td>6 Bearings inside gear reducer</td>
</tr>
<tr>
<td>Bearings inside gear reducer</td>
<td></td>
<td></td>
<td>7 Cabine cable</td>
</tr>
<tr>
<td>Cabine cable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submerged motor</td>
<td>Depends on condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submerged gear reducer</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Please consult HANSHIN ENGINEERING regarding regular maintenance and repair when using the Aquarator intermittently.

**Cases of Aquarator application**

Aquarator is suitable for all kinds of applications.