

## Lesson 1.5: Fact Sheet - Welding Safety – Compressed Gasses, Fumes and Fire

### Compressed Gasses

#### **Welding shop compressed gas cylinders contain:**

- Shielding gas for GMAW and GTAW typically consist of Argon, Carbon Dioxide, and a mixture of these two gasses
- Oxygen and fuel gasses, typically acetylene, for welding and cutting processes

#### **Parts of a cylinder:**

1. Valve handwheel
2. Valve pack nut
3. Valve outlet connection
4. Safety device
5. Cylinder collar
6. Cylinder cap
7. States that the cylinder conforms to DOT-3A
8. Serial number
9. Date of initial hydrostatic testing
10. Inspector's insignia for testing
11. Valve outlet cap

#### **If the valve of the cylinder breaks off:**

- The cylinder can release the gas quickly, possibly leaking hazardous or flammable gas into the air
- May cause the cylinder to spin
- Make a loud whistling sound
- May possibly become airborne like a rocket that can even break through block wall

#### **The cylinder valve can break off through improper use:**

- Dropping a cylinder without the cap on
- Using tools to open a stuck valve
- Tampering with or attempting to repair a valve
- Valve hitting another surface, or an object hitting the valve

#### **What can cause compressed gas cylinders to explode?**

- Striking an arc on the cylinder
- Exposing the cylinder to excessive heat
- Damage from a cylinder falling over
- The cylinder being part of an electrical circuit
- Oil or grease on the cylinder, valve, or regulators
- Anything else that may cause weakness or cracks in the cylinder wall

#### **Compressed gas safety**

- The most common hazard with compressed gas cylinders is falling on a person
- This typically happens while transporting the cylinder
- Cylinders are heavy and awkward to handle
- Take special care in storing, transporting, and using gas cylinders to prevent this and other safety hazards

**Storing Cylinders**

- Keep cylinders upright and secure with a chain or strap at all times in a manner that prevents tipping and falling
- Store empty cylinders away from full cylinders
- Mark empty cylinders as empty (MT)
- Store away from doorways and pathways
- Valves need to be closed and cylinder caps on
- Separate oxygen cylinders from fuel gas cylinders, like acetylene, at least 20 feet apart or with a noncombustible barrier
- Store cylinders in a well-ventilated area

**Transporting cylinders**

- Use a hand cart with the cylinder upright and securely chained or strapped in
- Do not attempt to drag or roll cylinders
- The cylinder cap must be on at all times through transportation
- Never lift a cylinder by the cap
- Use approved devices only when transporting by crane or lift truck

**Using compressed gasses**

- Never use cylinders as supports or rollers
- Never attempt to mix gasses or refill a cylinder
- Never tamper with the identification tag or other markings
- Never use tools to attempt to open a valve; it must be returned to the supplier if it cannot be opened by hand
- Never strike an arc on a cylinder
- Never expose cylinders to open flame, hot slag, sparks, and other heat sources
- Never tamper with safety devices
- Read the label on the cylinder and identify the contents by the proper name
- Keep in upright position and chained securely
- Before connecting to a regulator, stand on one side of the cylinder and “crack” the valve open slightly, then close to blow dust and dirt from the valve
- Keep oil and grease away from cylinders and valves
- Use in a well -ventilated area

**Oxyacetylene**

- Call oxygen and fuel gasses by proper name
  - Use “oxygen” instead of “air”
  - Use “acetylene” (or other fuel gas) instead of “gas”
- Oxygen hoses are always green

- Fuel gas hoses are always red
- Fuel gas connections are always left-hand threaded
- Do not use oil or grease around oxygen cylinders or valves
- Check torches and attachments for leaks using mild soap and water
- Use a striker only to light oxyacetylene flames; matches, lighters, welding arc, etc. shall not be used to light a torch
- Direct torch away from self, people, and flammable material before lighting
- Acetylene cylinders need to be moved, used, and stored in an upright, vertical position to avoid “spitting” acetone
- Open an acetylene valve no more than 1-1/2 turns
- Never force connections to fit; this could cause cross-threading and other damage to connections resulting in leaks
- Follow proper steps for equipment set up, lighting the torch, and stopping work

### **Welding Fumes and Ventilation**

#### **Welding fumes come from:**

- |                 |                                 |
|-----------------|---------------------------------|
| • Base metal    | • Fluxes                        |
| • Consumables   | • Coatings on the base metal    |
| • Shielding gas | • Cleaners used on the base met |

#### **Side effects and symptoms of welding fume overexposure include:**

- |                        |             |
|------------------------|-------------|
| • Irritation of eyes   | • Nausea    |
| • Irritation of skin   | • Dizziness |
| • Respiratory problems | • Headaches |

#### **Chemicals that produce harmful fumes:**

- |                            |                       |
|----------------------------|-----------------------|
| • Zinc                     | • Phosgene            |
| • Copper                   | • Carbon monoxide     |
| • Cadmium                  | • Ozone               |
| • Lead                     | • Nitrogen oxides     |
| • Fluorides                | • Hexavalent chromium |
| • Chlorinated hydrocarbons |                       |

#### **Zinc and Copper**

- |                                                              |                               |
|--------------------------------------------------------------|-------------------------------|
| • Zinc and copper are used in making brass                   | • Symptoms similar to the flu |
| • Zinc is used as coating for metals, like galvanized metals | • Chills                      |
| • Copper is used as a coating on GMAW wire                   | • Nausea                      |
| • Overexposure can cause “metal fume fever”                  | • Cough                       |
|                                                              | • Fatigue                     |
|                                                              | • Fever                       |

**Cadmium**

- Used as a coating on steel to prevent rust and brazing filler metals
- Classified as a potential human carcinogen according to OSHA, NIOSH and EPA
- Overexposure can cause lung irritation
- Acute exposure can cause pulmonary edema and, rarely, death
- Long-term exposure can cause emphysema and kidney damage

**Lead**

- Found in some alloys and lead-based paint
- Overexposure can cause lead poisoning
- Symptoms include:
  - Metallic taste in mouth
  - Nausea
  - Abdominal cramps
  - Insomnia
- Long-term exposure can cause damage to the nervous system, circulatory system, reproductive system, kidneys, and muscles

**Fluorides**

- Used in fluxes
- Overexposure can cause irritation to the eyes, nose and throat
- Long term exposure to high levels can cause pulmonary edema, bone damage, and skin rashes

**Chlorinated hydrocarbons and phosgene gas**

- Used in solvents for degreasing or cleaning
- Must be kept away from ultraviolet radiation and intense heat from the welding arc
- Ultraviolet radiation from the arc will decompose vapors and form a toxic phosgene gas
- Phosgene gas reacts with moisture in the lungs, producing hydrogen chloride which destroys lung tissue

**Carbon monoxide**

- Produced by welding and cutting
- When carbon dioxide is used as a shielding gas, there is a “breakdown” of the shielding gas while welding that can produce carbon monoxide.
- Overexposure can cause dizziness, nausea, headache, and ringing in the ears

**Ozone (O3) and Nitrogen Oxides**

- Produced by ultraviolet light from the arc, especially with GMAW and GTAW processes
- Can cause irritation to mucous membranes
- Ozone overexposure can cause headache, chest pain, dryness of the upper respiratory tract
- Nitrogen Oxide overexposure can cause irritation of the eyes, nose and throat
- Long term exposure may affect the lungs

**Hexavalent Chromium**

- Produced while welding stainless steel
- The chromium in stainless steel turns hexavalent with the heat of the arc

- High exposure can cause irritation to the eyes, nose, and throat. It can also affect the lungs and possibly cause lung cancer

**Manganese**

- Used as an alloy in many metals and welding wires
- Overexposure may cause damage to the lungs, liver, kidneys, and central nervous system

**How to avoid exposure**

- Proper ventilation while welding is designed to prevent exposure from hazardous fumes and chemicals.
- Make sure the ventilation system in your school's welding shop is turned on before you start welding.
- If using a cleaning agent on your base metal, make sure it is completely dry before welding
- Remove paint or other coatings off of metal before welding
- Position your body and head so that your face stays out of the weld plume
- Position your work so that the ventilation system carries the fumes away from your face

**More information**

- Information on these and other hazardous chemicals can be found in Material Safety Data Sheets (MSDS), warning labels, or by information provided by OSHA, ANSI, and other health and safety related agencies
- An MSDS is available for each chemical used
- Ask your teacher where to find MSDS

**Fire and Explosion****Examples of fire/explosion hazards**

- Sparks
- Slag
- Molten Metal
- Hot surfaces
- Containers

**Sparks**

- Sparks are formed and flying during most welding, cutting, and grinding processes
- Sparks are the main cause of fires in a welding shop
- Sparks can travel as far as 35 feet and can get anywhere including your clothing
- It can be difficult to know where sparks are landing while you are welding.
- Cutting and grinding processes give you the most control over where sparks land.
- While grinding or cutting, watch the spark stream to make sure that it is not coming in contact with flammable material, like paper, cardboard, rags, plastic, and especially people
- Put up a screen or other type of barrier while grinding to prevent sparks from hitting other people or flammable material
- Clear the welding area of all flammable chemicals, liquids, and materials

- The fumes from flammable chemicals and liquids are combustible
- If you smell fumes from any flammable chemical, liquid, or gas, do not weld until the source of the fumes is gone and the fumes are dispersed
- If welding or cutting over wood flooring, you must wet it with water, cover it with wet sand, or cover it with a sheet of metal
- After welding or cutting, thoroughly inspect the surrounding area for fires
- Fires can smolder for a while without clearly visible smoke or flame
- If welding on metal with a combustible coating, such as paint, remove the coating before welding
- If you weld over paint or a combustible coating, you may not see the flames until you are done with the weld, giving the fire time to spread
- Make sure you are not flammable!
- Never cuff your pants or wear a shirt with open pockets in the front- this provides a great area for sparks to land and smolder, creating opportunity for your clothing to catch fire
- Never wear frayed clothing (holes in jeans, loose threads, etc.)- frays provide excellent opportunity for heat or sparks to create fire
- Never have a lighter or matches in your pockets while welding- a spark could ignite these
- Know your school's fire procedure!
- Know the escape route in case of fire
- Know the locations of all fire extinguishers, fire blankets, or other fire extinguishing equipment

Fires and explosions can be prevented; be aware of your surroundings and take proper precautions!