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# Compressed Gas Safety

# OSHA Regulations

- 29 CFR 1910.101 - Compressed Gases


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# Hazards of Compressed Gas Cylinders

- Chemical Hazards
- Physical Hazards

# Compressed Gases

- Chemical Hazards
  - Inerts
  - Oxidizers
  - Flammable
  - Toxic

# Chemical Hazards of Compressed Gas Cylinders




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# Oxidizers

**OXYGEN & GAS MIXTURES**

- OXYGEN CONCENTRATION >23.5%

# Oxidizers

- SUPPORTS COMBUSTION.
- NEVER ALLOW PETROLEUM-BASED PRODUCTS TO COME INTO CONTACT WITH OXIDIZERS.
- SEPARATE FROM COMBUSTIBLES & FLAMMABLES IN STORAGE.
  - 20’ DISTANCE, OR
  - 5’ HIGH, 1/2 HOUR FIRE WALL

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# Oxygen

- Odorless, colorless gas
- Non-flammable but is necessary for other material to burn
- Hyperoxia

# Oxygen Cylinder


# Inerts

**NITROGEN, ARGON, HELIUM, CO2**

- Simple Asphyxiants which can displace oxygen
- Will not support life

# Inerts

- USE IN WELL VENTILATED AREAS
- DO NOT DISPOSE OR VENT OFF UNUSED QUANTITIES.
- MONITOR FOR OXYGEN > 19.5% WHEN USED IN CONFINED SPACE

# Inerts

# Argon

- Odorless, colorless gas
- Can be stored with flammables or combustibles.

# Flammables

**ACTYLENE, PROPANE, PROPLYENE**

- Gas flammables in concentration of 13% or less in air by volume
- Gas in flammable range greater than 12% by volume


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# Flammables

- STORE IN A WELL VENTILATED LOCATION
- KEEP AWAY FROM HEAT SOURCES
- STORE AWAY FROM OXIDIZERS AND COMBUSTIBLES

# Flammables

# Acetylene

- Slight garlic-like odor
- Burns easily in air
  - 2.5% LEL - 99% UEL
- May be explosive under high pressure
  - Used at 15 psi or less

# Toxics

**ARSINE, NITROGEN DIOXIDE, BORON TRICHLORIDE**

- Material capable of causing death or serious debilitation
- In absence of data on human toxicity tested on laboratory animals has a LC50 value


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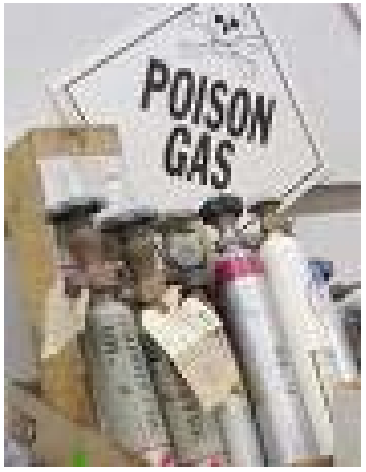
# Toxics

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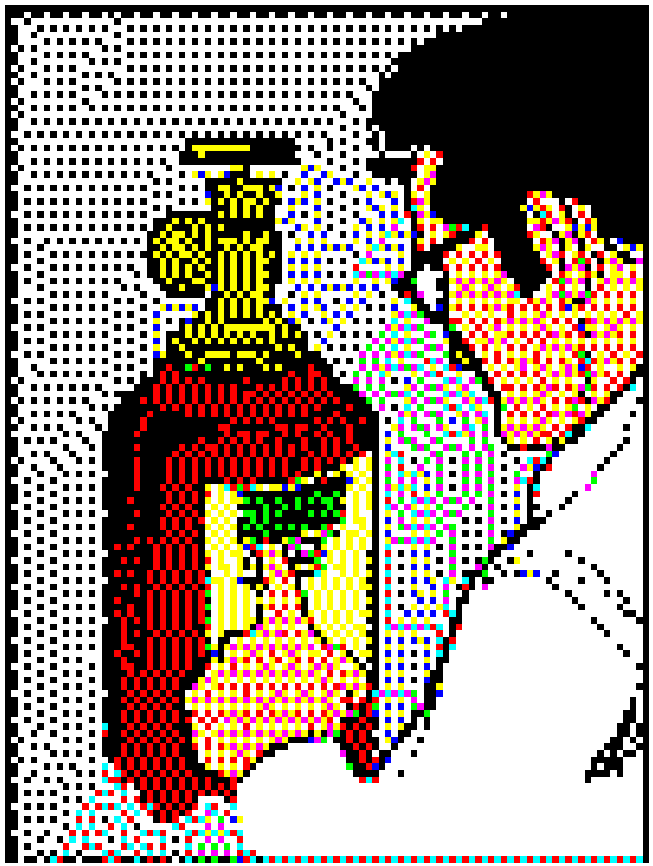
# Cylinder Identification

- Every Gas Cylinder or Vessel Must Be Clearly Labeled
  - Product Name
  - DOT ID Number
  - DOT Hazard Class
  - Manufacture Name & Location
  - Precautionary Statement



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# Cylinder Identification

- Never rely on color of cylinder for identification.
- Color of cylinder may vary by manufacturer or owner.
- Always use product label to properly identify contents.


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# Cylinder Identification

- Never modify, cover or remove a label.
- If cylinder label becomes illegible or detached
  - Write product name with black marker.
  - Mark as “contents unknown” if unknown.
  - Contact manufacturer or distributor.

# Physical Hazards of Compressed Gas Cylinders

- Pressure
- Weight
- Stability
- Mechanical Failure
- Movement

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# Recognize the Hazards

## Pressure

- Causes
  - Typical High Pressure Cylinders have 1800 – 3000 PSI
  - Not regulating pressure
- Consequences
  - Uncontrolled release
  - Activation of relief device
  - Container failure

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# Recognize the Hazards

## Weight

- Causes
  - This stuff is heavy
  - Nitrogen 160
    - 251 lbs
  - Argon 450
    - 1059 lbs

### Common Industrial Cylinder Dimensions

#### Standard High Pressure Cylinders


| Size | 20 | 40 | 60 | 80 | 125 | 150 | 200 | 300 |
|---|---|---|---|---|---|---|---|---|
| Volume (cf) | 20 | 40 | 60 | 80 | 125 | 150 | 200 | 300 |
| Tare Weight (lbs) | 11 | 24 | 29 | 47 | 58 | 61 | 117 | 139 |
| Height (inches) | 14 | 17 | 23 | 32 | 43 | 47 | 51 | 55 |
| Diameter (inches) | 5 | 7 | 7 | 7 | 7 | 7 | 9 | 9 |
| Water Capacity (liters) | 3.5 | 7.8 | 10.3 | 15.4 | 21.6 | 23.4 | 43.2 | 49 |

*All values are approximate*
*Tare weight includes valve but excludes cap. Standard cap is 5 inches in length and 2 pounds in weight*

#### Propane* Cylinders


| Size | 20 | 33 | 60 | 100 |
|---|---|---|---|---|
| Volume (lbs) | 20 | 33 | 60 | 100 |
| Tare Weight (lbs) | 26 | 36 | 48 | 77 |
| Height (inches) | 19 | 27 | 44 | 49 |
| Diameter (inches) | 12 | 12 | 12 | 15 |
| Water Capacity (liters) | 21.6 | 36.3 | 64.8 | 108.4 |

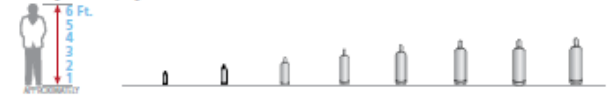
*All values are approximate*
*Tare weight includes valve but excludes cap. Standard cap is 5 inches in length and 2 pounds in weight*
**Measurements represent steel cylinders. Aluminum cylinders also available.*

#### Propylene Cylinders


| Size | 6 | 25.5 | 60 | 100 |
|---|---|---|---|---|
| Volume (lbs) | 6 | 25.5 | 60 | 100 |
| Tare Weight (lbs) | 8 | 25.9 | 48 | 75 |
| Height (inches) | 22 | 33 | 44 | 48 |
| Diameter (inches) | 6 | 9 | 12 | 15 |
| Water Capacity (lbs) | 8 | 26 | 48 | 75 |

*All values are approximate*
*Tare weight includes valve but excludes cap. Standard cap is 5 inches in length and 2 pounds in weight*

#### Acetylene Cylinders




| Size | MC | B | AC75 | SM | MED | LG310 | LG390 | LG420 |
|---|---|---|---|---|---|---|---|---|
| Volume (cf) | 10 | 40 | 60-75 | 110-140 | 200-250 | 300-340 | 397 | 420 |
| Tare Weight (lbs) | 8 | 25 | 43 | 70 | 120 | 168 | 170 | 178 |
| Height (inches) | 13 | 20 | 26 | 34 | 38 | 41 | 46 | 49 |
| Diameter (inches) | 4 | 6 | 7 | 8 | 10 | 12 | 12 | 12 |
| Water Capacity (liters) | 2.0 | 7.6 | 14.0 | 25.0 | 42.7 | 53.3 | 68.0 | 71.7 |

*All values are approximate*
*Tare weight includes valve but excludes cap. Standard cap is 5 inches in length and 2 pounds in weight*

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# Recognize the Hazard

## Weight

- Consequences
  - Smashed finger
  - Back strain
  - Broken foot
  - Internal injuries
  - Amputation

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# Recognize the Hazard

## Stability

- Causes
  - Naturally unstable
  - Transitions
  - Uneven surfaces
  - Debris on floors
- Consequences
  - Falling cylinder
  - Falling piles
  - Liquid container tipping over

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# Recognize the Hazards

- Mechanical Failure
  - Cylinder
  - Valves
  - Regulator

# Recognize the Hazards

## Mechanical Failure

- Causes
  - Over pressurization
  - Backflow
  - Flashback
  - Damaged in transportation
  - Worn threads
  - Valve packing and seats
- Consequences
  - Flying debris
  - Property damage
  - Injury/Death

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# Recognize the Hazard

## Movement

- Causes
  - Lose of control while rolling
  - Trying to catch falling cylinders
  - Miss alignment of cart hooks
  - Failure to secure to cart

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# Recognize the Hazards

## Movement

- Consequences
  - Smashed hand
  - Back strain
  - Shoulder strain
  - Broken foot
  - Internal injuries
  - Finger amputation

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# Cylinder Storage

- Store in dry, ventilated location.
- Secure from falling or rolling.
- Protect from falling objects.
- Do not use as a door stop.
- Keep valve closed when not in use.


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# Cylinder Storage

- Store with valve closed and cap on.
- Hand tighten caps.
- Do not store in extreme temperatures near flames or direct heat.
- If ice and snow accumulate on cylinders, thaw at room temperature.
- Do not store near gasoline.

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# Cylinder Storage

- Fuel gas
  - Always in upright position.
  - 20 feet from oxygen & combustible material.
  - Never place anything on top of cylinder.
- Oxygen
  - 20 feet from flammable or combustible material.
- Separation can be 1 hour fire wall.
- Cylinders in use or connected can be stored together.

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# Cylinder Handling

## Personal Protective Equipment

# Cylinder Handling

- Protect valve, couplings, regulators, hose and apparatus from oil & grease.
- Never drop or strike a cylinder.
- Do not lift cylinder by cap.
- Do not weld on lift attachments.

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# Cylinder Handling

- If cylinder does not have a fixed valve handle, a non-adjustable wrench must be with the cylinder while in use.
- Valve must be closed before moving a cylinder.
  - Unless secured to a cart, regulator must be removed and cap in place.

# Cylinder Handling

- Check container for bulges, dents, pits.
- Check container and valve for corrosion.
- Do not direct a gas stream directly at any person.
- Cylinders must be kept away from actual hot work area to protect from sparks, slag, etc.
- Cylinders need a check valve to prevent backflow.

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# Cylinders & Regulators

- Never attempt to repair or modify a regulator.
- Before attaching to cylinder
  - Stand to one side of cylinder outlet
  - Open valve slightly, then close
  - Never use Teflon tape on a CGA fitting
- Before removing from cylinder
  - Close cylinder valve
  - Release gas from regulator

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# Cylinders & Valve Leaks

- NEVER USE A LEAKING CYLINDER.
- Attempt to stop leak by closing valve.
- Move outdoors & away from ignition sources, allow to slowly empty.
- Tag or mark cylinder to warn others that it is leaking.

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# Cylinders & Fire

- Move cylinders away from fire if possible.
- Use water to keep cylinders cool.
- Inform emergency personnel of type & amount of gas on-site.

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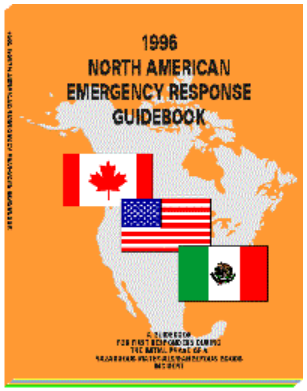
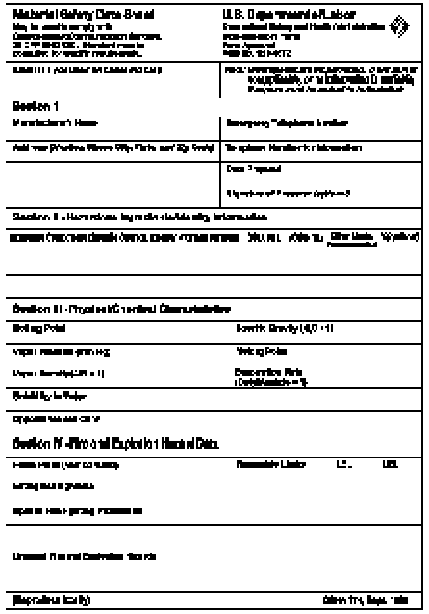
# Additional Information Sources

- Product Label
- Safety Data Sheet

  www.Mathesongas.com
- Emergency Response Guidebook







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# Summary

- Questions