American Eagle

Air System FAQ

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What size air compressor do I need?

- The answer to this question lies with what its intended use will be, specifically what the compressor is going to be used for.
    - Compressors come in many sizes and bigger isn't always better as there are large compressors with low air output and small air compressors with large output.
    - It is critical to understand the air consumption requirement the compressor needs to support.

Pneumatic CFM Requirements

- The first thing to do is determine the air needs. Pneumatic tools all require different amounts of air and these needs vary quite a bit, even within a single type of tool, which is why it is important to find out what the needs of the tool are.
- Air power is typically measured in two metrics: CFM and PSI. CFM or "Cubic Feet per Minute", is the amount of air that's being delivered. PSI or "Pounds per Square Inch" is the amount of force behind that air.
- Most tools are rated to run optimally at 80 to 110 PSI, so you'll want to find an air compressor that can deliver the right CFM at the PSI your tools require. The best way to determine your PSI and CFM requirements is to review all the tools to be used and check with the manual or manufacturer.
    - If more than one air tool will be used at the exact same time, the CFM requirements of each tool will need to be added together to determine total CFM requirements. Example: If one tool requires 30CFM and the second requires 20CFM, a compressor capable of 50CFM is needed (30CFM + 20CFM = 50CFM).
    - There will be instances that an end user will want a compressor that provides a PSI rating much higher than the tool being used for breaking force.
- A general rule of thumb is to factor a 25% increase above calculated CFM requirements to ensure the compressor is providing enough volume to overcome any inefficiencies while doing the task.
- Inflating tires is a challenge to calculate CFM requirements. The speed in which to fill the tire will be a critical item to understand as that will determine the volume, CFM, needed. The maximum pressure needed in the tire will be the determining factor for the PSI rating, force behind the air, as the compressor will need to have a higher PSI rating than that of the tire rating.

Difference Between CFM and PSI

- The difference between CFM and PSI are what they measure, CFM measures volume while PSI measures pressure. CFM and PSI are often used as performance specifications for air compressors. Together, they indicate the maximum air volume and pressure produced by an air compressor to power air tools.

CFM Definition

- As stated earlier, CFM stands for "Cubic Feet per Minute". CFM measures the volume of air in cubic feet for each minute it moves. In the case of an air compressor, CFM indicates how much air can move per minute. For example, an air compressor's output could be rated for 30 CFM, which means 30 cubic feet of air is flowing per minute.

PSI Definition

- As stated earlier, PSI stands for “Pounds per Square Inch”. PSI measures how many pounds of pressure (force), is in an area, specifically in one square inch. The force of the air is what gives compressed air its power. For example, an air compressor’s output could be rated for 100 PSI, which means that 100 pounds of pressure is delivered per square inch.

Relationship between CFM and PSI

- The relationship between CFM and PSI is an important way that ensures the proper operation of an air compressor. For a tool to operate and perform optimally, both CFM and PSI must be sufficient.
    - Here is a real-life example to help understand how CFM and PSI relate: Imagine you have a garden hose, and you turn it on. Water will flow out, and it might reach a few feet past the end of the hose, perfect for filling up your bucket or watering can. If you take the garden hose and restrict the space at the end of the hose with your thumb, to create less room for the water to flow out, the water will shoot out with much more pressure than before. Even though the hose is producing the same amount of water, the extra pressure will allow the water to travel faster and further, perfect for having a water fight!
    - A second example: Consider this second real-life air example. There’s a tunnel with wind blowing through it, and the tunnel gets smaller and smaller. As the wind blows into the tunnel, it travels through the shrinking space, and starts to feel stronger and stronger. This is because even though the volume of air (CFM) remains the same throughout the tunnel, the air is being squeezed into a tighter space, resulting in the pressure (PSI) increasing.
    - Both examples show the relationship between CFM and PSI. While having a sufficient volume of air to power air tools is important, it’s also crucial to ensure there’s enough PSI (pressure) to give the air power.

Continuous vs. Intermittent Use

- Tool CFM requirements give an idea of what a compressor will need to do but it’s not enough to simply match tool ratings with compressor ratings 1:1, what the air tool is and how it will be used matters. For example, during the use of an impact wrench:
    - will the trigger be held continuously while doing work, or
    - will it be used in quick bursts with short breaks in between use, allowing the compressor to catch up?
- Questions to ask to help determine CFM needs:
    - Are the tools used for lengthily periods of time? In this instance a compressor capable of 100% duty cycle is going to be needed.
    - Are the tools used for only a few seconds here and there? In this instance a smaller, intermittent duty compressor with an air tank may be preferred.

Compressor Duty Cycle

- Duty cycle is often hard to understand as there are no universally identified characteristics to represent the values among compressor manufacturers
- Simply put, a compressor duty cycle is amount of time the compressor will deliver pressurized air within a total cycle time. Example: 50% duty cycle equals 5 minutes of loaded time in a 10 minute window.
- Another consideration is how the compressor is cooled. Reciprocating air compressors are air cooled so they cannot operate in a continuous duty cycle whereas rotary screw compressors are cooled via an air cooled oil cooler.
- Reciprocating compressor duty cycle
    - Typical industry standard is 60%
    - American Eagle: 50% (Per documentation in the manual)
- Rotary screw compressor duty cycle: 100%
- 2-Stage reciprocating compressors do not have a higher duty cycle than single stage versions

Reciprocating or Rotary Screw Air Compressor

- A common question asked: Is a reciprocating or rotary screw air compressor needed?
    - The correct answer: It all depends on the application.
- Reciprocating compressors are best suited for applications that are shorter durations of use and don't require high volumes (CFM) of air for the application
    - Pros: Less expensive investment, easier to service, lower maintenance costs, more forgiving to the environment (dust, moisture)
    - Cons: Larger and heavier air ends, require air reservoirs, intermittent duty, higher discharge temperatures
- Rotary screw compressors are ideal for applications that need air continuously or high volumes (CFM) of air for the application
    - Pros: 100% duty cycle (continuous air flow), higher CFM output, smaller and lighter air ends, lower discharge temperatures
    - Cons: More expensive investment, higher maintenance costs, less forgiving to the environment (dust, moisture), must be operated for a minimum of 20 minutes
- Applications
    - Reciprocating compressors are considered "bullet" proof for use in most applications in the service body arena. Especially those that do not need high volumes of air for long durations.
    - The rotary screw compressor is a high dollar investment, between acquisition and maintenance costs, so care has to be taken in specifying for an application.
        - A mechanics truck application that requires a high volume of air can be a good scenario for the rotary screw, as long as the compressor is allowed to operate longer than 20 minutes each time it is turned on.
- Reasons why a rotary screw compressor might not be right
    - 100% duty cycle is not needed
    - Up front purchase cost is too high
    - High air flow (CFM) is not required
    - Maintenance schedule adhered to, or paid for

Air Tanks

- Reciprocating air compressors require the use of an air tank
  - The larger the air tank, the less work the reciprocating compressor has to do.
- Rotary screw compressors do not require an air reservoir, but;
  - for certain applications, a reservoir is a good addition to a rotary screw compressor application to provide a surge of air at initial start up and ahead of the compressor building pressure. A minimum 10 gallon reservoir is recommended for this.
  - is beneficial if the compressor has been shut off but air is needed. If the compressor has not completed its blow down process, relieving trapped pressure in the system, it cannot be turned back on right away. The air reserve could handle the quick need for air.
    - This would mitigate the opportunity for compressor short cycling.
- Important air tank functions
  - Dampens pulsations from the discharge line of a reciprocating compressor
  - Serves as a reserve of air to take care of sudden, or unusually heavy, demands for air in excess of what the compressor is designed to do.
    - Benefit to rotary screw compressors in certain applications; mechanics truck use
  - Prevents excess cycling of the air compressor
    - This is a detriment to rotary screw compressor effective operation
  - Foreign matter removal that may have bypassed the filtration system.
  - Removal of moisture prior to the air reaching tools or equipment

ACFM (actual cubic ft per min) vs. SCFM (standard cubic ft per min)

- Standard Cubic Feet per Minute (SCFM) measures the air output using a standard that takes atmospheric conditions into account
  - The parameters are determined by the American Society of Mechanical Engineers (ASME) and are recognized across many industries. SCFM calculations are based on atmospheric conditions (standard conditions) to measure air mass flow form an air compressor.
    - SCFM standard conditions include: Atmospheric pressure at sea-level at 14.7 PSIA (760 mmHg), relative humidity of 36% and Ambient Temperature of 68° F (19° C)
- Actual Cubic Feet per Minute (ACFM) is the true air mass flow given a certain set of real-life conditions and is impacted by atmospheric conditions.
  - Example: An air compressor at high elevation will have a lower CFM output than the same compressor at sea level.
- Quick calculation reference:
  - For every 1,000 ft (305 m) of elevation over standard conditions, ACFM demand increases approximately 5%
  - For every 20° F (11.1° C) of ambient temperature increase over standard conditions, , ACFM demand increases approximately 5%
  - For every 20% of humidity increase over standard conditions, , ACFM demand increases approximately 0.5%
  - Example: A 1" impact gun has a minimum air requirement of 45 CFM. The job site is at 1,211 ft (369 M), the atmospheric pressure is 14.2 PSIA (732 mmHg), humidity is 24% and the temperature is 84° F (27° C). For a compressor to generate the needed 45 ACFM in these conditions, the compressor actually needs to have an SCFM rating of approximately 49 SCFM.

- This does not need to be done for most applications but needs to be considered when working with severe applications, like high elevation scenarios.
- Why does it matter?
  - Considering ACFM ensures the compressor will be sized to meet the SCFM needed due to the environment it is being used in.
  - An air tank will help mitigate the impact of the environmental factors due to having a reserve of air that offsets the ACFM

Air System Component Sizing

- Every air system has components in it that need to be properly sized to ensure there is no negative impact on the compressor performance.
- Air travels from the compressor to tools through multiple components such as air hose, fittings, filters, regulators, etc. and each of these can restrict the flow of air if not sized properly, impacting the magnitude of the flow.
- The CFM does not change passing through the air system, but the pressure does with restrictions.
  - Example: A tool needs both air flow (CFM) and pressure (PSI) to work properly. A long small hose feeding a high air demand tool can cause substantial pressure drop due to the hose size being too small and creating a restriction. The result will be a compressor that is working harder to keep up with demand and, if it can't keep up, the tool performance will be reduced.
- A result of an improperly sized air system is the potential to order an air compressor that, technically, is larger than the application needs to overcome the system inefficiencies. An investment in properly sizing the air system components would be a better investment to size a compressor accordingly.

Hydraulic Compressor Minimum Chassis Specifications

- For most hydraulically driven air compressors, minimum chassis specifications are not needed as most chassis today have the ability to provide the hydraulic requirements needed.

Air Tool CFM Reference Chart

Pneumatic Tool	CFM @ Load	Suggested CFM
Wrenches		
1/4” Impact Wrench	8 – 36	30 – 40
3/8” Impact Wrench	8 – 36	30 – 40
1/2” Impact Wrench	9 – 42	30 – 40
3/4” Impact Wrench	9 – 55	30 – 40*
1” Impact Wrench	9 – 102	60 – 70*
#5 Spline Impact Wrench	60 – 95	100
Ratchets		
1/4” Ratchet	10 – 20	30 – 40
3/8” Ratchet	11 – 24	30 – 40
1/2” Ratchet	15 – 23	30 – 40
Drills		
3/8” Drill	13 – 44	30 – 40
1/2” Drill	17 – 35	30 – 40
Grinders		
1/4” Die Grinder	6 – 40	30 – 40
5” Angle Grinder	16 – 76	60 – 70*
Vertical Grinder	50 – 93	60 – 70*
Sanders		
Tire Buffer	13 – 15	30 – 40
Orbital Sander	14 – 22	30 – 40
Polishing Sander	22 – 39	60 – 70
Percussive		
Air Hammer	7 – 30	30 – 40
Scalers	4 – 15	30 – 40
Engraving Pens	1 – 5	30 – 40
Saws		
Reciprocating Saw	6 – 51	60 – 70
Walk Behind Saw	90 – 92	100
Concrete		
Clay Digger	36 – 47	60 – 70
30-35 lb Pavement Breaker	48 – 52	60 – 70
60 lb Pavement Breaker	64 – 70	60 – 70
90 lb Pavement Breaker	62 – 85	100

* = Adding an air tank may allow the use of a smaller CFM compressor in some situations.

1.) Normal Use – The chart is based on typical use of the tool. Tools in continuous duty applications need higher CFM than those used in intermittent.
2.) Tool Requirements – It is normal for tools to have a large range of CFM requirements, even from the same supplier. If in doubt, verify the tool specifications with the supplier.