

CDM

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High Speed Blower Technology

- ♦ Air Bearings
 - Journal and Thrust Bearing
 - Single or Twin Impellers
 - Originally developed in 1960s for airplane ventilation systems
 - Operate 20,000 to over 40,000 rpm
 - Efficiency increases with increasing speed
- Magnetic Bearings
 - Journal Bearings and Touch Down Bearing











			scfm		Installations	
Company	Bearings	Impeller	(6.5 psi)	Max HP	US(9/1/09)	Total (Feb 09)
Nueros	Air	Single	7700	300	86	400
HSI	Air	Twin	8000	300	3	250
Turblex	Air	Single	7700	300	0	0
Kturbo	Air	Twin	8100	300	5	945

Advantages of Direct Drive, Air-Foil Blowers

- Energy savings
- ♦ Higher surge margin
- No lubrication requirements
- Minimum scheduled maintenance
- ♦ Easy to install
 - 25% reduction in building footprint
- ♦ Compact
- Light weight
- ♦ Quiet





State of the Industry

- Different forms of procurement
- Highly competitive pricing
- Evaluated bids based on power consumption
- No standard ASME test
- Existing lines expanding and changing



WRPB WWTF – Franklin, New Hampshire

- Winnipesaukee River Basin Program
 - State-owned and operated
 - 10 community regional facility
 - Located in lakes region of New Hampshire
- Secondary Treatment Facility
 - Placed into operation 1979
 - 11.5 mgd design flow; 6.6 mgd current flow

WRPD Aeration History

- Original plant
 - 5-Cord PD each rated @ 3200 cfm
 - Coarse bubble diffusers
- Blowers replaced with 5-Roots PD 824 RCS in early 1990s
 - 124 HP, 2650 cfm, 8.0 psi, 2250 rpm
- Fine bubble diffusers installed in mid 1990s
 - Two of the Roots blowers removed
- Automatic DO control installed in 2000
 - Original motors and DC drives replaced
 - New motors and VFDs
 - Vibration issues prohibited auto DO control
 - Significant constraints on blower operation
 - Plant running inefficiently with high DOs @ low demand, insufficient DO @ high demands

Multi-phased Capital Improvement Program

- Focus
 - Sustainable design with long-term sustainability
 - Appropriate incorporation of green technologies
 - Governor mandated reduction of energy consumption by 10% in state facilities
 - Energy consumption at all new construction 20% less than state energy code
- CDM retained in June 2008
- Initial focus: Aeration system
 - Accounts for 36% of total electrical consumption @ plant

60 Day Neuros Pilot at Franklin NH

- Unit supplied by APG-Neuros Inc., Quebec Canada Neuros Co., Inc
- Started operation in Franklin Sept 25, 2008
- Operating evaluation through November 2008

Goals

- Validate claims made by direct drive manufacturers
- Increase blower reliability
- Simplify operation
- Significant reduction in energy consumption



Demonstration Blower Characteristics

Manufacturer	APG-Neuros Inc
Model	NX150-C070
Speed (max)	21,870 rpm
Motor	150 HP Permanent Magnet
Discharge Pressure	8.5 psi (impeller) 10.7 psi (machine)
Impeller	Single, Forged Aluminum (Axial + Centrifugal)
Air Flow Range	1,175 – 2,600 scfm
Bearing Type	Bump Air Foil, Oil less
Dimensions	30 in wide x 68 in length x 53 in high
Weight	1,675 lbs





















Comparison of Demonstration & Existing Blowers

- All comparisons of power draw and air flow rates based on data from plant Scada system
- Values of power draw using scfm/kw ratio truncated at airflow rates of 1,500 scfm
 - Values with airflow rates < 1,500 discarded
 - Inclusion of correct values less than this would likely further increase the power consumption difference in favor of the demonstration unit.
 - Scfm/kw values for the existing Roots units was constantly decreasing with decreasing airflow rates



Efficiency Comparison Demonstration to Existing Blowers

- Air flow rates approaching max capacity of existing units:
 - Demonstration unit 20% more efficient
- Air flow rates at lower limits of existing capacity
 - Demonstration unit 30% more efficient
- Average air demand @ WRBP WWTF = 2,600 scfm
 - Efficiency of the demonstration unit at 2,600 scfm 32% less than average power consumption of existing blowers

Blower Noise

- Measurements at approx 3 ft from blower enclosure.
- Operating at 1360-1390 cfm, 18400 rpm, 6.6 psi discharge
- ♦ 69-75 dBA
- Startup (20 seconds)
 - ◆ 95-100 dBA
- Shutdown (4 seconds)
 - ◆ 90-95 dBA
- Shutdown and startup through relief discharge directly to room

Conclusions from Demonstration

- Direct drive unit consumed 32% less power than existing PDs (direct wire to water)
- Automatic DO control & optimized unit sizing will reduce power consumption to 49-54% less than existing PDs
- Unit efficiency constant over full operating range
- Very quiet operation (69 to 75 dBA with no silencers)
- Small space requirement
- Equipment pad and anchor bolts optional
- Vibration free from speeds approaching surge to full speed of 21,870 rpm
- Installation is "plug &play"