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Compressed Gasses and Pressure Hazards

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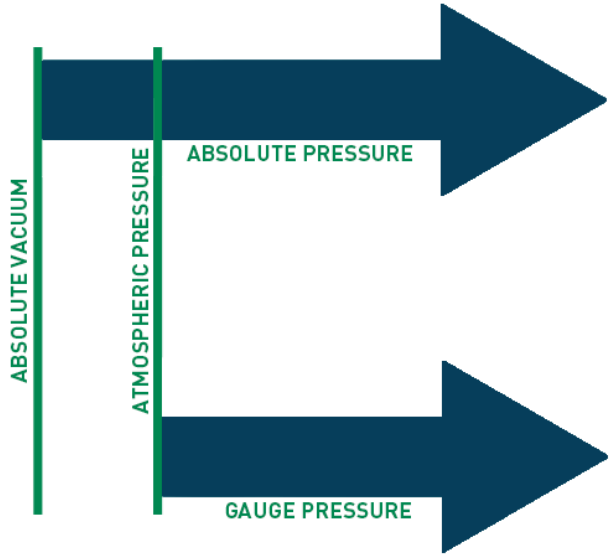
PSI, PSIG, Vacuum, and other pressure measurement

- PSI is Pounds per Square Inch or the amount of force that is exerted over a square inch of area. This is one of the most common measurements of pressure (in the USA)
- It can be measured in PSI (absolute) or PSI (gage) where absolute is referenced off of absolute vacuum and gage is referenced to the base atmosphere pressure

- Roughly 14.7 psi is atmospheric pressure

- There are other measurements of pressure such as
  - inHg
  - ATM
  - inH2O



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Knowledge Check 1

- True or False: Gage pressure's starting point (0) is regular atmospheric pressure

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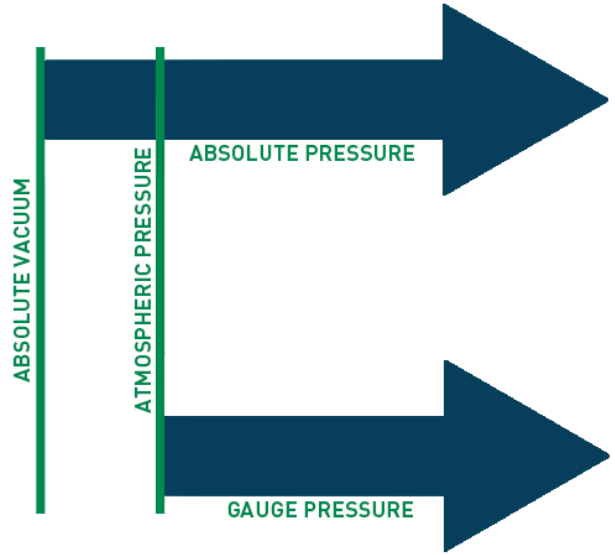
Knowledge Check 1

- True: Gage pressure starts at roughly 14.7 psi(atm)



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Pressure Hazards

Type of physical hazard

- The main hazards include an explosion or accidental release of compressed liquid or gas
- This can cause equipment and debris to go flying, create a whip like reaction or inject material into your skin

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Injection Injuries

These occur when small particles of a substance are injected into skin via high pressure systems

- They seem really insignificant but have serious consequences
  - Swelling
  - Fibrosis
  - Adhesions
  - Necrosis
  - Systemic toxicity

Photographs showing the innocuous appearance of a fluid injection wound and the extent of the surgery needed to treat it. (Use of photographs by kind permission of Fluid Power Safety Institute, Salt Lake City, USA.)

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Health Hazards of Gasses

- When using compressed gasses, it is important to understand the type of gas you are working with
- They can present different hazards depending on the gas
  - Oxygen displacement
  - Fires
  - Explosions
  - Toxic Exposure

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Compressed Gasses

- Compressed gasses are gasses that are under pressure in a tank or vessel that if released can cause a pressure hazard
- Each cylinder containing a compressed gas must be clearly marked and labeled with what type of gas it contains
- If the label is damaged or missing, it is important to take it out of service and return it to the manufacturer

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Pressure Vessels

- Defined as a tank that is designed to handle pressures that are not atmospheric
- It is important to pick the right vessel for your pressure needs
- It is also important to monitor the vessels regularly for cracks and dents
- These vessels get reused regularly and can fatigue over time

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Compressed Gasses

- There are many types of gasses that can be stored in gas tanks. These gasses can be
  - Flammable or combustible
  - Corrosive
  - Explosive
  - Poisonous
  - Inert
  - Acidic
  - Reactive
  - A combination of the above

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Before Use

1. Make sure that the cylinder is equipped with the correct regulator
2. Inspect the regulator and cylinder for damage
3. The valve on top should be easily accessible
4. If using a gas that is hazardous, it should be used with a fume hood
5. Use appropriate tools to attach and remove the regulator to avoid marring the fitting (this can cause leaks)
6. Read the SDS prior to use
7. If using gasses that are flammable, have a fire extinguisher handy
8. If using gasses that displace oxygen, monitor the oxygen level in the room

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Cylinder Storage

1. Secure cylinders using a cart or strap at all times
2. Store cylinders upright
3. Store cylinders in a cool, ventilated place
4. Place cylinders in a location that they will be not knocked over
5. Close the valves and secure the caps when not in use
6. Inspect the cylinders regularly for cracks or damage
7. Empty cylinders should be separated from full and clearly marked as “empty” or “full”
8. Store cylinders in a location where the tank will not become damaged

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Cylinder Storage

1. Store incompatible containers away from each other (don't store oxygen next to flammable gasses)
   - The proper storage for oxygen cylinders requires a minimum of 20 ft is maintained between cylinders that contain flammable material
   - The storage area for oxygen cylinders may also be separated by a firewall at least 5 ft high with a fire rating of 30 minutes

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Moving Cylinders

1. Transport the cylinders using carts, do not slide or roll them on the floor
2. Use a protective cap when transporting the cylinder
3. Do not transport the cylinder with the regulator attached
4. Do not drop cylinders or strike them against each other
5. Do not use the valve or valve cover to move the cylinder

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Use and Operation

1. Only trained personnel should use gas cylinders
2. Completely unscrew the regulator's valve before opening the top valve
3. Open the valve slowly
4. Flammable gasses' valve should not be opened more than ½ turns of the spindle and preferably no more than ¾ of a turn to prevent explosion
5. Do not heat the cylinder
6. Keep the gasses away from heat and flame
7. Close the valve when not in use

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Empty Cylinders

- Never fully empty a cylinder and leave a small amount of residual pressure
- Empty cylinders should be marked with an indication that they are empty (commonly they will use tags)
- Never try to refill the cylinder on your own. Send it to an approved vendor

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Knowledge Check 2

- True or False: Oxygen tanks should be kept 10 ft away from cylinders that contain explosive or flammable material

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Knowledge Check 2

- False: Oxygen must be kept **20ft** away from cylinders that contain explosive or flammable material

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Cryogenic Liquids

- Cryogenic liquids are usually gas at normal room temperature but are pressurized into liquid form
- Think liquid nitrogen, oxygen and helium
- These liquids pose a pressure hazard risk and a thermal safety risk
- Liquid nitrogen’s boiling point (the point it turns back into gas) is roughly -180 °C

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Hazards of Cryogenic Liquids

- Damage to tissues
- Pressure buildup
- Splashing
- Oxygen displacement and depletion
- Oxygen enrichment (fire hazard)

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Cryogenics Use and Handling

- Safety glasses must be worn at all times while handling cryogenics
- It is recommended that there is oxygen monitoring occurring for substances that displace oxygen or increase oxygen content
- These substances are COLD it is important to wear protective gloves, shoes and aprons to prevent tissue damage from splashing
- Provide proper venting and these liquids should only be transferred to an approved Dewar Flask to prevent explosion. Only fill the secondary container to 80% capacity

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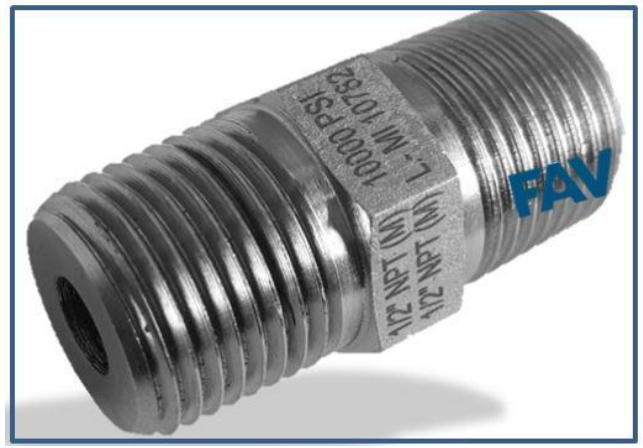
Pressure Ratings

- Fittings and hoses are rated for different pressures. It is important to know the pressure rating of the equipment you are using to avoid catastrophic failure



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Pressure Fittings

- It is also important to use fittings that are compatible and the correct sealing methods
- A fitting might seal with an O-ring, Teflon tape or metal to metal contact
  - If it seals with a O-ring it is important to inspect the O-ring regularly for damage and cracking

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Knowledge Check 3

- True or False: It is important to match your pressure fittings to prevent leaks

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Knowledge Check 3

- True: Not all fittings are designed to fit together (and sometimes it can be hard to tell) but it is important to check that your fittings are compatible otherwise you risk leaks or catastrophic failure

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How to Reduce Risk of Pressure Hazards

1. Install valves that are easily accessible
2. Store properly and away from heat
3. Train personnel dealing with compressed gasses on proper use
4. Examine the system periodically for leaks, cracks or dents
5. Operate the system for the pressures it was designed for
6. Bleed residual pressure out of the system
7. Keep pressure systems clean
8. Keep pressurized hoses as short as possible and minimize pressure fittings
9. Examine labels of the gases you are using

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Important Things to Remember

- Do not use copper fittings on acetylene tanks – this could cause an explosion
- Release all pressure from the system by closing the valve on the tank and then bleeding off residual pressure
- Purge all lines of flammable gasses before exposing it to heat and flame
- Do not force connections to fit together and do not cross thread
- Follow the SDS and manufactures guidelines for all compressed gasses

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End of Show

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