Water/ Wastewater Treatment Applications

Centrifugal Products

Water & Wastewater Treatment Solutions
Centrifugal Products
Water/ Wastewater Treatment Applications

Filter Back Wash
- Air Scour

Post Aeration

Digester Gas Extraction

Aeration Basin

Digester Aeration

Grit Removal

Dave Laurenson : GD Asia Pacific : February 2009
Gardner Denver Multi-Stage Centrifugal Blowers.

- The biggest range
- Un-matched experience
- From a global leader in the field
Gardner Denver® multi-stage centrifugals are the proven global standard for water and wastewater treatment applications requiring continuous low-noise operation with minimal maintenance requirements.

With several thousand installations worldwide, the Gardner Denver brand combines the Hoffman and Lamson heritage, each with nearly 100 years of quality innovation and experience.
• **Typical Applications**

  – Wastewater Aeration - 70%
    * Aeration Basins
    * Aerobic Digester
    * Post Aeration

  – Filter Backwash (Air Scour) - 15%
  – Digester Gas (Exhauster / Booster) - 10%
  – Grit Chamber Aeration - 5%
The biggest range of multi-stage centrifugal blowers.

Flow up to 68,000 m$^3$/hr

Pressure up to 1.4 barG
Small fabricated blowers with cast heads.

Multi stage

Normally all impellers same for simplicity.
Large blowers

“All cast” construction

Multi stage

Mixed impellers for optimum efficiency and performance
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AIR

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**Water/ Wastewater Treatment Applications**

**Centrifugal Products**

**MULTIPLE BAFFLE RINGS**
Many models feature our patented Multiple Baffle Rings (MBR™) which help turn airflow smoothly into the eye of the impeller, dramatically reducing inlet passage losses. MBR combined with the two-dimensional impeller design increases blower efficiency and pressure/vacuum capability.

**BALANCE PISTON**
A balance piston is located at the outlet end of the rotating impeller assembly to compensate for the axial force of the impellers on the inlet bearing. This greatly increases bearing life for longer, trouble-free operation.

**MULTISTAGE SHROUDED IMPELLERS**
Two-dimensional shrouded cast aluminum impellers are balanced individually and keyed onto the shaft. The complete assembly is then balanced to achieve smooth operation with lowest vibration levels in the industry. Rotor assemblies are designed to operate well below first critical speeds for added reliability.
FLEXIBLE COUPLING
Blowers/exhausters connect directly to the power source with a precision aligned flexible coupling. This optimizes power transfer and minimizes bearing loads for longer life.

CAST HOUSING
Blower housings are precision machined from high-grade cast iron. Smaller models are cast aluminium. The intermediate blower sections are assembled together using high strength steel tie rods. The blower and its driver are mounted together on a single steel baseplate. This assures long lasting performance and durability.

LABYRINTH SEAL
Non-contact, non-wearing labyrinth air seals are standard. This no-maintenance seal is used in most air and some gas applications (purge option available).

CARBON RING SEAL
For special air and gas applications requiring superior sealing, optional carbon ring seals are available with purge option.
Baffle rings direct the air flow from the section into the eye of the next impeller. The baffle rings minimize flow separation and increase efficiency.
Baffle rings assembled into casing section.
Labyrinth shaft seals.
Standard for Air applications

Carbon ring shaft seals.
Standard for Gas and option for Air applications
IMPELLERS

FABRICATED

CAST
Different impeller types are selected to give the optimum performance and efficiency for the application.

Impeller vane curve & angle can be selected.

Number of vanes can be altered to prevent resonance.
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![Diagram showing pressure and volume for centrifugal pumps with backward and radial curves for different impellers A, B, and C.]

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Impellers are individually balanced then assembled onto the shaft and balanced as a complete rotating assembly.
Typical Major System Components

1. Inlet Filter
2. Expansion Joint
3. Butterfly Valve
4. Coupling Guard
5. Check Valve
6. Vent Silencer
7. Modulating Surge Valve
8. Isolation Butterfly Valve
Capacity Control

Adjusting the suction side butterfly valve (3) will throttle the inlet and vary the flow through the blower.

If the control system detects onset of surge then the surge valve (7) is slowly opened to increase the flow through the blower.
Throttling the inlet causes the flow and power to reduce. Excessive throttling or increase in system resistance can cause surge.
Alternative method of flow control

As an alternative to inlet throttling, the blower flow can be adjusted with the use of a variable speed drive.

This method allows a second major advantage which is the ability to gain 60 Hz performance with a 50 Hz supply without the use of gearboxes etc.

Although big VSD’s can be expensive, when this cost is offset against increased blower output and the fact that the VSD effectively replaces the motor starter the extra cost of the VSD is not so high.

Modern VSD’s also incorporate PLC type functions so some or all of the blower control can be by the PLC.

Correct blower selection is essential.
VFD offers an annual 14% savings in energy usage versus inlet throttling in example shown based on weighted average of specified conditions.
### Power Consumption (kW) VFD vs. Inlet Throttling

<table>
<thead>
<tr>
<th>Inlet Air Temperature</th>
<th>100°F</th>
<th>65°F</th>
<th>30°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Seasonal Fluctuations</td>
<td>20%</td>
<td>60%</td>
<td>20%</td>
</tr>
<tr>
<td>6,000 SCFM (12.5%)*</td>
<td>245</td>
<td>238</td>
<td>246</td>
</tr>
<tr>
<td>5,000 SCFM (12.5%)*</td>
<td>217</td>
<td>185</td>
<td>188</td>
</tr>
<tr>
<td>4,000 SCFM (25.0%)*</td>
<td>163</td>
<td>162</td>
<td>161</td>
</tr>
<tr>
<td>3,000 SCFM (25.0%)*</td>
<td>135</td>
<td>135</td>
<td>140</td>
</tr>
<tr>
<td>2,000 SCFM (12.5%)*</td>
<td>82</td>
<td>82</td>
<td>84</td>
</tr>
<tr>
<td>1,000 SCFM (12.5%)*</td>
<td>53</td>
<td>53</td>
<td>56</td>
</tr>
</tbody>
</table>

* Typical flow demand fluctuations

#### Assumptions
- 3 x 2000 SCFM blowers @ 8 PSIG
- 3% Loss for VFD
- 5% Loss for motor
• VFD offers an annual 14% savings in energy usage versus inlet throttling in example shown based on weighted average of specified conditions.

• Blowers must be properly selected so performance curve is optimal for VFD. Otherwise savings will not be achieved.

• Blowers must be properly controlled and sequenced to maximize energy use.
WHAT IS SURGE?

Surge is a condition where pressure builds up in the discharge to the point where reverse flow happens.

Motor amps fluctuate rapidly from no load to design load.

The reverse flow is a pulsing condition and this pulsation causes rapid variation in end thrust which tends to cause impeller to casing contact and serious damage.

Surge is normally very noisy and is difficult to miss.

Surge MUST be detected and avoided and control systems have been developed which do this very effectively.

Increasing the flow through the blower by opening a valve on the discharge side is one simple and reliable method.
If onset of surge is detected by the control system the surge valve is modulated open to increase flow through the blower and prevent surge from developing.
Controls

A range of GD control systems are available.

The most comprehensive is Multigard II
PROTECTION FEATURES MAY INCLUDE:

- Blower Surge for constant speed applications or VFD applications
- Blower Surge compensated for varying inlet temperature
- Motor Overload
- Blower Bearing Temperature
- Blower Bearing Vibration
- Motor Bearing Temperature
- Motor Winding Temperature
- Motor Bearing Vibration
- Failed vibration sensor or RTD indication
CONTROL FUNCTIONS MAY INCLUDE:

- Start and stop of blower
- Blower inlet and/or blowoff valve control (discrete or 4-20 mA modulating) for individual blower
- Pressure control of individual blower
- Dissolved oxygen

MultiGard™ II Multi-Variable Digital Monitor
Gardner Denver's new MultiGard™ II is a pre-certified, programmable logic controller (PLC) capable of monitoring various operating conditions for single or multiple blower applications. The number of blower flue that can be monitored by a single MultiGard II is dependent on the number and type of sensors/inputs.

PROTECTION FEATURES MAY INCLUDE:
- Blower Surge for constant-speed applications or PID applications
- Blower Sream concentrated for various wind/turbulence
- Motor Overload
- Blower Bearing Temperature
- Blower Bearing Condition
- Motor Bearing Temperature
- Motor Bearing Condition
- Motor extended sensor or HOOnicative

CONTROL FUNCTIONS MAY INCLUDE:
- Start and stop of blower
- Blower inlet and/or blowoff valve control (discrete or 4-20 mA)
- Pressure control of individual blower
- Dissolved oxygen

COMMUNICATIONS:
- Industry Standard
  - Modbus RTU
  - Modbus TCP
Regional References

Christchurch WWTW
3 Sets 67104 250 kW
Variable speed drive
Installed 2000 / 2001

Tasman Pulp and Paper in Kawerau, North Island have 2 sets of 450 kW model 67106 installed in 1998.

The application is Waste Water Treatment.
Werribee WWTP

Melbourne
3 sets gear drive
2403 (24 inch, 3 stage)
Wazi WWTP
Perth
5 sets variable speed drive
2006 (20 inch, 6 stage)
Over **150 units** have been sold in Australia

Most to Municipal and Industrial WWT and some to Ore Flotation in mining.
• **What information do we need?**

1. Volume flow requirement in Nm³/hr or Scfm  
   Or  
   Mass flow

2. Absolute discharge pressure

3. Inlet conditions  
   Ambient temperature and pressure (altitude)  
   Relative humidity

4. Process application details (more is better)
GD software selection tools help our experienced engineers to select the right blowers for your application.

Normally at least 3 or more selections are available for initial evaluation.

We then look at price and efficiency before making a detailed proposal including recommended accessories.
Water and Wastewater treatment solutions from a global leader in the field.

Gardner Denver Centrifugal Blowers
WE THANK YOU FOR YOUR TIME !!