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Air System Sizing

Optimal performance of pneumatic equipment is dependent on the proper sizing of the air system supplying it. This includes the sizing of the compressor, tank, and feed lines. The crucial limitation of all systems is the amount of air consumption the pneumatic equipment requires. Both continuous and intermittent consumption demands should be considered. All parts of the air system need to be adequate for the consumption required or performance will suffer. The information in this sheet outlines how to roughly size an adequate air system. All systems are different and the manufacturer of the system components should be consulted for specific applications.

Pneumatic Nomenclature

- SCFM- Standard Cubic Feet per Minute
  - This is the flow of air at standard conditions. 70°F(21°C), 14.7psia (101 kPa), 0%RH
- ACFM- Actual Cubic Feet per Minute
  - The flow of air at any reference point. Needs to be defined further for pressure and temperature.
- FAD – Free Air Delivery
  - Actual quantity of air compressed converted back to the inlet conditions of the compressor
  - Standard Inlet Conditions from IS) 1217 68°F(20°C), 14.5psia(100kPA), 0% RH
- ICFM- Inlet Cubic Feet per Minute
  - Same as FAD
- $Pressure_{max}$ - Maximum Set Pressure of Compressor (Shut off set point)
- $Pressure_{min}$ - Minimum Set Pressure of Compressor (Start set point)
- $Pressure_{Inlet}$- Pressure at inlet of Compressor (Atmospheric)

Air Compressor Size

- Consider PSI Requirements
  - 0-80 psi: A single stage compressor is adequate.
  - 80-250 psi: A two stage compressor is recommended.
- Air Consumption
  - List all requirements in SCFM for ease of calculation.
  - Consider both continuous and intermittent usage.
- Compressor Horsepower
  - Determine total SCFM
  - Add approximately 20% for system variables

- Be sure to consider future expansion needs.
- For 100 psi system requirements:
  - Divide the total SCFM by 4 to get horsepower required for a single stage pump
  - Divide the total SCFM by 5 to get horsepower required for a two stage pump
- For any other system pressure requirement use the following equations.

$$HP = 0.015 * P_{Inlet} * (R^{.29} - 1)$$ - Single Stage Pump

$$HP = 0.030 * P_{Inlet} * (R^{.145} - 1)$$ - Two Stage Pump

$$R = \frac{Pressure_{Max}}{Pressure_{Inlet}}$$

Tank Sizing

As a general rule–the larger the tank, the better the system. A good rule of thumb is enough capacity for 1 minute of compressor capacity.

$$Tank\ Volume\ (gal) = \frac{14.7\ psi * SCFM_{Compressor}}{Pressure_{Max}(psi)} * 7.48$$

If you have a high flow, low duration air demand, the tank will need to be sized to have enough buffer to avoid a low pressure situation.

$$Tank\ Volume_{Buffer}(gal) = \frac{14.7\ psi * SCFM_{High\ Demand} * Duration(\min)}{[(Pressure]_{Max} - Pressure_{Min})} * 7.48$$

Air Line Sizing

The proper line size of the air supply line is critical to the proper performance of your tool. As the length of the air line from the compressor to the tool, the pressure at the tool will decrease if the line size is too small. Below is a table of recommended line sizes for various line lengths and air flows.

SCFM	Length of run in feet, Air line size in inches								
FLOW	**25**	**50**	**75**	**100**	**150**	**200**	**300**	**500**	**1000**
6	½	½	½	½	½	½	½	¾	¾
18	½	½	½	¾	¾	¾	¾	1	1
30	¾	¾	¾	¾	1	1	1	1 ¼	1 ¼
45	¾	¾	1	1	1	1	1 ¼	1 ¼	1 ¼
60	¾	1	1	1	1 ¼	1 ¼	1 ¼	1 ½	1 ½
90	1	1	1 ¼	1 ¼	1 ¼	1 ¼	1 ½	1 ½	2
120	1	1 ¼	1 ¼	1 ¼	1 ½	1 ½	1 ½	2	2
150	1 ¼	1 ¼	1 ¼	1 ½	1 ½	2	2	2	2 ½