

Welcome to Maintenance Welding & Safety



Welding
Safety Series



Oxy-Fuel
Safety Series



Thank you, ND, CO, KS, UT & NM LTAP



Student/Reference Manuals

110—180 pages of articles, charts, powerpoints , etc.

Maintenance Welding Student/ Reference Manual



Arc Welding Process Training
Oxy-Fuel Cutting & Safety
Practical Metallurgy
Welding Safety

April, 2019

Presented by



Maintenance Welding Student/ Reference Manual



Arc Welding Process Training
SMAW, GMAW, FCAW
Oxy-Fuel Safety
Welding Safety

October, 2019

Presented by



Maintenance Welding

PROCESSES

For our purpose: The arc welding processes most commonly used for weld repairs & surfacing in maintenance shops throughout the country.

✓ **SMAW / stick**

✓ **GTAW / TIG**

✓ **GMAW / MIG**

✓ **FCAW / flux core**



Maintenance Welding

the "unsexy" side of welding

Welding that is often performed in less-than-ideal conditions, including:

- Contaminated metals
- Out-of-position
- Dissimilar steels
- Field repairs (wind, rain, cold)
- Difficult to weld metals



Pre-Quiz

- **What do you know about welding?**
 - **Collusion encouraged**



don't be these guys

Practical Metallurgy 1

Carbon Steel

An overview of basic metallurgical principles for welders, machinists, metalworkers & associated personnel

Discussion, Q & A – encouraged at all times

- ✓ **Terminology** used in the industry
 - Elements, mechanical properties & how tested
 - Allotropes of iron; crystal structures
 - Short videos, photos & samples throughout
- ✓ Brief discussion of **heat treatments**
- ✓ **2 labs:** ¹spark test, ²quench & temper

Mechanical Properties of Steels

✓ The ability of a material to become *permanently deformed* without failure

A. Toughness

B. Malleability

C. Ductility

D. Elasticity

Mechanical Properties of Steels

- ✓ **The *measured* resistance of a metal to indentation, abrasion, deformation, or machining**

A. Hardness

B. Brittleness

C. Toughness

D. Elongation

Hardness Testing

- [Brinell hardness testing video \(3:05\)](#)
 - **Hard spherical indenter**
- [Rockwell hardness testing video \(2:30\)](#)
 - **Rounded diamond indenter**
- [Vickers hardness testing video \(2:33\)](#)
 - **Pyramid diamond indenter**

Note the grain structure of the magnified areas tested



Heat Treatments

✓ A heat treatment applied to ferrous products after hardening for the purpose of decreasing hardness & *increasing toughness*

A. Annealing

B. Quenching

C. Tempering

D. Stress Relieving

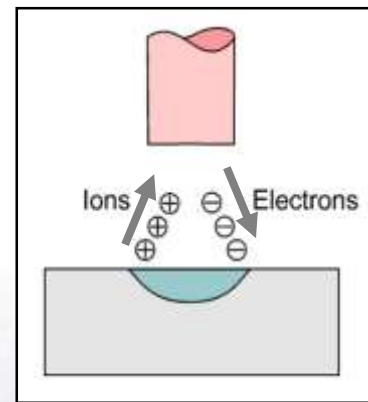


Basic Electricity & Welding Safety

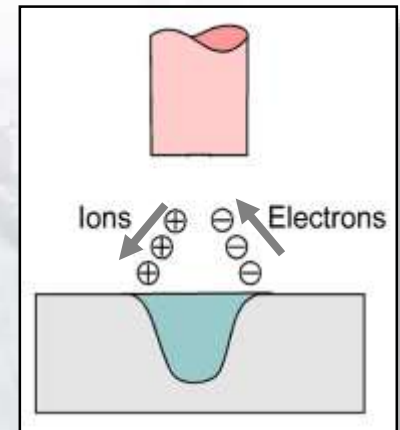


- Voltage – The electrical potential or pressure that causes current to flow
 - *Measured in Volts*
- Current – The movement of charged particles in a specific direction
 - *Measured in Amps*
 - *Direct or Alternating*
- Polarity
 - **DC-** (*Direct Current Electrode Negative*)
 - **DC+** (*Direct Current Electrode Positive*)

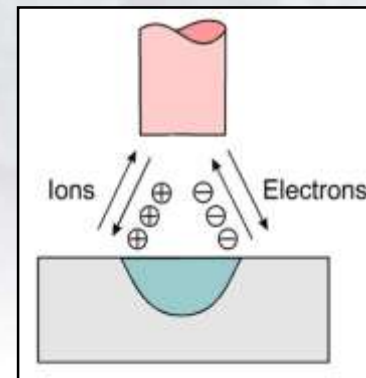
DC -



DC+



AC



- Protect yourself and others from potential hazards including:
 - *Fumes and Gases*
 - *Electric Shock*
 - *Arc Rays*
 - *Fire and Explosion Hazards*
 - *Noise*
 - *Hot objects*



Lincoln Safety [Intro.](#) (0:36)



- Electric shock can kill
- Do not touch live electrical parts
 - *Primary Voltage – 230, 460 volt input power*
 - *Secondary Voltage – 6 to 100 volts for welding*
- Insulate yourself from work and ground
- Follow all warnings on welding equipment



Lincoln Safety Module 1:
Electric Shock 9+ min.

Fumes and Gases



Lincoln Safety Module 2:

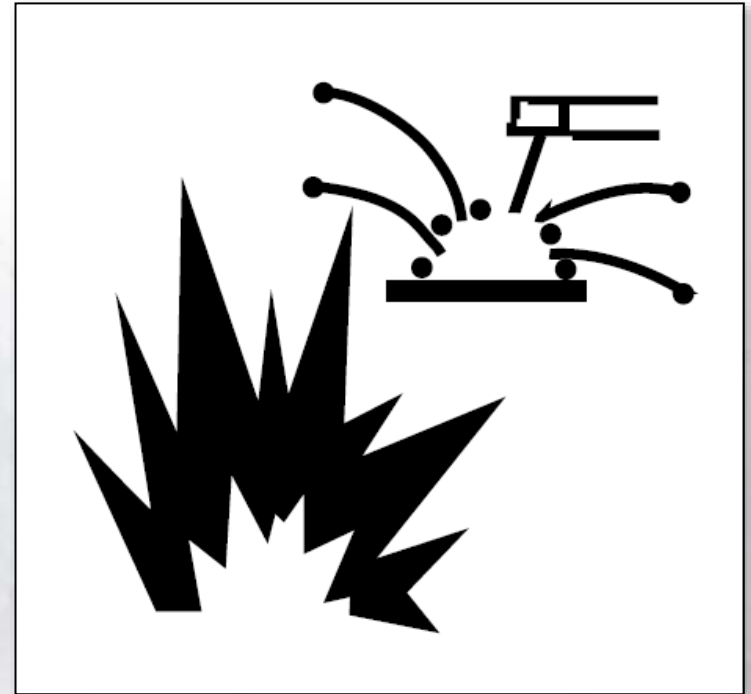
Fumes & Gases < 8 min. total

- Fumes and gases can be hazardous to your health
- Keep your head out of the fumes
- Use enough ventilation, exhaust at the arc, or both, to keep fumes and gases from your breathing zone and the general area
- See product labeling and MSDS for ventilation and respirator requirements

Ventilation 3:56-7:45

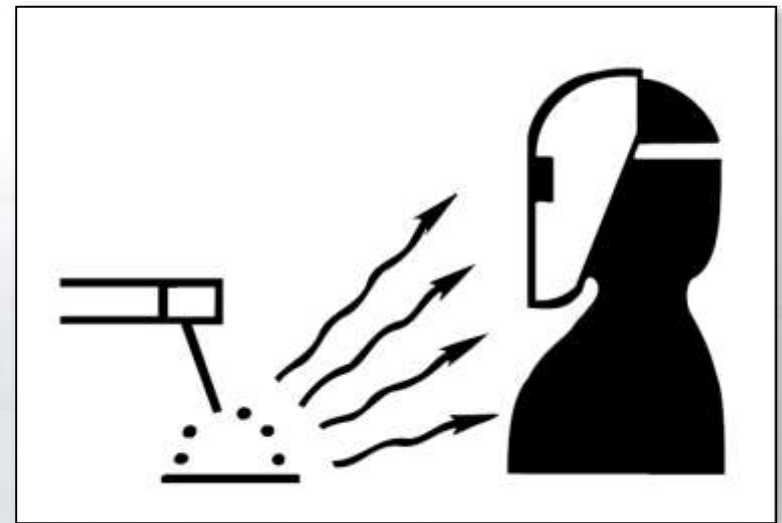
Fire and Explosion Hazards

- Welding sparks can cause fires and explosions
- Sparks and spatter from the welding arc can spray up to 35 feet from your work
- Flammable materials should be removed from the welding area or shielded from sparks and spatter
- Have a fire extinguisher ready
- Inspect area for fires **30 minutes** after welding



Lincoln Safety Module 3:
Fire & Explosions 7+ min.

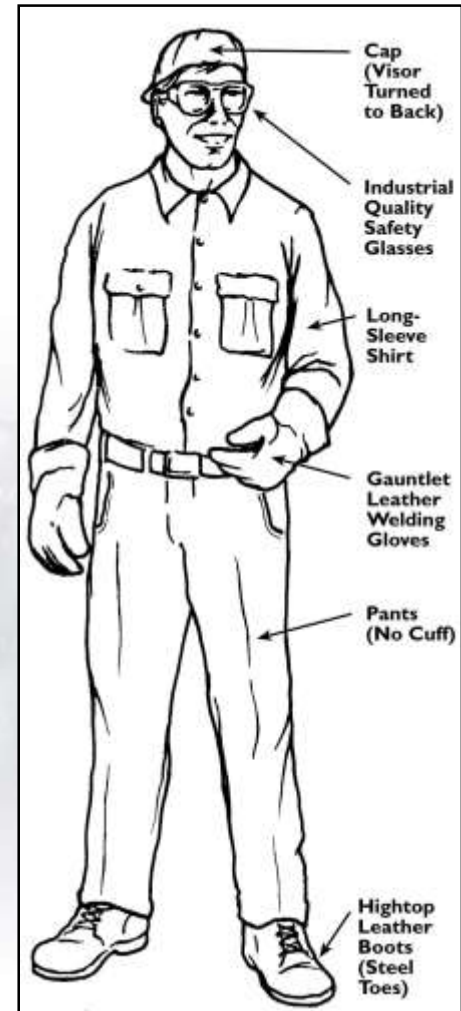
- *Arc rays can injure eyes and burn skin*
- *The welding arc is brighter than the sun*
- *Precaution must be taken to protect your eyes and skin from UV radiation*
- *Wear correct eye and body protection*



Lincoln Safety Module 4:
PPE 9:17

Welders must wear protective clothing for

- *Protection from sparks, spatter and UV radiation*
- *Insulation from electric shock*
- **Protective clothing includes ...**
 - *Fire-proof clothing without rolled sleeves, cuffs or frays*
 - *Work boots*
 - *Welding gloves, jackets, bibs, and fire-proof pants*
 - *Welding cap, helmet and safety glasses*
 - *Ear protection – ear plugs and muffs*



Oxy-Fuel Cutting & Heating

- **Fuel gasses used**
- **Cylinder safety practices**
- **Equipment**
- **Safety gear**
- **Alternative Fuels**
- **Victor Technologies Safety Checklists**



Cylinder *un*-Safety



This was an accident that occurred in Russia. Russians have dash cams in order to provide additional evidence in court, to guard against police corruption and insurance fraud.

Highway to
[Hazmat] Hell
(3:40)



Oxygen

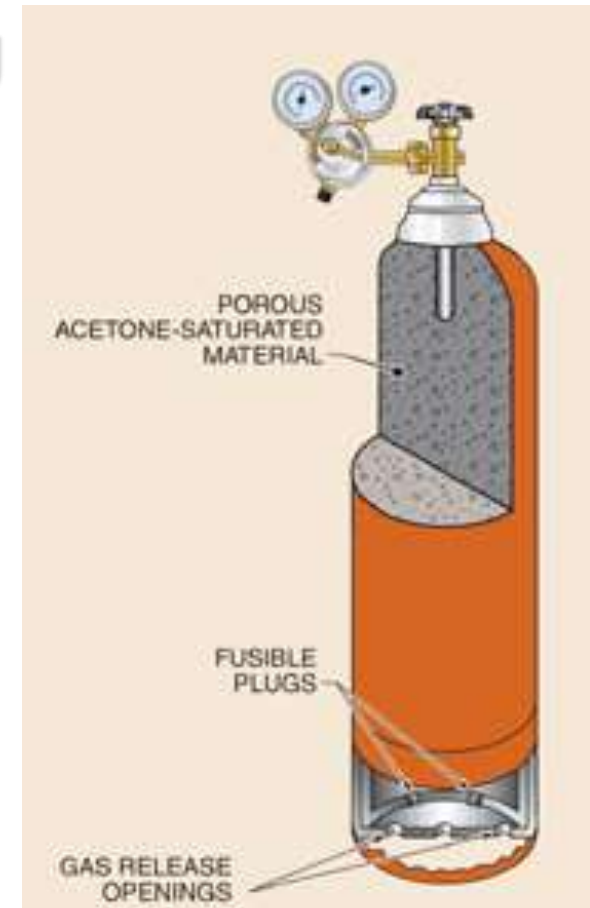
- Separated from other gases in air.
- Cylinders are made from seamless drawn steel.
- Cylinders are hydrostatically tested to around 3,300 psi
- Cylinders are equipped with a **high-pressure (back-seating) valve**.
- Protector cap screws onto neck ring.



**Never use O₂
as compressed
air**

Acetylene

- **Gas with distinctive, nauseating odor; highly combustible when mixed with oxygen; highly unstable at pressures above 15 psi. Explosive at 29 psi.**
- **Calcium carbide and water.**
- **Cylinder packed with porous material (agamassan).**
- **Equipped with fusible plugs.**



Acetylene Cylinder

Cut-away view of inside of the cylinder showing type of valve, felt pad in neck & agamassan material that is saturated with acetone.



Acetylene

- Opened with valve handle, or on older style cylinders...a special square wrench (key) is used.
- For considerable amounts of welding, a manifold system may be used.
- Flash arrestors prevent an explosion or backfire from reaching the regulator or cylinder.



ESAB Welding and Cutting Products

Cylinder Safety

- To move a cylinder, rotate it on its bottom edge while walking behind cylinder (Never walk to the side of cylinder).
- Never lift a cylinder by the protector cap.
- Always keep cylinders in a vertical position.
- Do not allow grease or oil to contact cylinder valves.



Cylinder Safety

- **Avoid exposing cylinders to furnace heat, radiators, open fire, or sparks from a torch.**
- **Shut off cylinder valves completely before moving cylinders.**
- **Do not tamper with or attempt to repair cylinder valves.**
- **Never wrap electrical wires or welding cables around cylinders, or gauges.**

[Acetylene fire surveillance video](#)

(2 min.)

Cylinder Safety

- **Keep valves closed on empty cylinders.**
- **Cylinders should be chained during use and when stored.**

[Guy runs away, knocks himself out – stupid video \(0:36\)](#)

oops!



ACETYLENE
CYLINDERS

Equipment



- **Oxy-Fuel Torch**
 - Welding tips
 - Cutting tips
 - Specialty tips
 - Heating tips (“rosebud”)
- **Valves & Regulators**
- **Flashback Arrestors or Check valves**
- **Hoses**

Equipment

- **Sparklighter**
- **Goggles or glasses & face shield**
- **Apron, shop coat, or coveralls**
- **Leather coats, sleeves, or capes.**
- **Leather gloves**



Other Gases Used in Oxy-Fuel Systems



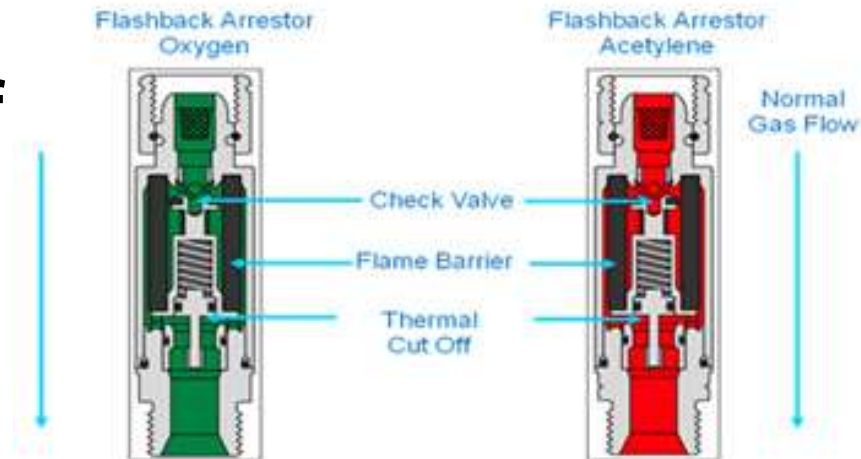
- **MAPP gas**
(Methylacetylene propadiene stabilized)
- **Hydrogen**
- **Propane**
- **Natural gas**
- **Propylene**



Backfire & Flashback

Backfire – A quick recession of the flame into the welding/cutting tip, typically followed by extinction of the flame.

Flashback – A recession of the flame into the mixing chamber of the torch. (Usually accompanied by a loud “pop”).



Oxy-Fuel Safety

A big thank you to Victor Technologies for the well-produced Oxy-Fuel Safety video training program included here.



INNOVATION TO SHAPE THE WORLD



[Acetylene cylinder clip](#)

Thanks for attending Maintenance Welding & Safety



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