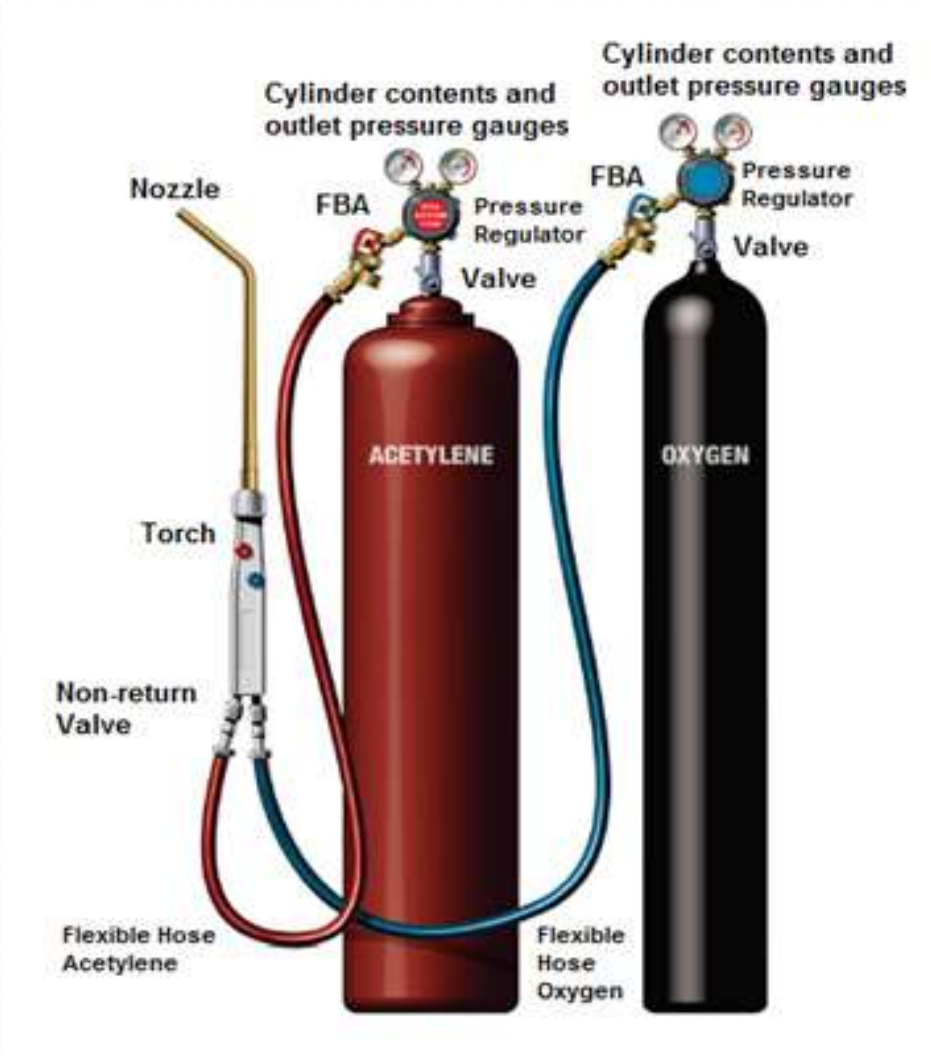
GAS CUTTING

Gas Cutting Set Up

Equipment used are:

- Gas cutting torch.
- Pressure regulators.
- Gas cylinders.
- Hoses and Hose fittings.
- Non return valve.
- Goggles and glasses.
- Gloves and apron
- Spark lighter and spanner.



Cutting Torch:

- It is used to cut materials.
- It is similar to welding torch, but can be identified by the oxygen blast trigger or lever.
- This oxygen reacts with the metal, producing more heat and forming an oxide which is then blasted out of the cut.
- The cutting torch peripheral flame only heat the metal to start the process.

Gas Hoses:

- A double-hose or twinned design can be used, meaning that the fuel and oxygen hoses are used together.
- The colour of the hoses varies between countries. In UK and other countries(except united states), the oxygen hose is blue (black-old equipment) and the acetylene(fuel) hose is maroon.
- The thread on oxygen hose is right handed and on fuel hose is left handed just to avoid accidental miss-connection.

Non-return Valve:

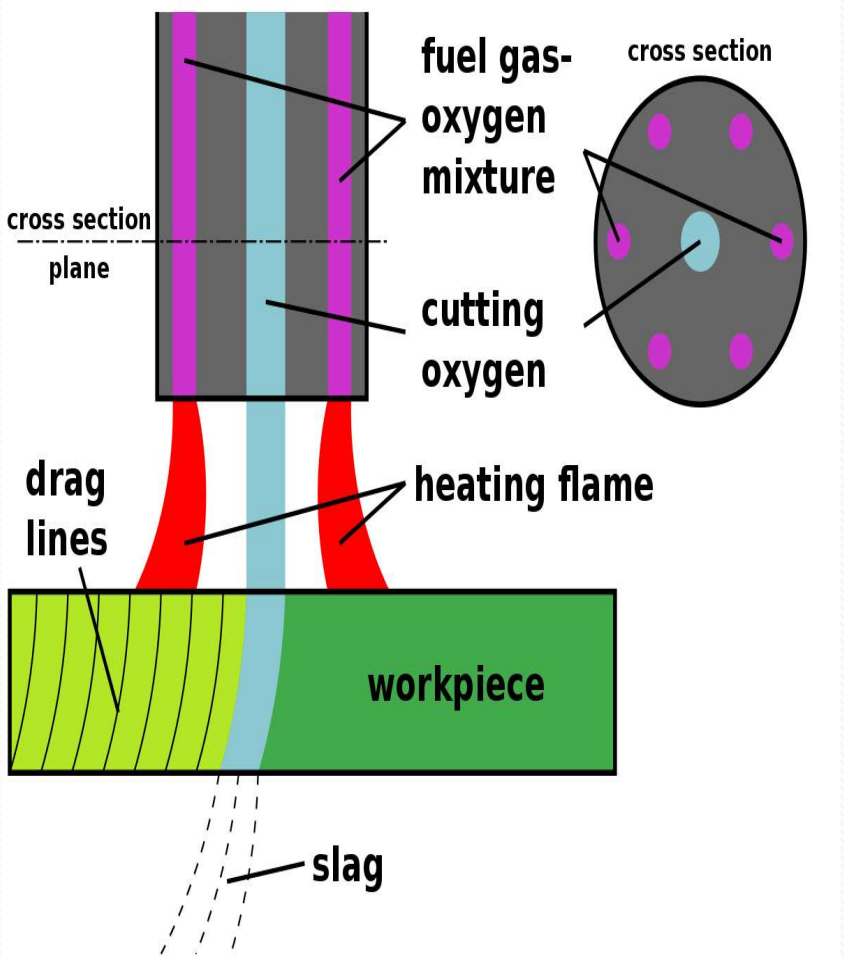
- Acetylene is not just flammable but it is explosive in certain condition.
- A Non-return Valve is needed to prevent black flow of detonation wave created by acetylene explosion.
- So , It should be installed to prevent flame or oxygen-fuel mixture being pushed back into either cylinder and damaging the equipment or causing a cylinder to explode.

Fuels:

- Oxy-fuel processes may use a variety of fuel gases, the most common being acetylene.
- Other gases that may be used
  are propylene, liquefied petroleum gas (LPG),
  propane, natural gas, hydrogen,
  and MAPP(Methylacetylene-propadiene) gas.
- LPG , Propane, Methane , Butane, Natural gas are suitable for cutting but not for welding.

Working of Oxy-acetylene Gas Cutting

- A cutting torch has a 60- or 90-degree angled head with orifices placed around a central jet.
- The process consists of preheating the metal to be cut to its kindling temperature e.g. 870° C for steel.



- The preheating is done by oxy-acetylene gas flame, which is supplied from surrounding openings of the cutting torch.
- When this temperature is attained, a jet of high pressure oxygen from a central opening of cutting torch is directed on the red hot metal.
- The metal is rapidly oxidized, and slag is formed. This slag is washed out by the jet of oxygen.
- The process of cutting steel consist of following reaction:

$$3Fe + 2O_2 \rightarrow Fe_3O_4 + \text{heat (27,000 cal.)}$$

- The metal is cut entirely by exothermic chemical action.
- The Iron and Steel itself is not melted because the rapid rate at which the oxide is produced blows them away from the cut-zone.
- The heat to keep the cut going—once it has started—is provided partly by the heating jet, and partly by the heat of the chemical action.

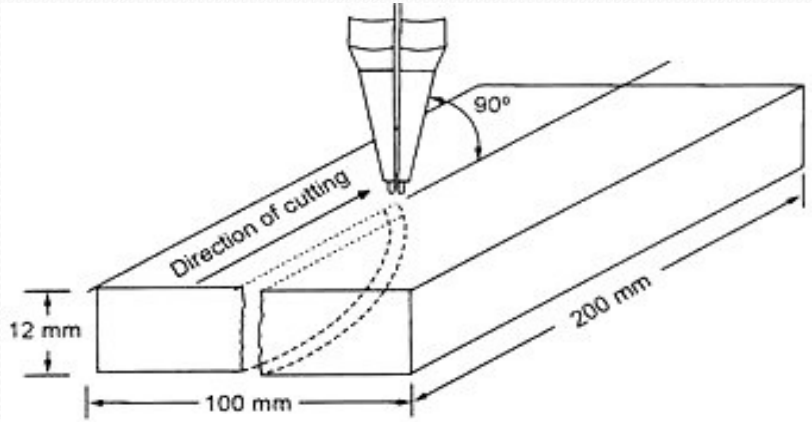


Fig. 7.1(A) M.S. Plate Cutting Procedure

- The following two points should be satisfied:

1. The melting point of the metal should be greater than the oxidation temp. of the metal.
2. The melting point of the formed oxides must be lower than that of the base metal itself.

- Although acetylene is commonly used as a fuel in this process , other gases can be used including butane, methane, propane, natural gas.

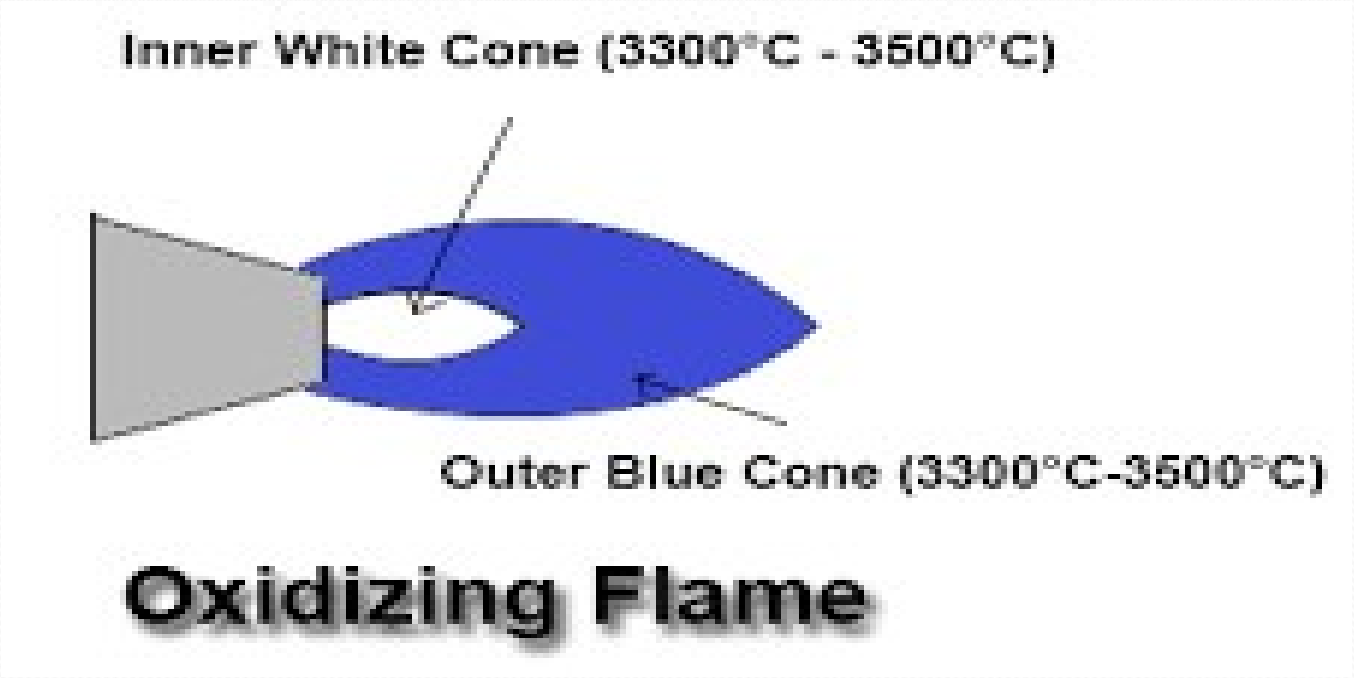
Types of Flames

1. Oxidizing flame(Excess of Oxygen)
2. Neutral flame or Natural flame (Acetylene &Oxygen in equal amount)
3. Carburizing or Reducing flame (Excess of Acetylene)

Oxidizing Flame

- It is burnt in excess amount of oxygen with 1.15-1.5 times of acetylene.
- It has highest temp amongst all flame at inner cone of 3300° C – 3500° C.
- It produces roaring sound with less smoke.
- Material-Copper ,Brass ,Zinc.
- The oxidizing flame creates undesirable oxides to the structural and mechanical detriment of most metals.

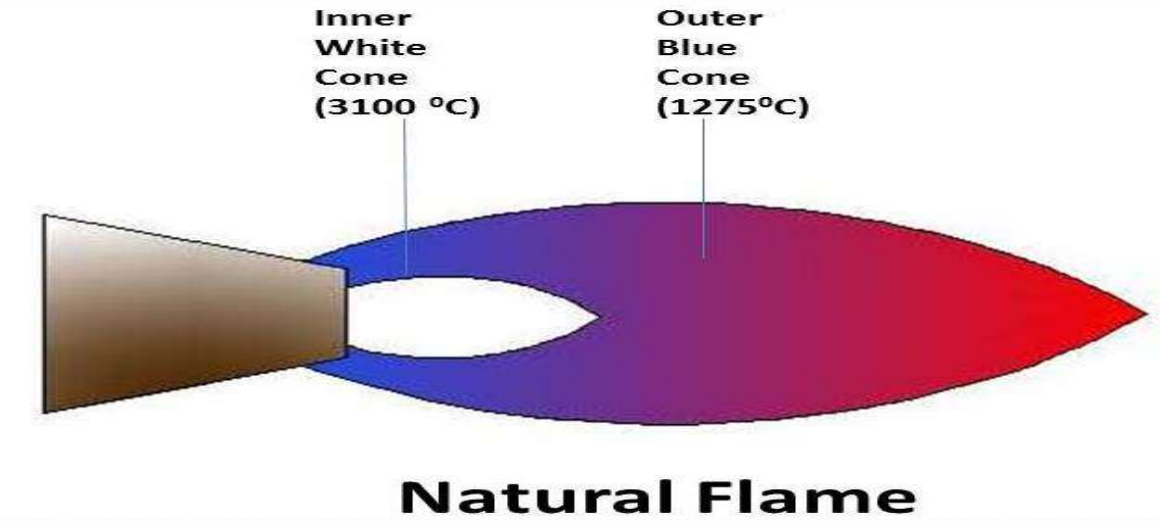
- A slightly oxidizing flame is used in braze-welding and bronze-surfacing while a more strongly oxidizing flame is used in fusion welding certain brasses and bronzes.



Neutral Flame

- It is the most generally used flame for cutting or welding.
- It is burnt with equal amount of oxygen and acetylene.
- It has flame temp of 3100° C at inner core.
- It produces hissing sound with medium smoke.
- Material-M.S, C.I, Low carbon Steel, Medium carbon steel.

- The welder uses the neutral flame as the starting point for all other flame adjustments because it is so easily defined.
- The two parts of this flame are the white inner cone and the blue outer cone. The inner cone is where the acetylene and the oxygen combined.

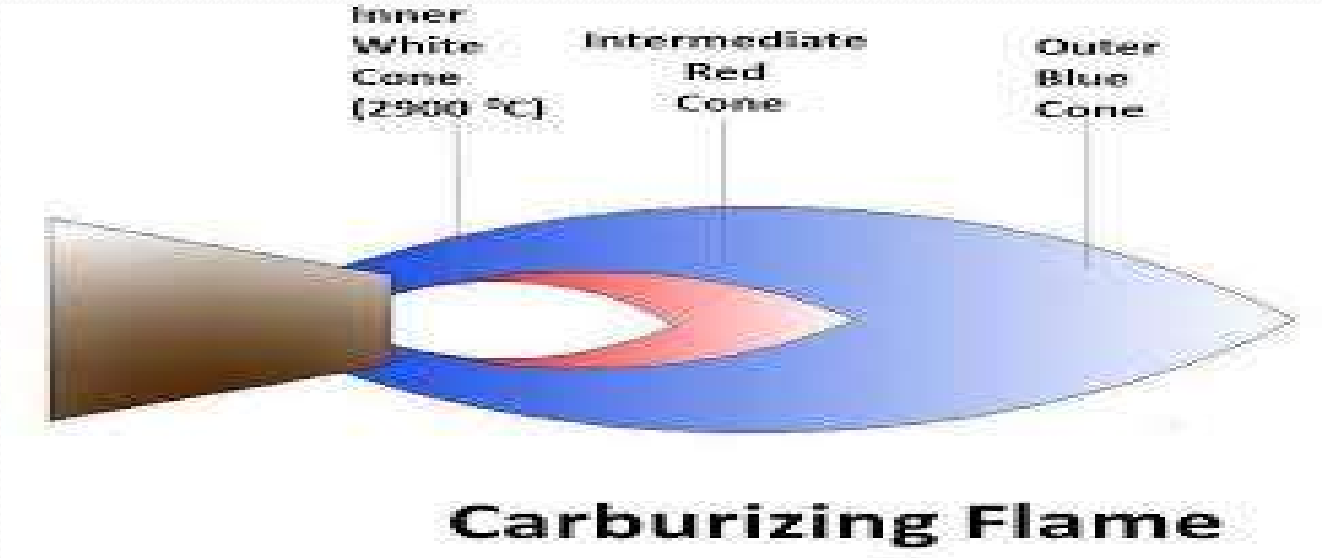


Natural Flame

Reducing Flame

- It is burnt in less amount of oxygen with 0.85-0.95 times of acetylene.
- It has flame temp of 2900° C at inner core.
- It has no sound with more smoke.
- Material-Nickel alloys, High Carbon steel.
- It has secondary luminous cone which is extra in comparison to other two types , which gives reducing effect in welding areas.

- This flame is characterized by three flame zones; the hot inner cone, a white-hot "acetylene feather", and the blue-colored outer cone.
- The reducing flame is typically used for hard facing operations or backhand pipe welding techniques.



Carburizing Flame

Limitations of Oxy-fuel cutting

- Oxy-fuel cutting is not recommended for the cast iron because its ignition temperature is higher than its melting temperature.
- The process is not appropriate for cutting stainless-steel, high-alloy chromium, chrome-nickel alloys, and non-ferrous alloys because oxides has higher melting point than base metal itself.

Applications of Oxy-fuel cutting

- Oxygen cutting would be useful only for those materials which readily get oxidized and the oxides have lower melting points than the metals. So it is most widely used for ferrous materials.
- Oxygen cutting is NOT used for materials like aluminum, bronze, stainless steel which resist oxidation.
- Cutting of high carbon steels and cast irons require special attention due to formation of heat affected zone (HAZ) where structural transformation occurs.

Safety Precautions

- Never move cylinders without protective caps in place.
- Do not wear clothing made of synthetic fibers while welding.
- Before and while lighting the flame, keep the tip pointed away from your body.
- Do not cut on containers that have held flammable materials.
- Set the operating pressure carefully. Never use acetylene at a pressure over 15 psi.

- Store oxygen cylinders away from acetylene cylinders. A non-combustible wall at least 5 feet high should be used to separate cylinders.
- Be sure the cylinder valves are closed and pressure is relieved from the hoses before you leave the work area.
- Wear welding gloves, helmet, leather apron, welding chaps, leather shoes, welding goggles, and other personal protective equipment to help prevent weld burns and injury.

THANK YOU