SELECTING THE RIGHT BLOWER TECHNOLOGY
Available Blower Technology

- Positive Displacement
  - Two lobe or Three lobe
  - Rotary Lobe Compressor
Available Blower Technology

- Centrifugal
  - Multi-stage
  - Single stage with gear
  - Single stage high speed turbo
    - Magnetic Bearing
    - Air Foil Bearing

- Multi-stage
- Single stage high speed turbo
  - Integral gear single stage
  - High Speed Turbo

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Positive Displacement Blowers - Aerzen Generation 5 Packages
Pulsations and piping noise

Conventional blowers generate piping noise & destructive pulsations

Pressurized air in discharge is about to return into blower housing

Atmospheric pressure (light blue)

System pressure (dark blue)

Abrupt pressure equilization causes sound wave and shock
Wave created by squeezed volume meets discharge wave at 180°.

Returning air pressurizes this chamber.

Wave created by squeezed volume meets discharge wave at 180°.

the wave of reduced amplitude is then DEPHASED by the incoming ‘squeeze’ pulsation. The result is 95% - 97% pulsation cancellation!
Packaging Innovation

Compact I from 1960’s
Packaging Innovation
Positive Displacement Blower

- Constant volume against varying pressure
- Flow changes by varying speed with VFD
- High Turndown (Typically 4:1)
- Easily adapts to changes in pressure & temperature
- Lowest initial cost
AERZEN GM 60S DELTA PACKAGE, PRESSURE
INLET FLOW

Performance data based on air @ 68 deg F/14.7 psia inlet.

See temperature chart on second sheet for allowable operating range.

Performance data based on complete package
July 1999
Delta Hybrid Concept

- High Efficiency of a Compressor
  - Comparable Efficiency to Turbo
- Packaging Principles and Economy of Aerzen Generation 5 Blower Package
- High Turndown (4:1)
- Proportional Control (Standard VFD)
- Capital Cost:
  - 10% > PD
  - 20-40% < Turbo
Compressor Design Principles

- Positive Displacement Compressor (VML)
  - Used since the 1940’s (Deep Cell Aeration)
  - Rotors mesh, compressing air inside housing
  - Flow changes by varying speed (VFD)
  - Design for up to 50 psig
  - Higher capital cost (2X PD blower)
Delta Hybrid Advantages

- More Efficient than Aerzen 3 Lobe Blowers
  - 5% - 25% Energy Reduction

- Two rotor profiles:
  - L: Isochoric compression (supercharger)
  - S: Screw compressor profile (3+4)
  - Why: Proper Profile Required for Optimal Performance
Hybrid Rotor Profiles

- L Series (Patented)
- 3 + 3 Twisted Rotors
- Range: 3-8 PSIG

- S and H Series
- 3 + 4 Screw Rotor
- Pressure Range:
  - S: 7-15 PSIG
  - H: 16-22 PSIG
Hybrid Machine Ranges

- 250 to 5,000 CFM
- 25 to 400 HP

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<th>max. psi</th>
<th>Volume flow max. m³/h</th>
<th>max. cfm</th>
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Delta Hybrid Innovations

- Non-Wearing Shaft Seals
- Fluidic Inlet Port
- Large Oil Cooling Surfaces (Patent)
- Timing Gears on Cool Side
Delta Hybrid Innovations

- Labyrinth Drive Shaft Seal
- Helical Gears (Hydraulic Fit)
- Piston-Ring Seals at Rotor
- Bearing Cartridge 50% Longer L-10 Bearing Life (Patented)
Delta Hybrid Packaging

- Spring Loaded PRV
- Base with Oil Pan
- Non-Absorptive Discharge Silencer
- Easy Access to Filter
- Startup Unloading Valve
- Springless Integral Check Valve
- Hinge Plate Motor Mounting
- Automatic Belt Tensioning
- Easy Belt Change
- Quietest Package (76 dBA)
- Side by Side Installation
- Oil Change from Front
- Check Oil While Running
- Integral Enclosure Fan

Blowers ■ Compressors ■ Vacuum Pumps

aerzenusa.com
Single Stage Oil Free High Speed Turbo Blower
From KTurbo to Aerzen

- State of the Art Components
  - Permanent Magnet Motor
  - Air Foil Bearing
  - Stainless Steel Impeller
  - CPU Controlled Inverter
  - Advanced Protection & Control
State of the Art Components
Air Foil Bearing

1. Top Foil
   - TEFLON-S
   - 20,000 On/Off Cycles

2. Bump Spring
   - 10-30 Year Life
   - Advanced technology (4th Generation)
Impeller Design

- Jet Engine Technology
- 17-4 PH Stainless
- Strength and Efficiency
- High Rise to Surge
Performance Map

VOLUMETRIC FLOW [cfm]

TB100-0.8S

GUAGE PRESSURE [mmAq x 1000]

VOLUMETRIC FLOW [m³/min]

speed ratio = 1.0

Constant Current Control (Aerzen)

Constant Pressure Line

Constant Speed Control (Others)

temperature: 20 °C
density: 1.20 kg/m³
Idling/Scrolling Function

- Bypass Valve Opens
- RPM Drops to ~10,000
  - Sufficient to maintain “loft” on Bearings
  - Minimal Power Draw (Avg 2%: 2 – 5 kW)
- Avoids Bearing Wear
- Avoids Start/Stop Cycles
- Useful in SBR/MBR Systems
Which Technology to Choose?
Proper Evaluation

- Will Life Cycle Costs be Evaluated?
  - Not always
    - Filter Air Scour (limited duty)
    - Smaller Sizes (Low HP)
    - Low Electrical Costs

- Capital Costs may be the deciding factor
  - Standard PD Blowers
Proper Evaluation

- If Life Cycle Costs Will be Evaluated
  - Conduct a Fair, Representative Evaluation (Aerzen Whitepaper)
    - Use Expected Operating Points
    - Not Design Point Only
  - Include ALL Package Losses
  - Compare with PD Blower, Turbo Blowers, Screw Compressors, & Hybrid Rotary Lobe Compressors
Life Cycle Costs

- Energy Costs are the Most Significant Factor in Aeration Blower Evaluation.
  - 60% of WWTP energy use is for Aeration
  - 80% - 90% of Life Cycle Cost is Energy
Performance Comparison

Specific Power Comparison Delta Hybrid D62S, GM 60S, and K-Turbo TB100-1.0
(Inlet T1=68F, P1=14.5 PSIA, RH=0%) P2=11.6 PSIG

Flow SCFM

SCFM/BHP

D 62S
GM 60S
K-Turbo TB100-1.0

11.6%
3%
6%
20.7%
25.8%
23.2%
19.1%
Performance Comparison

Specific Power Comparison: Delta Hybrid D62S and TB100-1.0S
(Inlet T1=100F, P1=14.09 PSIA, RH=80%) P2=12 PSIG

Flow SCFM

SCFM/PSHP

Design Point

TB100-1.0S Max
Turndown 800 SCFM

Hybrid Max
Turndown 509 SCFM
Proper Evaluation

- Aeration System Characteristics
  1. Varying Water Depth (SBR/Digester)
  2. On/Off Cycling
  3. Higher Pressures
  4. Turndown Requirements
Generation 5 Blowers

• Efficient 3 Lobe Blower
• Quiet Package (70-75 dBA)
• Easy Installation & Maintenance
• Side by Side, Indoor Outdoor

Optimal Uses:

• Capital Cost Primary Factor
• Low Electrical Costs
• Intermittent Use
• Large Turndown Requirement
Delta Hybrid

- Same Packaging as Generation 5
- Superior Efficiency to Standard PD
- Similar Efficiency to Turbo
- Excellent Turndown (4:1)

Optimal Uses:
- Life Cycle Cost Primary Factor
- Flows <3,000 SCFM
- Varying Pressures
- Higher Pressures
- Large Turndown Requirement
Turbo

- High Volume in a Compact Package
- Quiet Package, Easy Installation
- High Efficiency
- Complete Package (VFD, Control Panel)

Optimal Uses:
- Life Cycle Cost Primary Factor
- High Volumes at Low Pressure
- Flows >1,000 SCFM
- Limited Turndown Requirement (2:1)
- Relatively Stable Pressures
Multiple Technologies

EFFICIENCY %

VOLUME FLOW – CFM

OPERATING RANGE

HYBRID

TURBO
Multiple Technologies

**Turbo plus Hybrid**
Inlet: 90 F, 90% RH, 800 fasl ... Discharge: 9 psig

- 2:1 turndown
- 6:1 turndown
- 4:1 turndown

AERZEN
One step ahead.

Blowers ▶ Compressors ▶ Vacuum Pumps

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Thank You