Alternative Strategies for Air Compressor and Blower Room Design

Tom Jenkins, P.E.
WEF Fellow
Keynote Speaker

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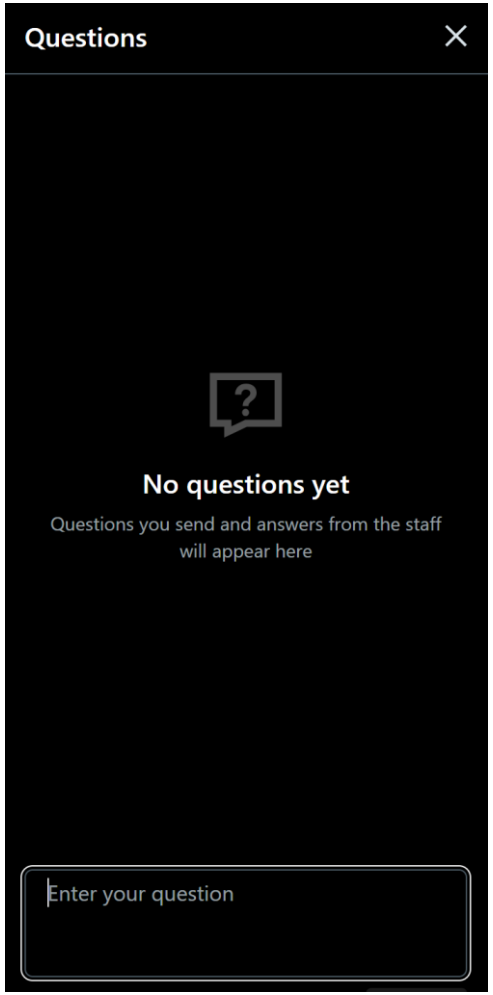
Q&A Format



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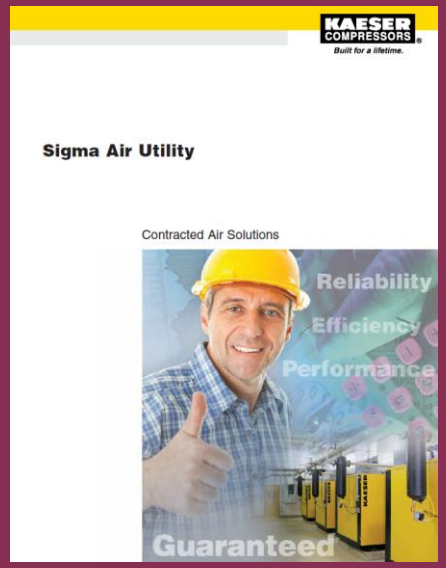

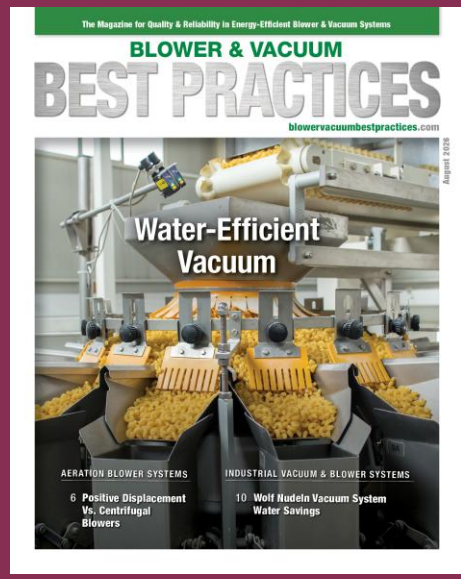

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Disclaimer

All materials presented are educational. Each system is unique and must be evaluated on its own merits.

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Tuesday, October 13, 2026|11:15 AM – 12:15 PM **Indianapolis, IN (Indiana Convention Center)**

Key Takeaways

- Align plant utility operations with zero-carbon and energy targets
- Apply practical engineering solutions for compressed air and process cooling systems
- Execute large-scale utility and efficiency capital projects effectively
- Gain real-world insights from technical experts managing plant utility upgrades

Featured Panelists

Mustafa Wahid
Roche Diagnostics

Jose Luis Sarmiento Escalante
John Deere

Brad Runda
Runda Energy Consulting

Jim Nonnenmann
PRVN Consultants

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Alternative Strategies for Air Compressor and Blower Room Design

Introduction by

Compressed Air Best Practices® Magazine

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About the Speaker

Tom Jenkins, P.E.
WEF Fellow

- Over 40 years of experience with aeration blowers and blower controls
- Chairman of ASME PTC 13 committee
- WEF Fellow

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Topics

- General Arrangement
- Heat Dissipation
- Foundations and Cranes
- Noise
- Piping
- Electrical Systems

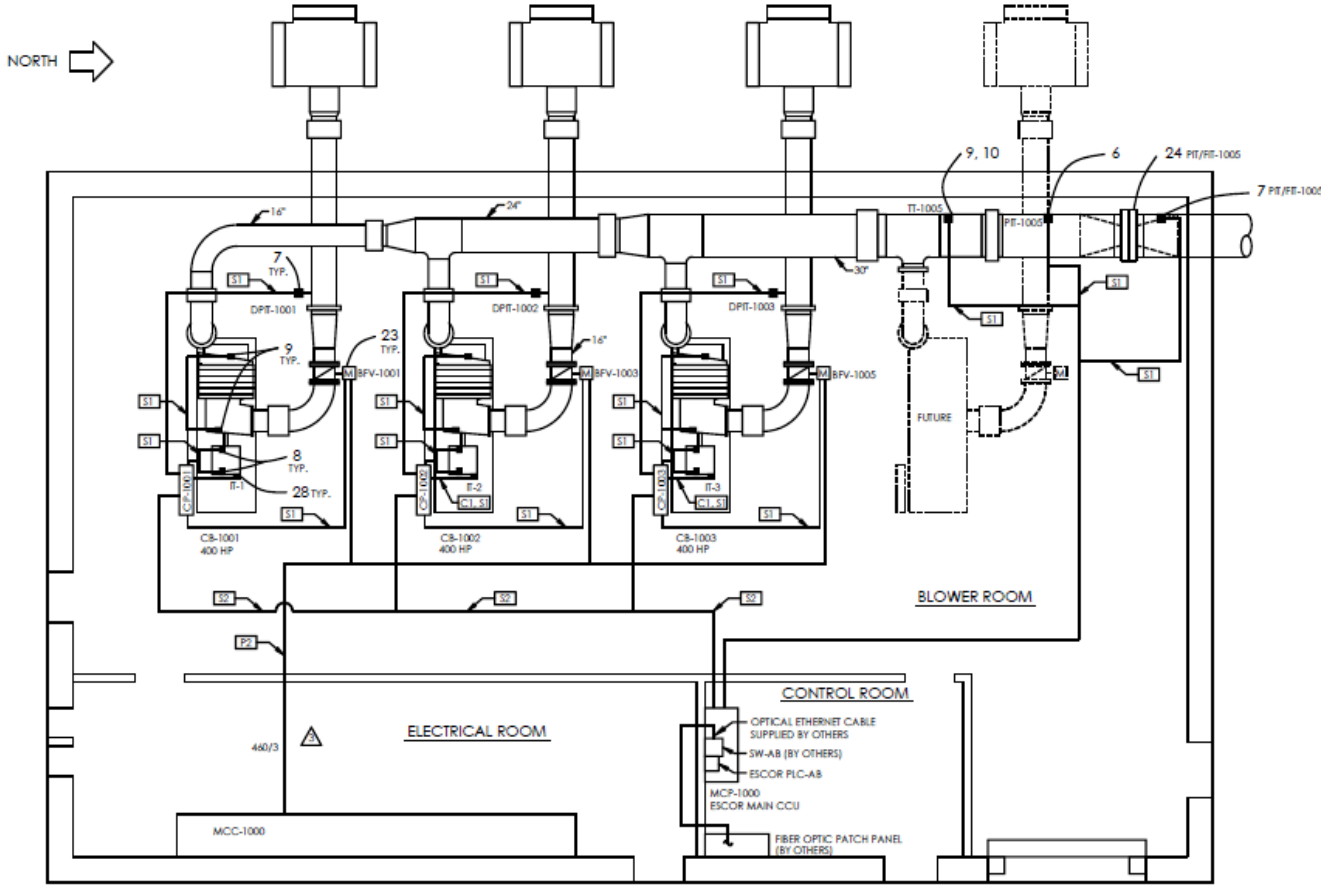
General Arrangement

- It doesn't much matter how good the blower or compressor is if the installation is compromised
- Installation and blower room problems affect:
  - Blower performance
  - Equipment life
  - Serviceability
  - Operator satisfaction

- This is an overview and not a comprehensive design guide!
- More information is available from the CAGI *Compressed Air and Gas Handbook*, which can be downloaded from: https://www.cagi.org/resource-library

General Arrangement

- There's lots of "stuff" in a blower room
- A single row of blowers perpendicular to the wall is the most common arrangement

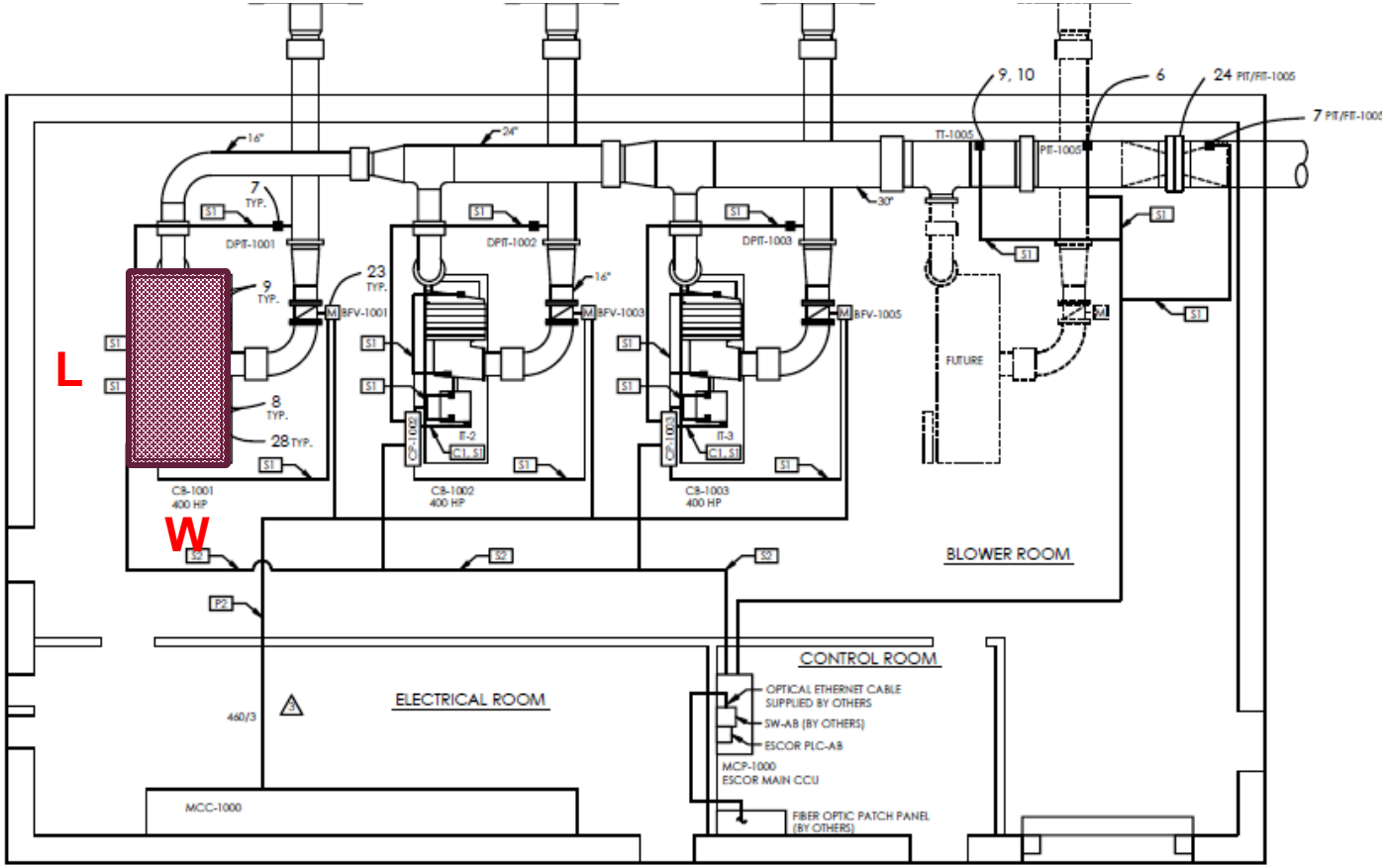


General Arrangement

- Sometimes two rows works better

General Arrangement

- Footprint: length and width in plan view
- Can be a problem to determine if multiple vendors are possible



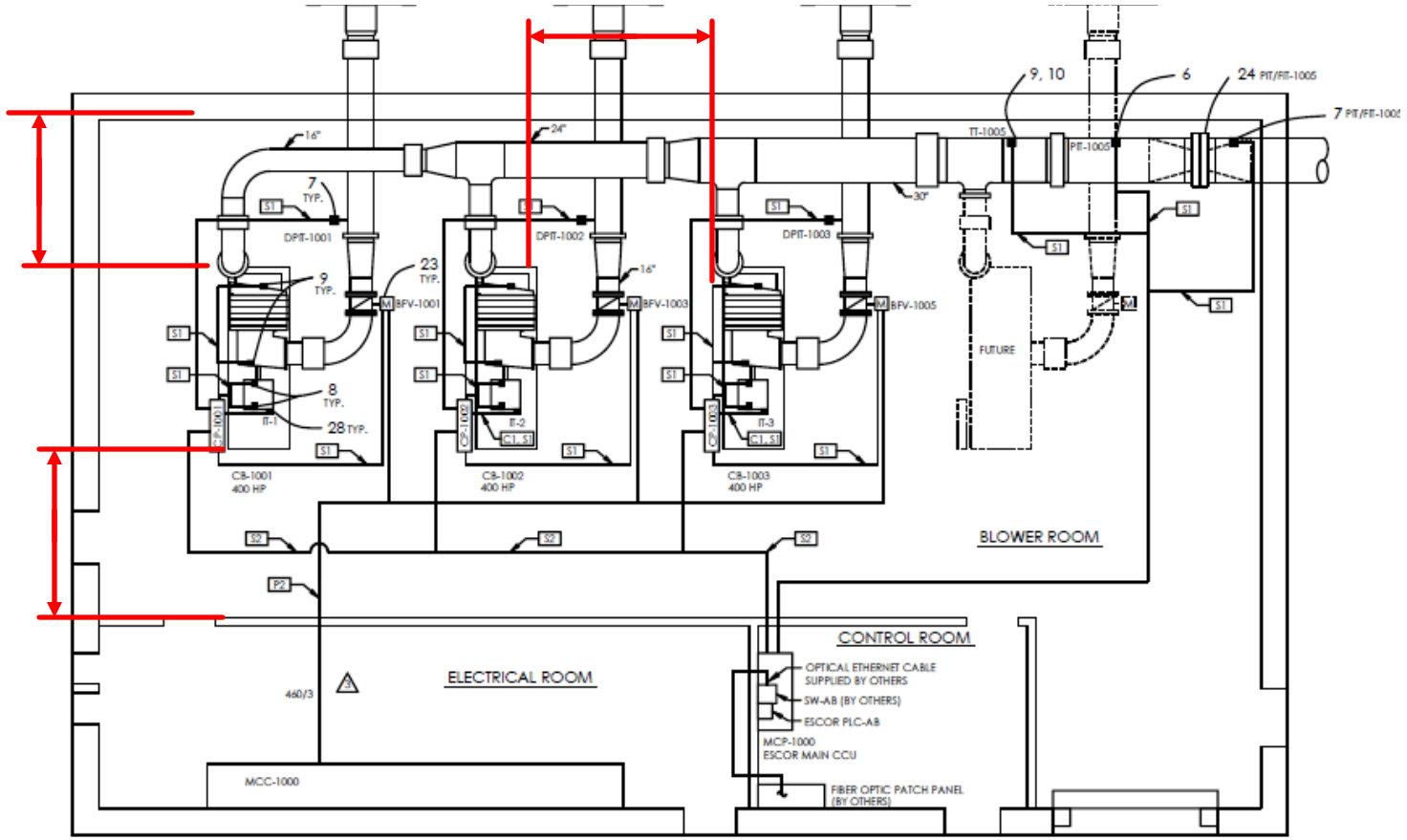
General Arrangement

- Access for service is important:

Source: TPO Magazine

General Arrangement

- Access for service is important:
- Three foot minimum unless the manufacturer indicates otherwise



Heat Dissipation

- There are many sources of heat in an equipment room
  - The compression process inherently generates heat
  - Blower or compressor inefficiency increases heat generation

$$\Delta T = \frac{\left[\left(\frac{p_d}{p_i}\right)^{0.283} - 1\right] \cdot T_{in}}{\eta_b}$$

Where:

ΔT = temperature increase, °R or °F

$p_{d,i}$ = discharge and inlet pressure, psia

T_{in} = inlet temperature, °R = °F+460

η_b = blower efficiency, decimal

Heat Dissipation

- There are many sources of heat in an equipment room
  - Most of the heat of compression leaves the room with the discharge air
  - Pipes and cases are heated by the air, and transfer some heat to the room

$$H_{b,p} = 2.4 \cdot F \cdot A \cdot (T_d - T_a)$$

Where:

$H_{b,p}$ = Heat rejected to room from blower or piping, BTU/hr

F = Factor for surface area, $F = 1.0$ for pipes, $F \approx 1.25$ for a ribbed blower case

$T_{d,a}$ = Temperature of discharge air or ambient air, °F

- Journal bearings and ball bearings can overheat in high ambient temperature areas
  - Lubrication can be compromised

Heat Dissipation

- Inefficiency in the motor generates heat
- Inefficiency in Variable Frequency Drives (VFDs) generates heat

$$H_e = 2544 \cdot P_m \cdot (1 - \eta_m \cdot \eta_{vfd})$$

Where:

H_e = Heat rejected to room from electrical components, BTU/hr

P_m = Motor power draw, hp

$\eta_{m,VFD}$ = Efficiency of motor and VFD, decimal ($\eta_{VFD} = 1.0$ if constant speed)

- Note that elevation affects temperature ratings
  - Most electrical equipment must be derated above 3,000 feet

Heat Dissipation

- Generated heat must be removed
- Ventilation with outside air may be sufficient to maintain acceptable temperature

$$q_{fan} = \frac{H_b + H_p + H_e}{1.08 \cdot (T_r - T_o)}$$

Where:

q_{fan} = Required ventilating air flowrate, cfm

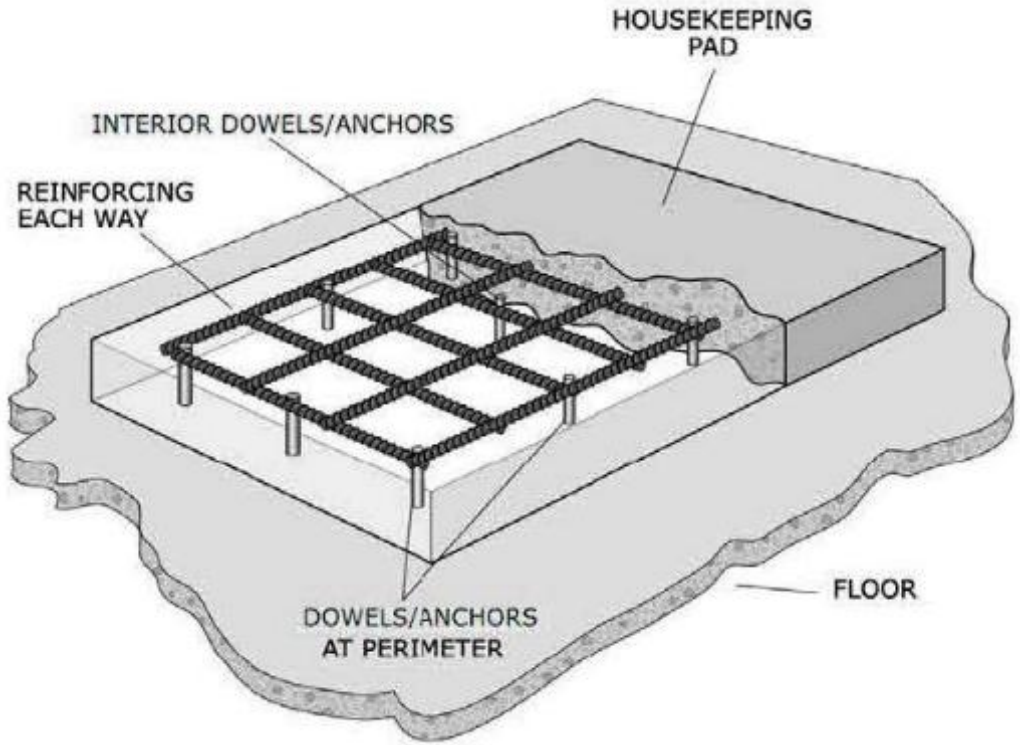
$H_{b,p,e}$ = Heat rejected by blower, piping, and electrical equipment, BTU/hr

T_r, T_o = Room and outside air temperature, °F

- Track where the heat goes:
  - With some designs heat is contained within the enclosure and warms the inlet air, affecting performance
  - With some designs heat is rejected to the blower room
  - With some designs heat is ventilated directly from a blower enclosure to the outside
- In hot climates air conditioning may be required, especially for electrical rooms

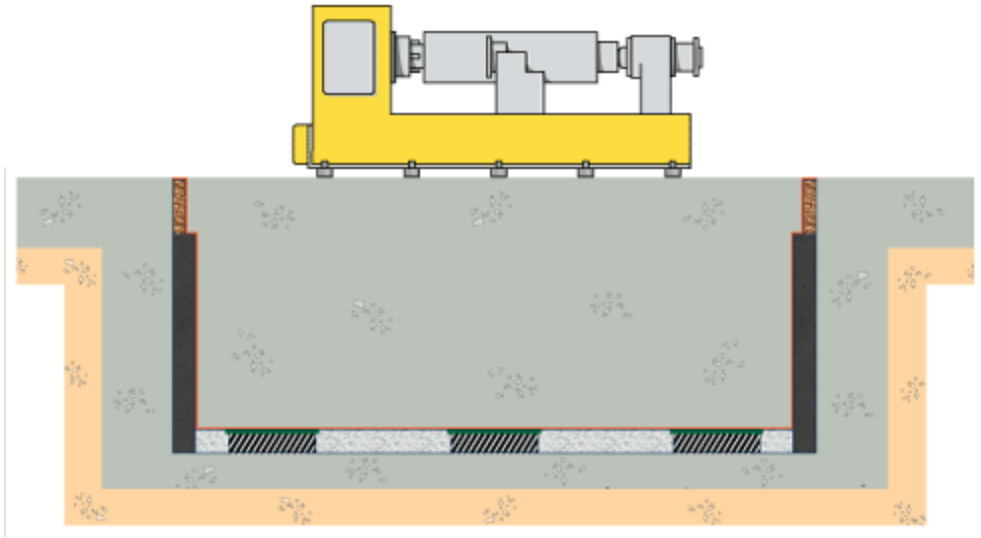
Foundations and Cranes

- Foundations must have sufficient stiffness to minimize deflection
- Foundations must have sufficient stiffness to minimize vibration transmission
- Most installations employ a housekeeping curb
  - 4” high is common



Foundations and Cranes

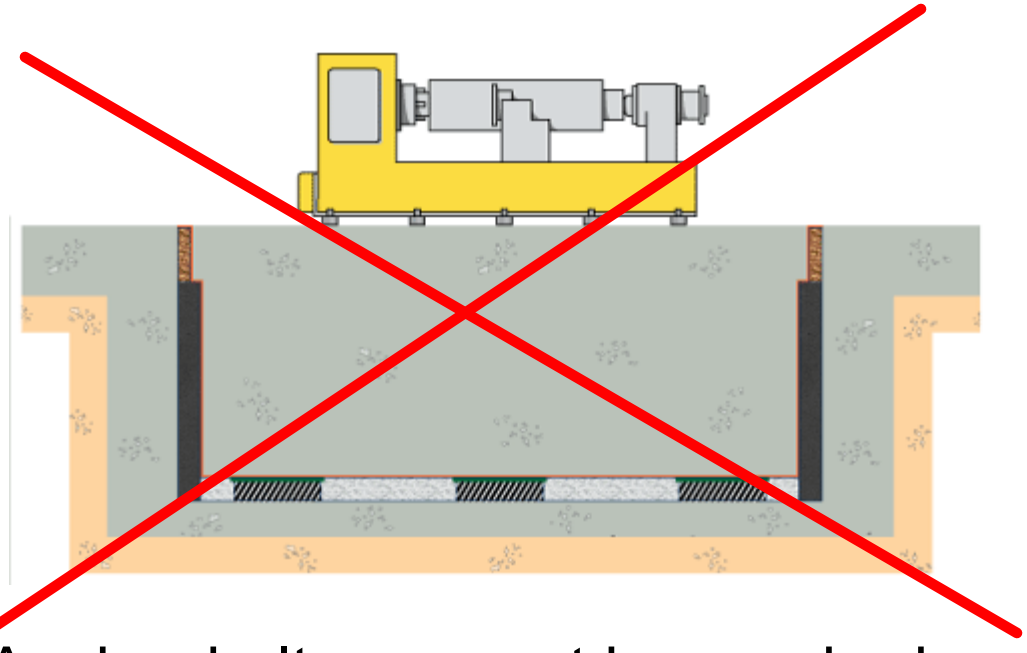
- Vibration isolation slabs are recommended for reciprocating compressors larger than 50 hp



- American Concrete Institute recommends mass of slab = 3 to 5 times the mass of the compressor assembly
  - Align slab center of gravity with compressor assembly center of gravity
  - Vibration isolation is required between slab and floor

Foundations and Cranes

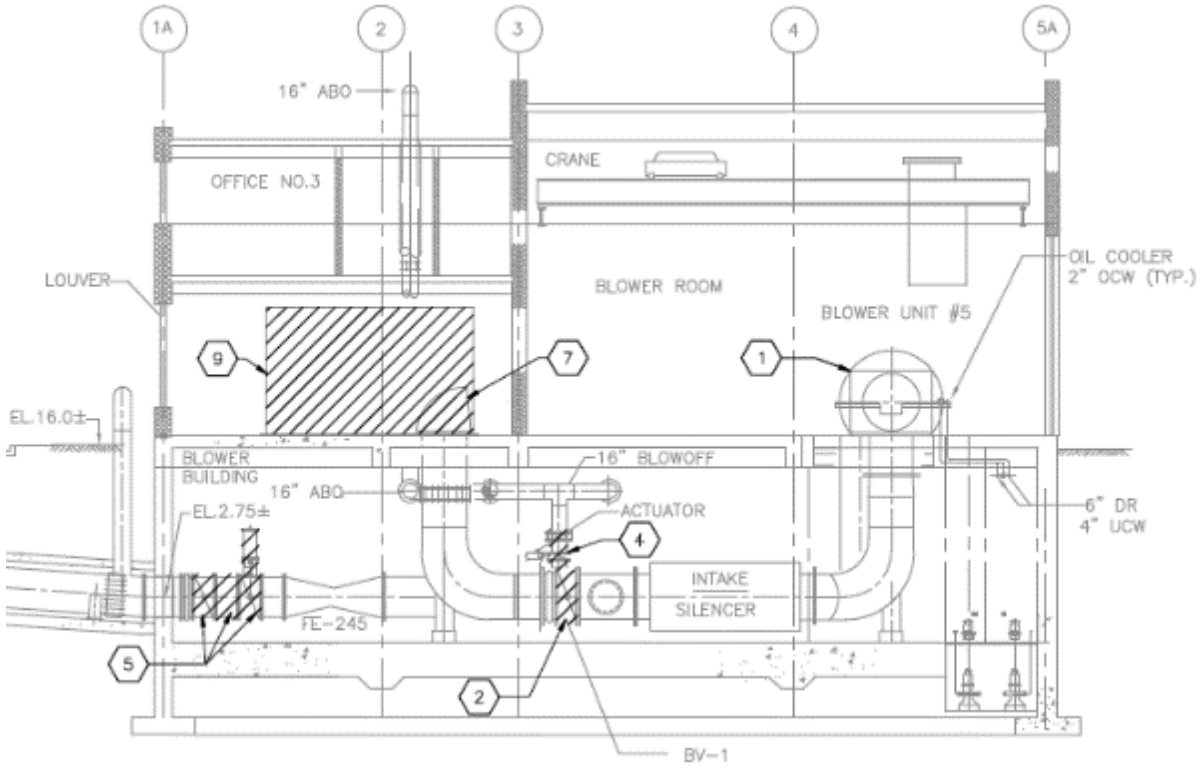
- Massive vibration isolation slabs are generally not needed for blowers or packaged compressors



- Anchor bolts may not be required or may not be tightened
  - Verify requirements with the blower manufacturer

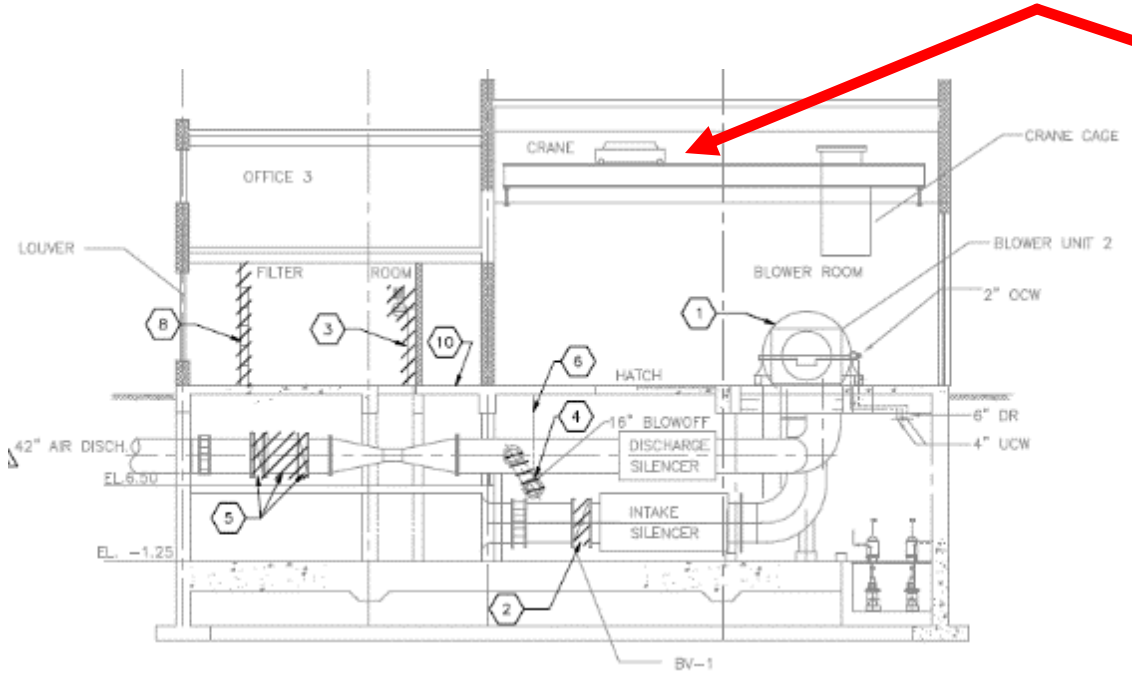
Foundations and Cranes

- Many older installations of large blowers had piping and instruments in a basement
- Structural adequacy and condition should be verified



Foundations and Cranes

- Overhead cranes may be supplied for equipment removal for replacement or service
- Cost effectiveness should be checked



Foundations and Cranes

- Doors and aisles should be large enough to accommodate fork trucks, flatbed trucks, and similar equipment needed for potential equipment removal

Noise Abatement

- Noise is always a concern
- Specific factors include:
  - Noise level produced – dB(A), a logarithmic scale for representing the noise energy
  - Distance – noise energy dissipates inversely with the square of the distance from the source
  - Frequency – high frequency noise may be more irritating but is easier to attenuate
  - Time of exposure – as exposure time increases the potential for harm to personnel increases
  - Room geometry and wall treatment – rooms with reflective walls will be louder

Noise Abatement

- Allowable exposure is a function of noise level (dB(A)) and length of exposure

$$t = \frac{480}{2^{\left(\frac{L-85)}{3}\right)}}$$

Where:

$t =$ Recommended maximum exposure time, minutes

$L =$ Noise level, dB(A)

Recommended Maximum Noise Exposure	
Noise Level, dB(A)	Time
80	25 hours
85	8 hours
90	2.5 hours
95	48 minutes
100	15 minutes

Noise Abatement

- Sound attenuating enclosures are standard for many packaged blowers and compressors

- Sound attenuating enclosures are available for all types of blowers
  - Cost effectiveness should be evaluated

Noise Abatement

- Some enclosures are suitable for outdoor installation
  - NEMA 3R, 4, 4X
- Consider climate in design
  - Servicing equipment in rain, snow, or extreme heat and cold can be a problem
  - HMI (Human Machine Interface) legibility can be impaired by sunlight

Noise Abatement

- A variety of noise attenuating methods can be employed:
- Thermal insulation on piping
- Sound deadening panels on blower room walls
- Acoustic wrapping of blowers
- Hearing protection earmuffs (20 to 30 dB(A) potential reduction)
- Silencers in air piping for inlet and discharge

Blower Piping

- Piping should be sized to minimize friction losses and noise
- Preferred velocities vary with pipe diameter for blowers:

Typical Distribution Piping Air Velocities	
Nominal Pipe Diameter	Design Velocity, feet per minute
1” to 3”	1,200 to 1,800
4” to 10”	1,800 to 3,000
12” to 24”	2,700 to 4,000
30” to 60”	3,800 to 6,500

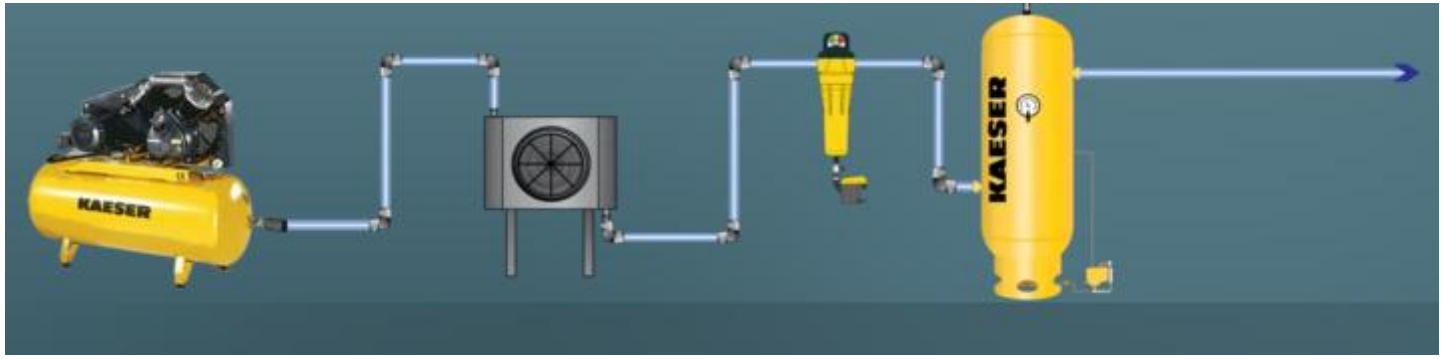
- Fittings and valves usually create more pressure drop than the pipe
  - Throttling valves can also generate significant noise
- Carbon steel is most common pipe material inside equipment rooms

Piping

- Avoid putting weight of piping on the blower connections
  - Use expansion joints

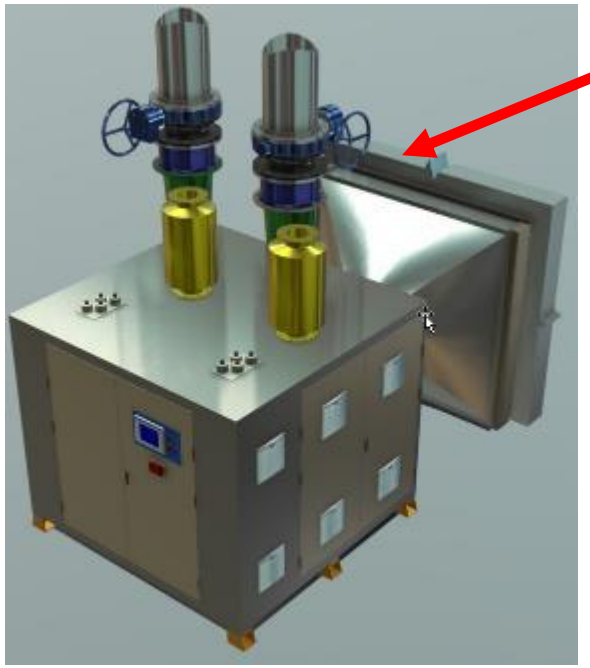
Piping

- Discharge piping is more complex for compressors
- Possible components:
  - Receivers
  - Aftercoolers
  - Filter/regulator/lubricators (FRLs)
  - Driers
- Design velocity 1,200 ft/min to avoid transporting debris and water droplets
  - 1,800 max



Piping

- Inlet air may be piped from outside the blower room
  - This is my preference for extreme cold or hot climates
- Many packaged blowers are standard with louvered inlet from the room
  - Piped inlet is usually an option
  - Process air and package cooling air may have different inlets



Electrical Systems

- Electrical systems generate heat
- Electrical systems are sensitive to heat
- Instruments are limited in ambient and process connection temperatures
  - Pigtails can be used with high process temperatures:

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Electrical Systems

- Conventional electromechanical motor starters do not usually have heat issues
- RVSS starters are more sensitive to heating issues than electromechanical starters
- VFD and motors can generate significant heat
- Common VFDs ambient temperature limits are 50°C (122°F) or 40°C (104°F)
- Motor inefficiency generates heat

$$1\ \text{kW} = 3{,}415\ \text{BTU/hr}$$
$$1\ \text{hp} = 2{,}544\ \text{BTU/hr}$$

Electrical Systems

- VFDs in enclosures or MCCs may need extra cooling, such as
  - Fans
  - Air conditioning
- Bypass contactors are recommended for RVSS
- Cooling is of particular concern if using NEMA 12 or 4 enclosures
- It is common to provide control rooms and electrical rooms with air conditioning
- Note that if the VFD is mounted a significant distance from the motor harmonics and bearing fluting may become issues
- Package blowers often have a VFD in the package and include cooling equipment as part of the package

Submit Questions and Comments

About the Speaker

Neil Mehltretter
Kaeser Compressors

- Technical Director, Kaeser Compressors
- 20 years of compressed air station design and auditing experience
- CAGI Certified Compressed Air System Specialist (CCASS)
- Certified Energy Manager (CEM®)
- CAGI Assessment Section Chair

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Rethink the Equipment Room: Why the Best Strategy May Start Outside Your Plant

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Topics

- Common problems with equipment locations
- Benefits of packaged systems
- Comparing options
  - Skid
  - Container
  - Enclosure
- Case studies
- Air as a utility

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Common Problems with Room Design

- Bad ambient conditions
- Poor ventilation
- Insufficient space for service
- Poor design
- Production or storage encroaching on space
- Safety concerns

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Why move out?

- Improve reliability with better controlled environments
- Gain space
- Reduce/eliminate engineering, permitting, and construction costs
- Scale up faster to meet needs of expanding production
- Improve/eliminate access issues for service
- Portability / remote location

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Applications are endless

- No specific sizes
- No specific industry or application
- Applied to myriad of industrial products
- Plant air
- Instrument air
- Process air
- Vacuum
- Blowers
- Boosters

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Installation, Start-up, and Maintenance Benefits

- Simpler, faster integration and commissioning
- Fewer contracting partners
- Less expensive than new construction or building modifications
- Avoided some construction costs (and taxes)
- Reduce or eliminate permitting process

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Installation, Start-up, and Maintenance Benefits

- Single point connections (air and power)
- Safety and security
- Compliance (NEC)
- Controlled environment
- Avoid additional heat load in compressor room
- Precise compressor room temperature
- More reliability air quality

Meeting specific requirements: special requests

- Fire detection / alarm
- Emergency exit lighting
- Custom instrumentation
- Customer specified connections
- Specific piping needs

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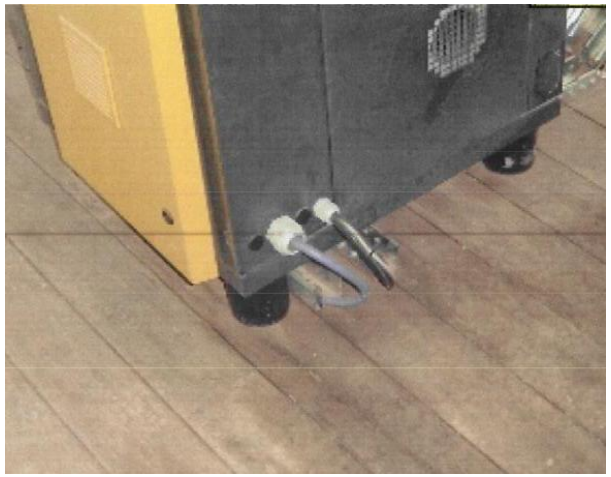
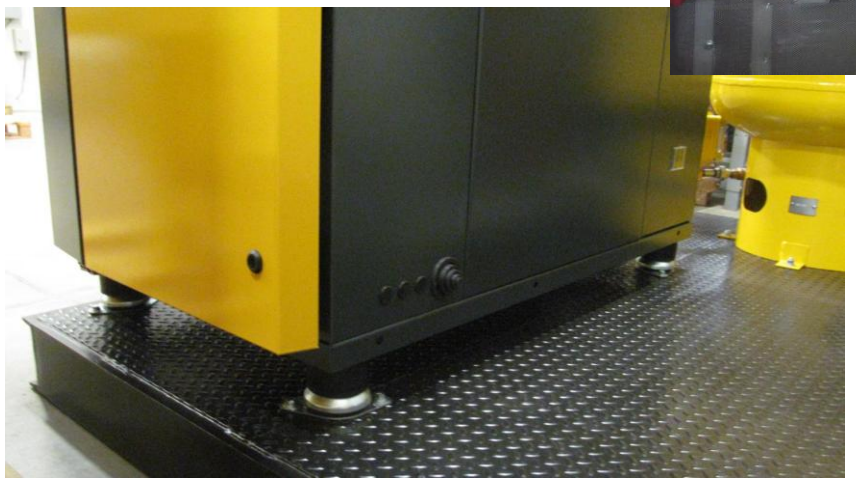
Meeting specific requirements: special requests





- Seismic zone reinforcing
- PE stamped enclosure drawings
- Witness testing (FAT)
- Documentation
- Weather related:
  - High ambient and/or low ambient
  - Wind
  - Snow
  - Lightning
  - Pollen

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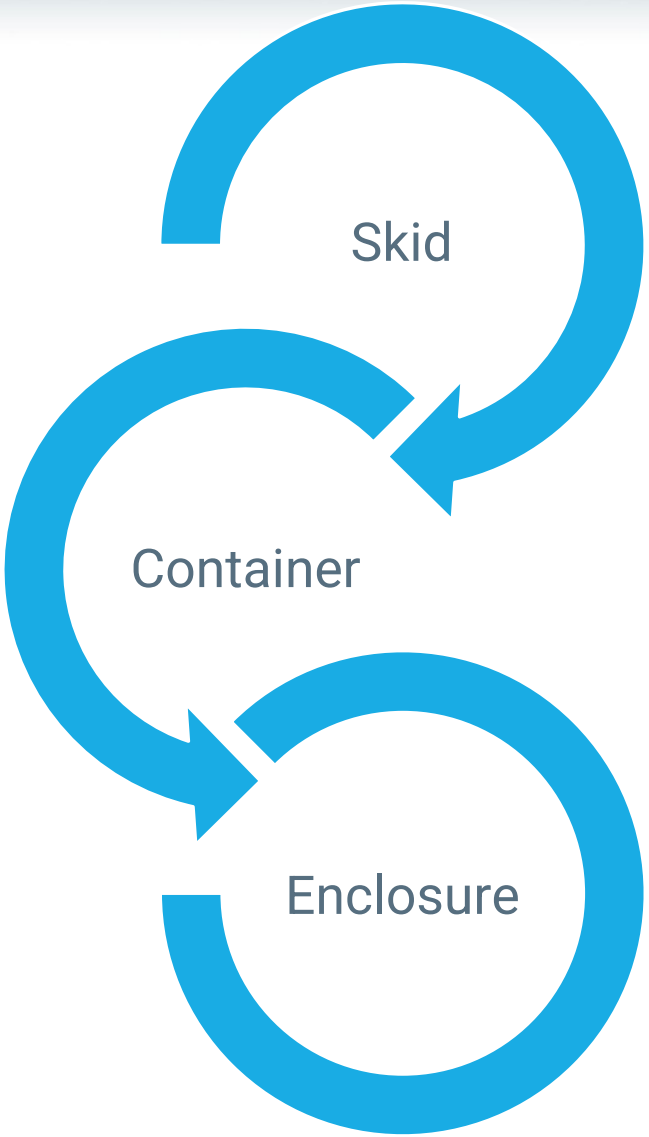

Comparing Options

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Case Study: Natural Gas Pumping Station

- Unable to place compressed air equipment in hazardous location
- Detailed equipment specification and design
- Limited onsite support
- Temperature extremes

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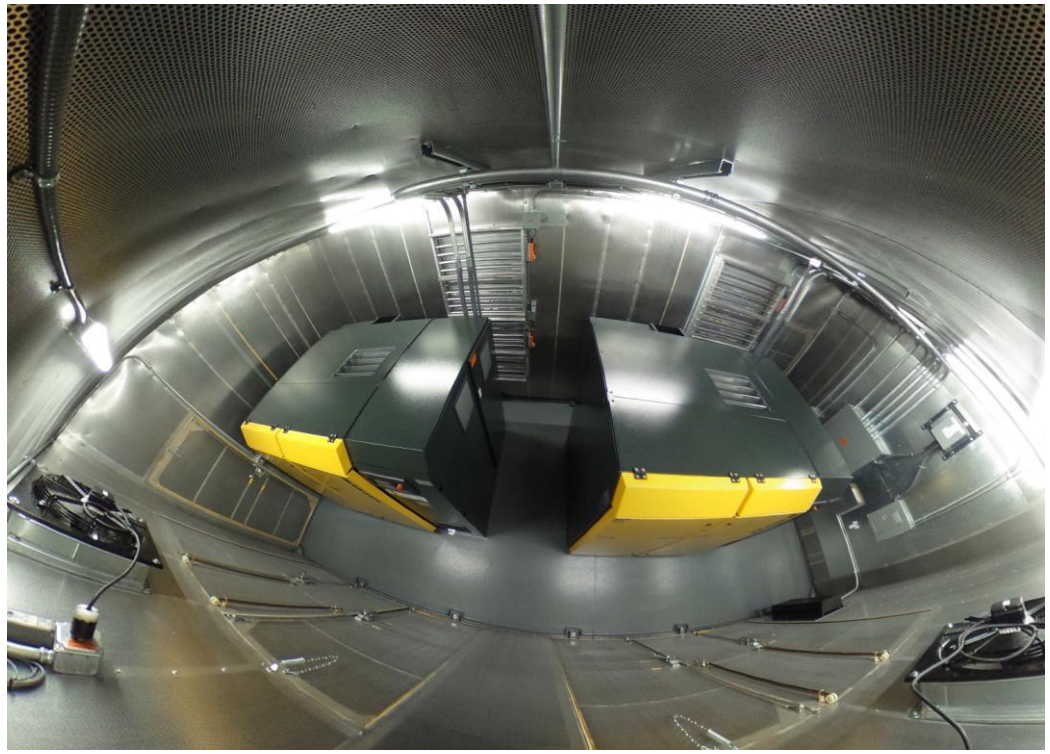
Case Study: Wastewater Treatment



- High temperature fluctuations
- Snow load consideration
- Single point hook up: air and electrical

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When to consider air as a Utility?

- Simpler, faster integration and commissioning
- Reduce or eliminate permitting process
- Save on new construction
- Gain space in plant
- Let the experts tailor the solution
- Air on site ASAP

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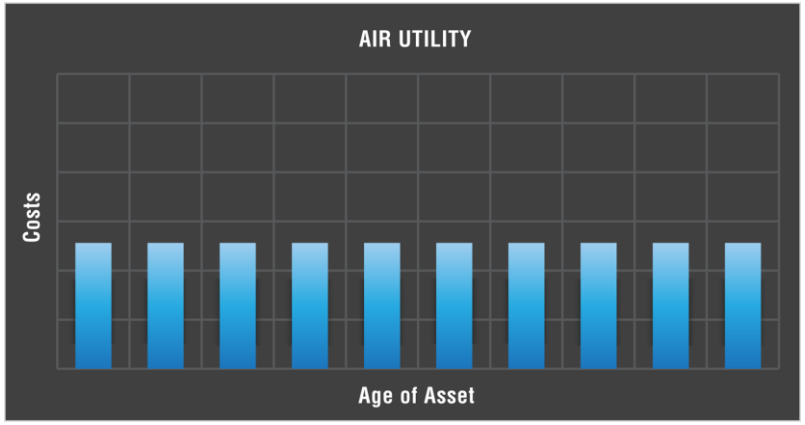
How does an Air Utility work?



- No capital outlay
- Predictable costs – no big service bills as equipment ages
- Includes redundancy
- No need to dedicate personnel to monitoring, maintenance, repair
- Remote monitoring services
  - Should include 24/7 support

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Summary and Conclusions

- Compressed air is costly
- Compressor room design is challenging
- Packaged compressors solve numerous issues
- Select the right vendor
- Address specific challenges
- Evaluate air utility outsourcing

Thank You.

If you’re ready to think outside the compressor room, consider KAESER your partner.

Explore these three turnkey options:

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Submit your poll answer to qualify. Winners notified tomorrow!

What is a primary advantage of moving equipment outdoors?

A	• Faster production speeds
B	• Lower utility rates
C	• Saves plant space

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Q&A

Please submit any questions through the Question Window on your GoToWebinar interface, directing them to Best Practices Magazine. Our panelists will do their best to address your questions and will follow up with you on anything that goes unanswered during this session.

Thank you for attending!

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September 2026 Webinar

How to Apply CTI ATC-128: Sound Testing for Cooling Towers & Dry Coolers

Jacob Faulkner, P.E.
Black & Veatch
Keynote Speaker

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