Texas High School Welding Series

2021-2022

Study Manual

Oxy-Fuel Cutting

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1) GENERAL SAFETY INSTRUCTIONS FOR COMPRESSED GAS

a) Wear proper eye protection or face shield with properly tinted lens at all times

b) Obtain instructor's permission every time before using Compressed gases.

c) Make sure to store fuel gas Cylinders separately from oxygen cylinders

d) Keep all compressed gas and fuel cylinders upright and chained or secured at all times.

e) Gas cylinders should be stored either outside or in a well ventilated area.

f) Do not bump or put pressure on pipes, connections, valves, gauges or other equipment connected to compressed gas cylinders .

g) Check for leaks thoroughly before using the oxy-fuel equipment.

h) Avoid using equipment exposed to oil or grease.

i) Always perform cuts or welds in well ventilated areas.

j) Always have approved fire extinguishers on hand when using oxy-fuel equipment.

k) Make sure all cylinders without regulators or other apparatuses attached have caps screwed on.

l) All equipment that discharges gas should always be pointed away from the operator.

2) Oxy- Fuel Equipment

a) Torch - a torch is an assembly that mixes gases and discharges them to support a controlled flame.

b) Cylinder - a gas cylinder is a long cylindrical tank with extremely thick walls built to hold gases under large amounts of pressure.

c) Valves and Regulators - Valves and regulators are devices that control or regulate the flow of gas

   i) Valve - a device that allows the gas to flow from the cylinder

   ii) Regulator - a device that keeps the pressure of the flowing gas at a constant rate.

d) Hoses - hoses are flexible reinforced lines that carry the gasses from the regulator to the workpiece.

e) Gauge - a gauge is mounted on the Regulator to measure and indicate the pressure in the hose, tank, or manifold.

3) Setting up Oxy - Fuel

a) After all components are assembled, the following sequence is used to turn on the compressed gases. (make sure the area is properly ventilated and your wearing proper PPE)

   i) Close the acetylene valve on the torch.

   ii) Close the oxygen valve on the torch.

   iii) Turn the acetylene regulator handle counterclockwise until no spring tension is felt.

   iv) Open the oxygen cylinder valve slowly until the pressure gauge shows responds to the pressure. Open the valve all the way.

(1) Do not stand in front of the gauges when gas is being turned on.

v) Open the acetylene cylinder valve slowly a half a turn

(1) The acetylene cylinder valve is never opened more than half a turn so it can be turned off quickly and easily.

vi) Open the oxygen torch valve an eighth of a turn. Turn the oxygen regulator handle clockwise until the pressure gauge reads desired pressure. Close the oxygen valve on torch.

vii) Open the acetylene torch valve an eighth of a turn. Turn the acetylene regulator handle clockwise until the gauge read the desired pressure. Close the acetylene valve on the torch.

(1) Steps 7 - 8 purge the lines and set the regulator to a safe starting pressure.

4) Testing for Leaks

a) A leak test should always be performed when equipment is first set up, when cylinders are changed, or if the odor of acetylene is present when not in use.

b) To test for leaks, put a small amount of non-detergent hand soap and use a brush or spray around fittings. Bubbles will form where leaks exist. If a leak is found, tighten the fitting and repeat. Inform instructor if leaks still exist.

5) Lighting and Adjusting Torches

a) There are two types of torches available: welding torches used for welding, brazing, or heating and cutting torches. The following procedure is used to light and adjust both a welding or cutting torch.

i) Put on leather gloves and goggles with a No. 5 shaded lens.

ii) Open the acetylene valve an eights of a turn.

iii) Use a spark lighter to ignite the torch.

iv) Open the acetylene valve slowly until the flame just touches the tip. The flame at this point is called a **carbonizing flame.**

(1) A carbonizing flame is one with an excess of acetylene and is cooler than other types of flames.

v) Turn the oxygen valve on slowly and watch the inner flame shorten. Continue to adjust the oxygen until the long inner flame just fits the cone/cones. The flame at this point is called a **neutral flame**.

(1) A neutral flame has a correct balance of fuel and oxygen.

vi) If additional oxygen is added, cones become shorter and sharper and the flame becomes very noisy. The flame at this point is called an **oxidizing flame**.

(1) An oxidizing flame has an excess of oxygen.

b) If the torch cannot be adjusted properly, clean the tip using tip cleaners.

6) Shutting Off Torches and Bleeding Lines

a) Torches can become a hazard if they are not properly shut off. This may cause popping noise, soot, or carbon deposits in the tip.

b) To correctly shut off a torch, first close the acetylene valve and then close the oxygen valve.

c) When a torch is not in use, it is important to close every point where gas can escape. Gas should be removed from all lines and equipment.

This practice is called bleeding the lines. The following are the procedures

i) Turn off the acetylene
ii) Turn off the oxygen
iii) Open the acetylene valve on the torch until the regulator shows zero. Then close the valve on the torch.
iv) Open the oxygen valve on the torch until the regulator shows zero. Then close the valve on the torch.
v) Turn all regulator handles counterclockwise until they are easy to turn.
vi) Coil hoses over cart handles, hangers, or large part of the cylinder.
vii) Store the rig properly
    (1) Do not hang hoses on the regulator as they may break or cause leaks.

7) General Principles of OXYFUEL

a) Oxygen and Fuel Gases are stored under pressure in tanks or cylinders. They are released as individual gases through specifically designed valves, regulators, and hoses.
b) **Oxy Fuel cutting:** is a process in which steel is heated to the point that it burns and is removed to leave a thin slit called a **kerf. Slag** is formed during this process.
c) **Heating**:In heating, the temperature may be raised enough to soften the metal for bending or shaping.

d) **Brazing:**Brazing is the process of bonding with metals and alloys that melt at or above 840 degrees fahrenheit

e) **Fusion Welding**:This process takes place when metal is joined by melting it together.

8) Characteristics of Oxyfuels

a) Oxygen - oxygen is not a fuel and it will not burn on its own. However, it combines with other substances and causes them to burn. Fire triangle (fuel plus heat plus oxygen equals fire).

b) Acetylene - the fuel most suitable for welding is acetylene because it produces a cleaner weld than most other fuel gases. It also produces a more controllable flame. However, acetylene is unstable and therefore it is hazardous and needs to be handled with caution.

(1) Acetylene must not be used at a pressure greater than 15 psi. The lower the pressure, the more stable the gas is.

c) Propane and Natural Gas - Propane is available in cylinders and tanks. Natural gas is piped into buildings in urban areas. Both may be used for torch heating and cutting, but not for welding. Both gasses consume large volumes of oxygen.

d) MAPP Gas - MAPP gas is a fromulated mix of methylacetylene and propadiene gases. This gas has many of the advantages of acetylene but is more stable.

9) Cutting Steel with Oxyfuels

a) The flame - the flame should be a neutral flame when cutting, but it is more difficult to determine versus a welding torch. The cutting

torch must be adjusted to obtain a neutral flame both with and without the oxygen jet.

b) Cutting Steel - to start the cut, hold the flame over the corner and edge of the metal, at a slight angle away from the edge. The cones of the preheat flames should just not quite tough the metal. Hold the torch steady until the piece turns cherry red then press the oxygen lever and move the torch across the metal at a steady pace.

   i) Preheat: if the preheat flame is too hot or the torch travels too slow, the surface melts and leaves a rounded appearance.

   ii) Clearance: the distance from the torch to the metal, generally the tips of the flames are almost level with the surface.

   iii) Speed: Moving the torch too fast across the metal results in an incomplete cut and rough edges. Moving the torch to slow could melt and gouge the top.

   iv) Pressure: If the oxygen is too high it might cause a dished kerf at the top. Too low, the cut may not be complete.

   v) Correct: the correct cut is straight and square with a smooth face.

10) Piercing Steel

a) A cutting torch may also be used to pierce steel. To **pierce** means to make a hole.

b) To pierce steel, the cutting torch is held above the marked spot at normal preheat distance. When the spot becomes cherry red, raise the torch about a half inch and slowly press on the oxygen lever. Move the tip in a circular motion until the hole is made.

11) Cutting Pipe

a) Cutting pipe is much like piercing and cutting thin plate. To cut pipe up to 3 inches in diameter, first pierce a hole in the top of the pipe, then cut a kerf, to the left side, and one to the right. Rotate the pipe and repeat the process.

b) For larger pipes the torch is held at a right angle to the pipe and the pipe is rotated to complete the cut.

Notes: