Understanding Current Blower Technology and Isentropic Efficiency in Blowers

5 tips on assessing your current blower system

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Welcome

Types of Blowers

Choices, Choices, Choices

- How do you choose between the different types of blowers available?
- Each has advantages and disadvantages
- Each can be effective when properly applied

Common Blower Technologies

Dynamic

- Multi-Stage
- Turbo

Positive Displacement

- Rotary Lobe
- Rotary Screw

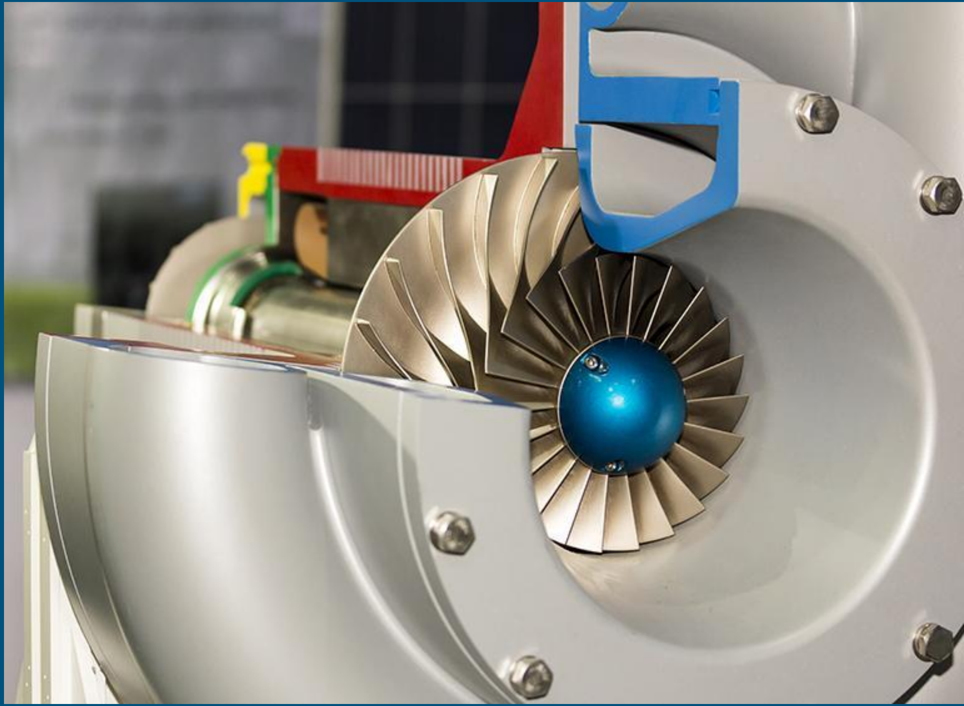
Simplified Technology Comparison

Dynamic

Positive Displacement

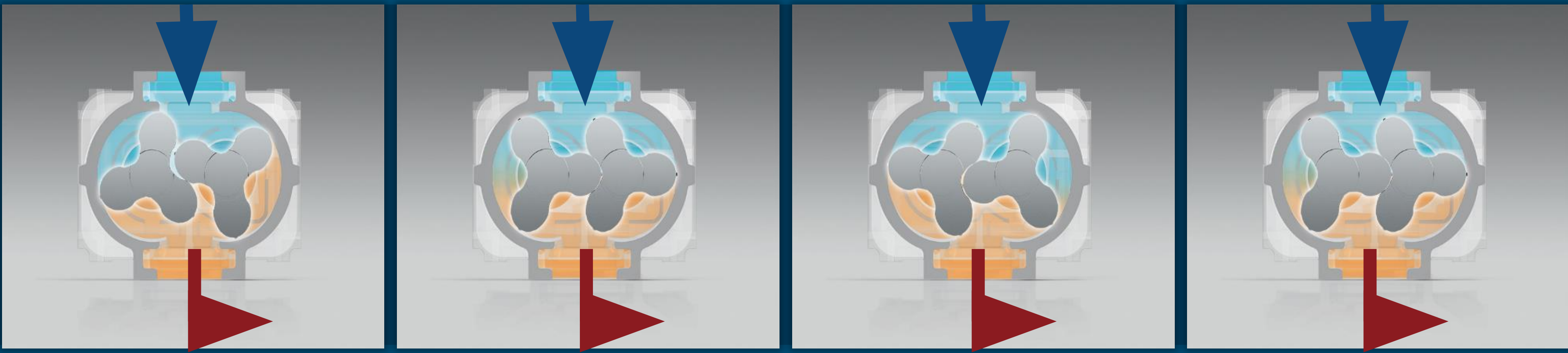
Dynamic Compression : Multistage/Turbo

- Kinetic Energy: Uses the impeller tip speed to generate velocity which is converted into pressure via a diffuser
- Core: Can be a single stage, multi stage, or direct coupled high-speed machine
- Throttling: Flow variations achieved by throttling the air flow with variable valve control or VFD.
- Adaptive: Only produces the amount of pressure needed, but you must be mindful of surge



Rotary Lobe Blowers: External Pressurization

- Isochoric Compression: Pressure doesn’t build until air is pushed into the process line
- No Back Pressure: If process line is free of resistance (no water in the basin)
- Adaptive: Only produces the amount of pressure needed



Rotary Screw Blowers: Internal Pressurization

- Internal Compression: Pressure builds within the air chamber between the inlet and outlet ports
- Air Volume and Pressure: The geometry of rotors and housing of each airend determines the pressure ratio and volume displacement
- Over Compression: Occurs when the internal compression exceeds the required system pressure. Excess work/power consumption

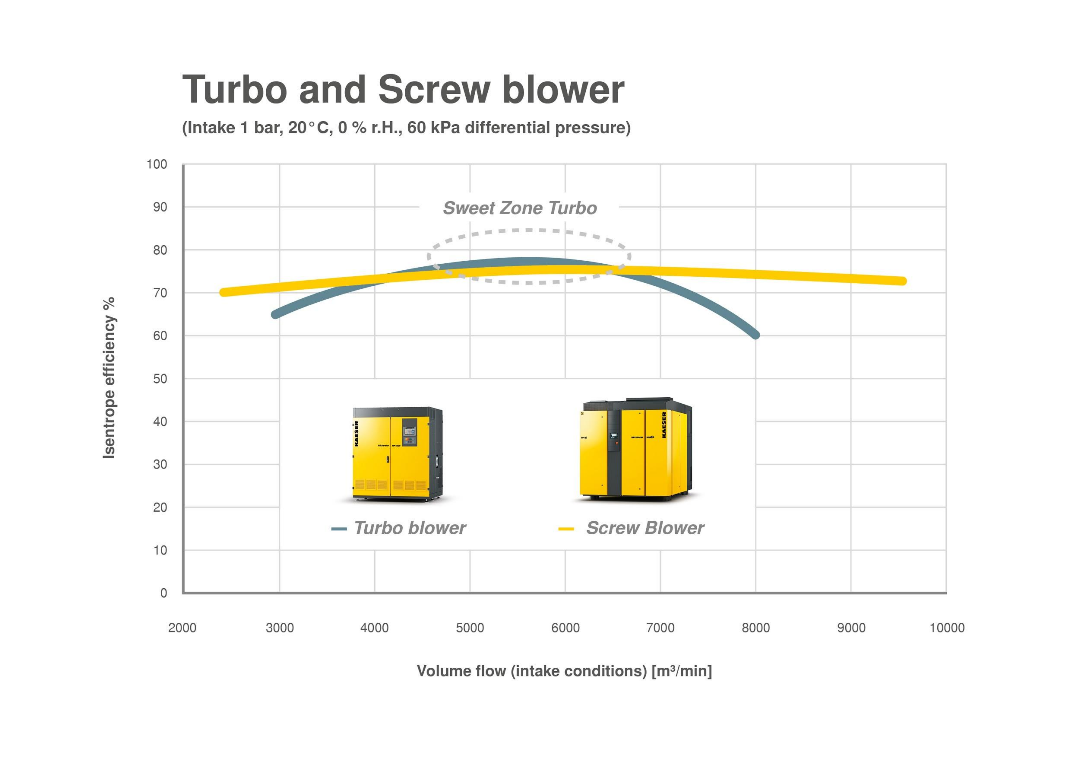
Performance Curves

Screw

- Wide control range
- Flat efficiency curve
- Traditional maintenance

Turbo

- Most efficient at optimal operating point
- Low maintenance
- Costly repairs



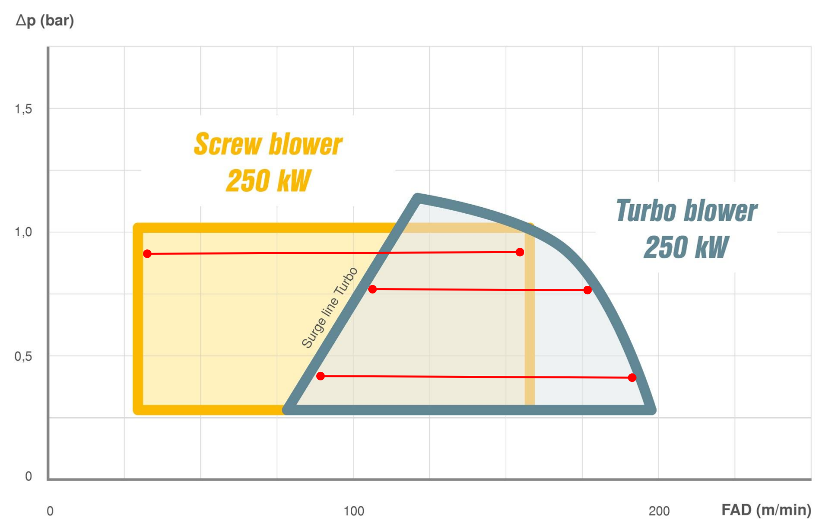
Control Range

Screw

- Wide and consistent control range

Turbo

- Control range largely dependant of pressure



Factors that Impact Efficiency and Life Cycle Cost

- Electrical consumption: package input kW?
- Power costs: $/kWh?
- Comparable performance metrics: specific power (kW/100 cfm)?
- Time: load hours?

Making the Right Choice

- Know your application
- Consider investment cost, operating cost, and service cost
- The most efficient machine is not always the right choice
- While it may be more efficient, the payback might take decades

Measuring Blower Performance:

Isentropic Efficiency

What is Isentropic Efficiency

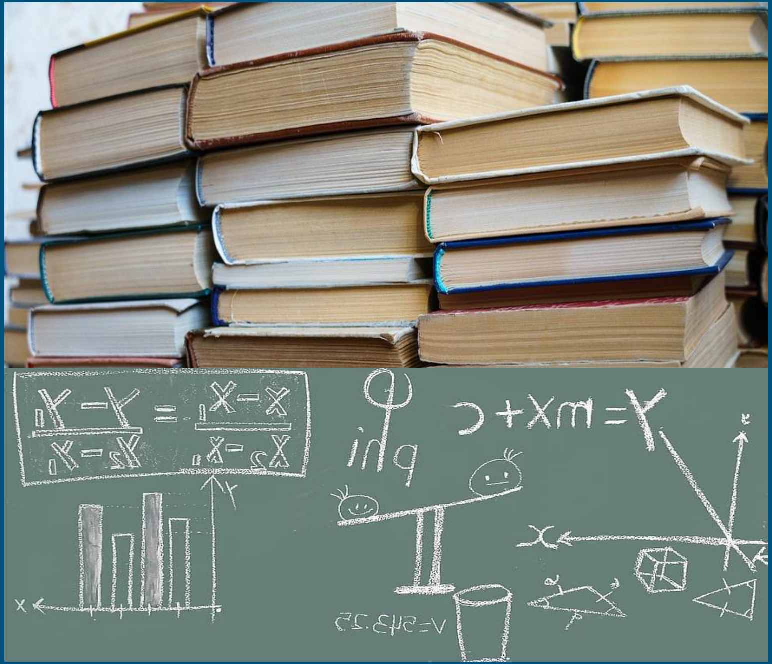
- A comparison of real power to theoretical power
- Theoretical is a thermodynamic model
- Real power is measured
  - Blower
  - Motor
  - Silencers
  - Filters
  - Drive losses (VFD, belts, gears)
  - Auxiliaries (fans, pumps, other)

$$efficiency = \frac{theoretical\ power}{actual\ power}$$

How to Determine Isentropic Efficiency

Several standards used to calculate blower work

- Dynamic
  - PTC 10
  - ISO 5389
- Positive Displacement
  - ISO 1217 (Annex B (blower), Annex C (package), Annex E (VFD package)
- Combined
  - BL300
  - PTC13
  - ISO (in development)

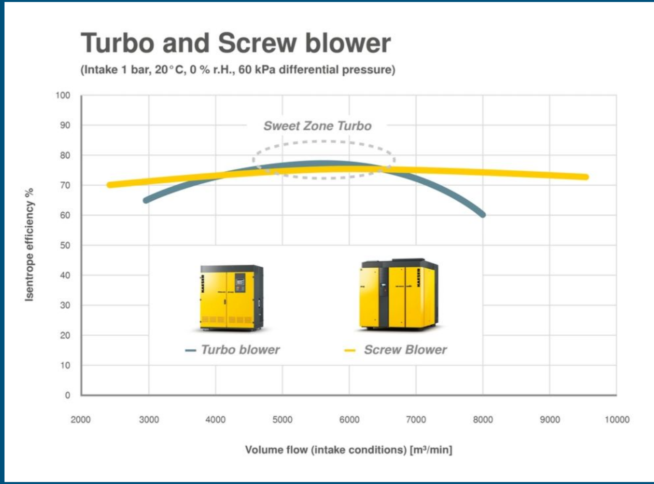


How to Determine Isentropic Efficiency

- These standards utilize project conditions to determine theoretical power requirements
- Actual power consumption will be higher
  - Motor efficiency
  - Drive losses
  - Flow losses
  - Ancillary devices
- Comparison of theoretical to real is your efficiency

$$efficiency = \frac{theoretical\ power}{actual\ power}$$

How to Use Isentropic Efficiency



- Easy reference to compare machines and technologies
- Be careful not to compare peak vs peak...focus on actual usage points
- Efficiency gains will be reflected in a reduction in power cost

5 Tips for Assessing Your System

1 Consider newer technologies

- Newer technologies, such as rotary screw blowers, deliver more air per horsepower - saving on electric power

100 hp Lobe Blower

=

75 hp Screw Blower

2 Estimate your potential savings

- Screw & turbo blowers can provide 20-30% reduction in overall power consumption
- Integrated blower technologies cost between $1,000-$1,500 per hp

Example:

Power Bill:	$100,000 per year
Savings:	$20,000-$30,000
Existing Lobe	
Blower Equipment:	(1+1) 100 hp
New Screw Blower:	(1+1) 75 hp
Capital Cost:	$150,000 - $225,000
ROI:	5 - 11.25 years

3 Refine your estimates

- Locate the original design criteria and engineering specs
- Assess current operations
  - Were the original estimates realized?
- Consider an Air Demand Analysis
- Check for potential equipment incentives

4 Call a contractor

- Installation can be the largest portion of an upgrade
- Contractors often know the hidden costs
- Discuss the project goals
- Take advantage of the full potential of the selected technology
- Refine your design with installation cost in mind

5 Get it on the schedule!

- Notify the town management or engineering firm
- Prioritize the upgrade
- Seek out complementary expertise with the NRWA
- Do not wait!

1. Consider newer technologies
2. Estimate your potential savings
3. Refine your estimates
4. Call a contractor
5. Get it on the schedule!

There is the potential to save money, if you know what you are doing

Thank You!

For more information,
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