# GAS WELDING

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- Er. Sanjeev Karki

# CONTEXT ON WELDING

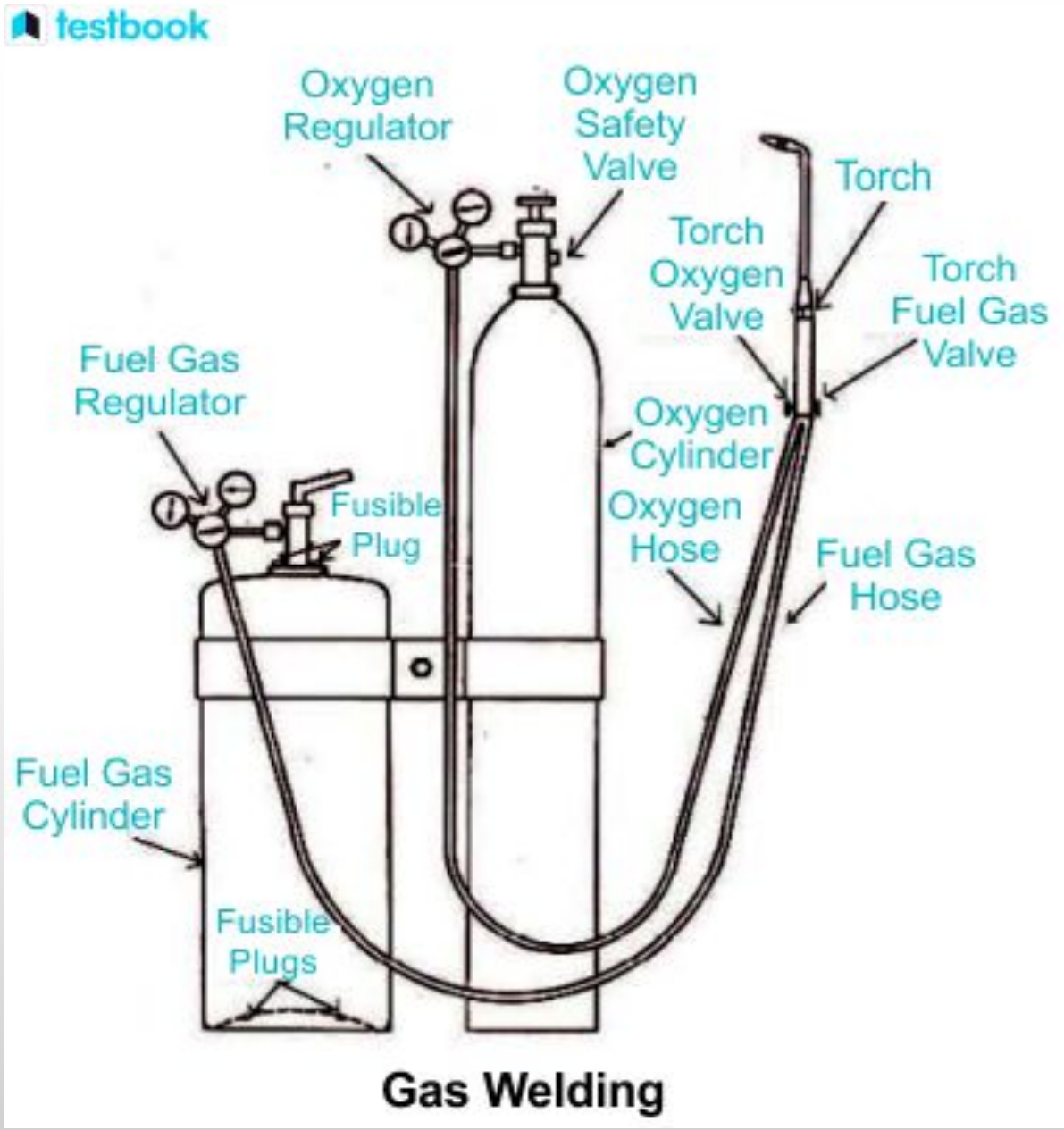
- It is method of joining metals by applications of heat, without the use of solder or any other metal or alloy having a lower melting point than the metals being joined.
- First introduced in the early bronze age Europe ( 5$^{th}$ century B.C)
- The parts that are joined are known as a **parent material**. The material added to help form the join is called **filler** or **consumable**.
- There are many types of welding processes like pressure welding, fusion welding, modern welding techniques etc.

# DIFFERENCE BETWEEN WELDING AND BRAZING/SOLDERING

| Welding | Brazing | soldering |
|---|---|---|
| Joins metal by melting the base metal. | Joins the metal but doesn't melt the base metals. | Joins metal by melting the base metal. |
| Temperature are higher in comparison with the base metal and are mostly around the melting point of them. | Temperatures are lower than the melting points of the base metal | Temperature are very low in comparison to welding and brazing |
| Overall produces stronger joints in comparison to brazing and soldering. | Produces lower strength joints than that of welding. | Produces lowest strength joints in comparison making it very unsuitable. |

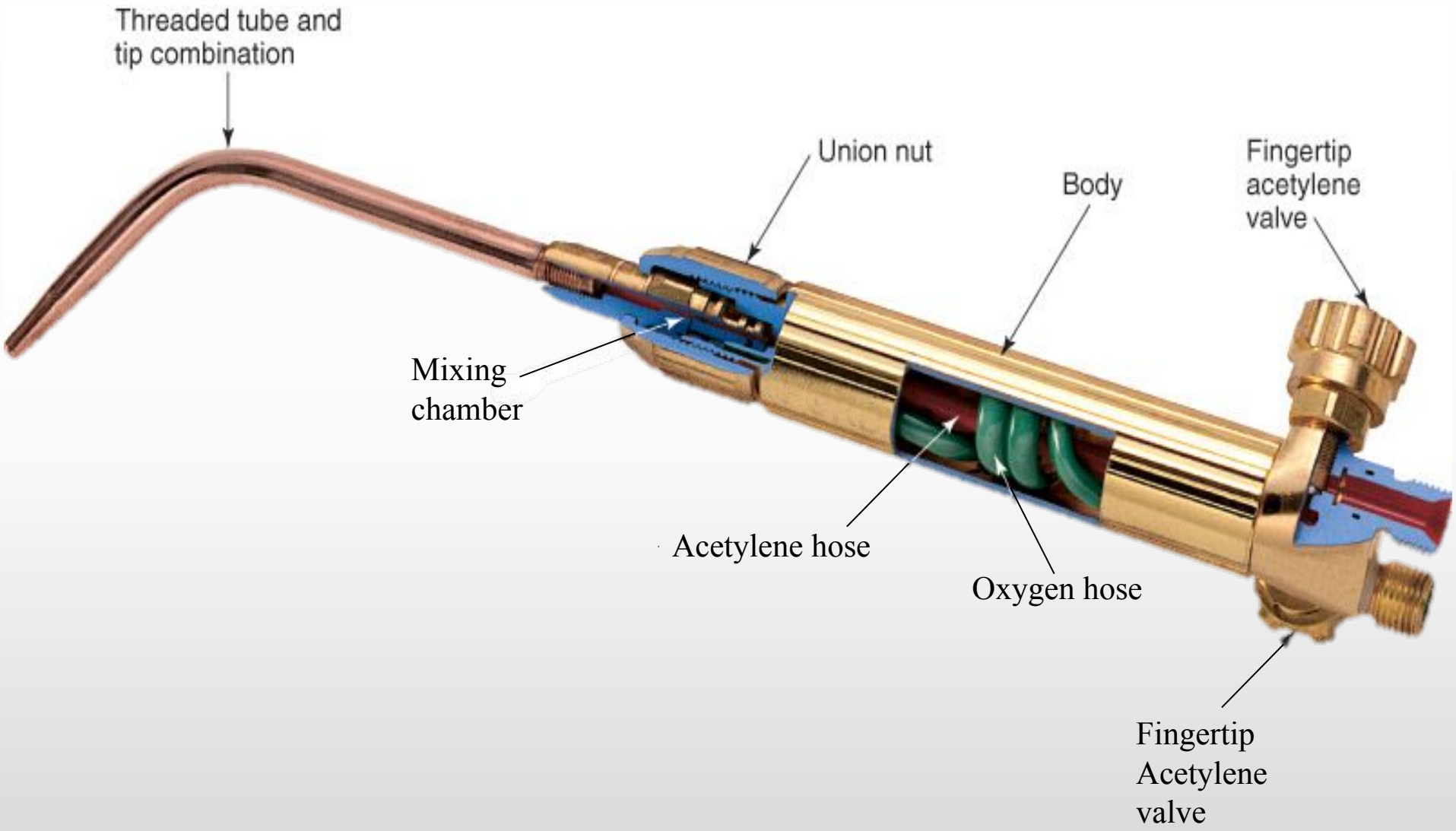
# GAS WELDING

- It is a method of fusion welding in which a flame produced by a combustion of gases is employed to heat and melt the parent metal and filler rod of a joint.
- It is very useful in day-to-day life as it can be used to weld different type of materials together.
- it produces a comparatively higher temperature and also an inert gas envelop, consisting of CO2 and water vapors, which presents the molten metal from oxidation.
- Gas welding is often termed as "**oxy acetylene welding**" in which acetylene gas and oxygen is combusted to produce flame.


testbook
Oxygen Regulator
Oxygen Safety Valve
Torch
Torch Oxygen Valve
Torch Fuel Gas Valve
Fuel Gas Regulator
Oxygen Cylinder
Fusible Plug
Oxygen Hose
Fuel Gas Hose
Fuel Gas Cylinder
Fusible Plugs
Gas Welding

# FURTHER MORE,

- Welding accessories:
  - Welding torch:  The welding torch is the primary tool used in oxyacetylene gas welding. It consists of a handle, mixing chamber, and a nozzle where the flame is produced.


Threaded tube and tip combination
Union nut
Body
Fingertip acetylene valve
Mixing chamber
Acetylene hose
Oxygen hose
Fingertip Acetylene valve

- Hoses and gauges:  Flexible hoses connect the cylinders to the welding torch, while gauges monitor the pressure of the gases and regulate their flow.

- Tips: Tips or nozzles are attached to the welding torch and control the size and shape of the flame. Different tips are used for welding, heating, brazing, or cutting.

Acetylene nozzle

Propane nozzle

- Cylinders:  Separate cylinders are used to store acetylene gas and oxygen. These cylinders are equipped with pressure regulators to control the flow of gases to the torch.

- Goggles/ face shield: Welding goggles with shaded lenses protect the welder’s eyes from the intense light and radiation produced during welding.
  If incase goggles aren’t available, one can use face shield to protect themselves.

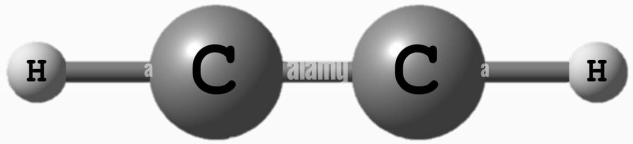
- Filler rods: Filler rods, also known as welding rods, are used to add additional material to the weld joint. These rods are typically made from the same material as the base metal or a compatible alloy and are melted along with the base metal to form a strong joint.

- Flint lighter: A flint lighter is used to ignite the acetylene gas when starting the welding process.

# VARIOUS TYPES OF FUEL GASES

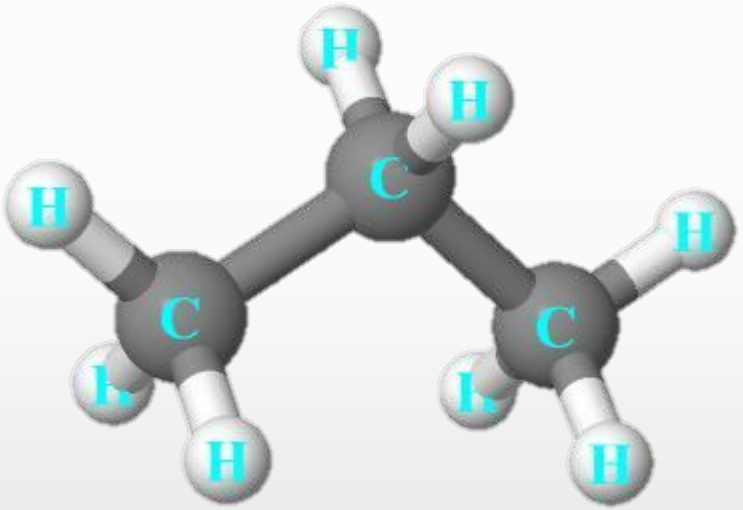
1. Acetylene ($C_2H_2$):

- Acetylene is the most commonly used fuel gas in gas welding due to its high flame temperature of around 3400℃
- Acetylene is often preferred for its versatility and ability to weld a wide range of metals.



## 2.Propane (C3H8):

- Propane burns at a slightly lower temperature of around 2000℃ compared to acetylene but still produces a sufficiently hot flame for welding and brazing.
- Propane is often chosen for its lower cost and availability compared to acetylene, especially in remote areas where acetylene may not be readily accessible.



## 3.MAPP Gas (Methylacetylene-propadiene):

- MAPP gas is a mixture of methylacetylene and propadiene.
- It produces a hot flame of around 2950℃ suitable for welding, brazing, and cutting applications.
- MAPP gas was commonly used in the past but has become less prevalent due to safety concerns and environmental regulations.

## 4.Natural Gas:

- Natural gas is used in some gas welding applications, although it generally requires specialized equipment for effective use.
- It burns at a lower temperature of around 2750℃ compared to acetylene but can still be suitable for certain welding and brazing tasks.
- Natural gas is often chosen for its availability and lower cost in industrial settings.

# TYPES OF FLAMES

1. Neutral flame.

- When the ratio of oxygen and acetylene is equal, a neutral flame is obtained.
- This type of flame has a temperature of about 3250°C, is white in colour and has a sharply defined central cone with a reddish purple envelope.
- It does not react chemically with the parent metal and protects it (the metal) from oxidation.
- The neutral flame is used to weld carbon steels, cast iron, copper, aluminium, etc.

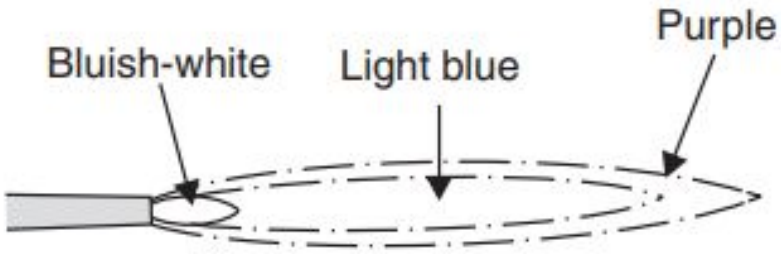


Fig. 7.9. Neutral flame (3250°C).

## 2. Carburizing (or reducing) Flame:

- A carburizing flame is formed when there is an excess of fuel gas compared to oxygen.
- It has a longer inner cone with a yellowish appearance and a shorter, sharper outer envelope.
- The carburizing flame introduces excess carbon into the weld zone, which can lead to increased strength and hardness in some cases.
- It is used for welding or brazing certain types of steel and for carburizing surfaces.

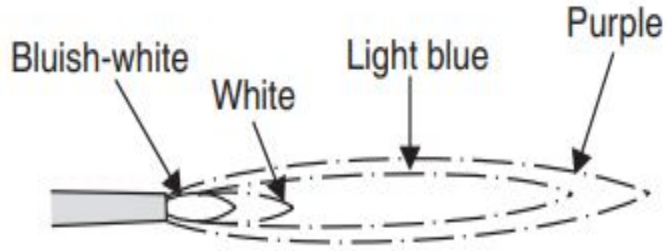



Fig. 7.10. Carburising flame (3150°C) (*Excess acetylene*).

3. Oxidising flame.

- The ratio of oxygen to acetylene varies from about 1.2 to 1.5.
- It is used in the following cases :

  — To weld copper, brass and bronze and zinc bearing alloys.

  — For gas cutting.

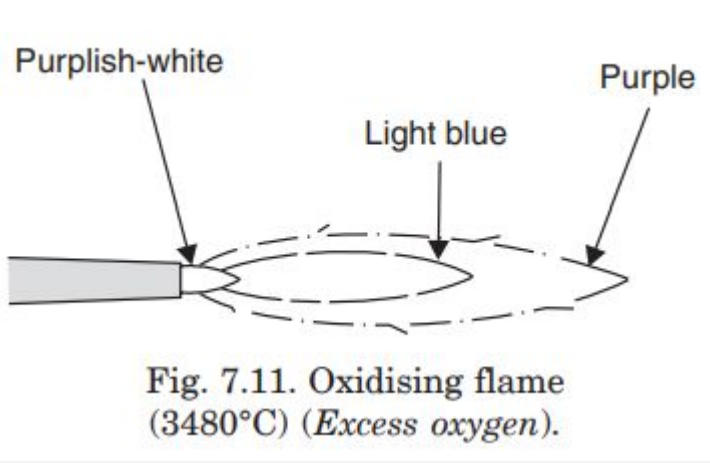



Fig. 7.11. Oxidising flame (3480°C) (*Excess oxygen*).

# COMPARISON OF THE TYPE OF FLAMES

| Oxyacetylene flame temperature | | | |
|---|---|---|---|
| Ratio of oxygen to acetylene | Types of flame | Temperature | |
| | | ℃ | ℉ |
| 0.8 to 1.0 | Carburizing | 3065 | 5550 |
| 0.9 to 1.0 | Carburizing | 3150 | 5700 |
| 1.0 to 1.0 | Neutral | 3100 | 5600 |
| 1.5 to 1.0 | Oxidizing | 3427 | 6200 |
| 1.8 to 1.0 | Oxidizing | 3482 | 6300 |
| 2.0 to 1.0 | oxidizing | 3370 | 6100 |
| 2.5 to 1.0 | oxidizing | 3315 | 6000 |

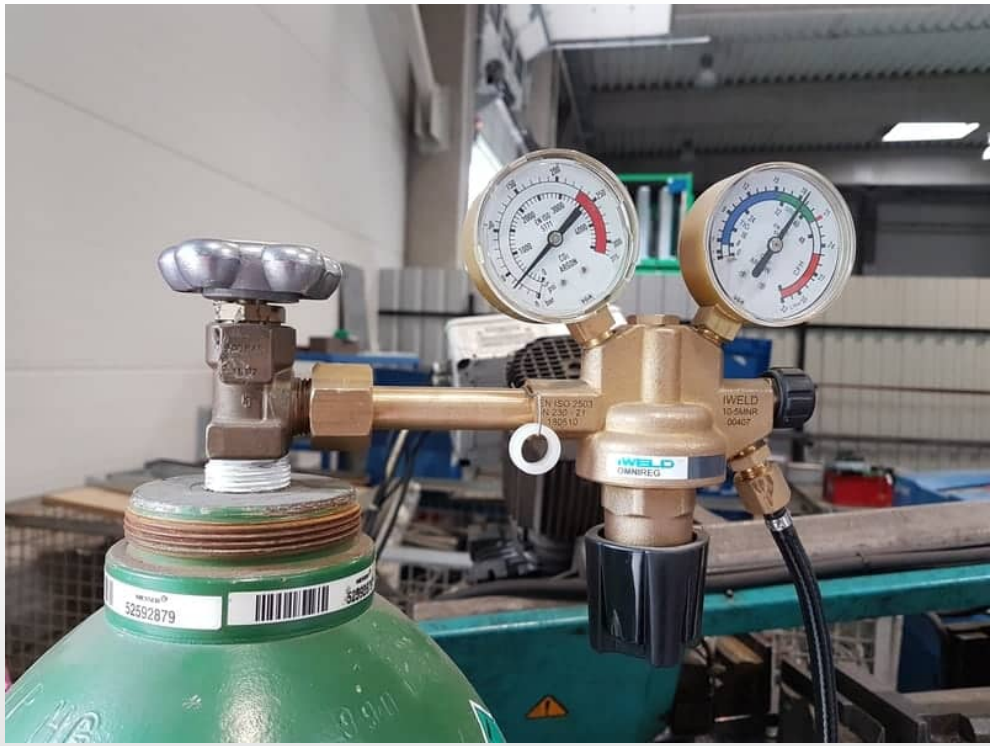
# WELDING TECHNIQUES

**Preparation:**

- Ensure the work area is clean, well-ventilated, and free from flammable materials.
- Gather all necessary equipment, including gas cylinders, regulators, hoses, welding torch, and safety gear.
- Secure the workpiece in a suitable position, ensuring it is stable and properly aligned for welding.

## Gas Setup:

- Connect the appropriate gas cylinders (acetylene and oxygen) to the regulators using hoses.
- Open the cylinder valves slowly and check for leaks using a leak detection solution or soapy water.
- Adjust the regulators to the recommended pressure settings for the specific welding task.



**Torch Setup:**

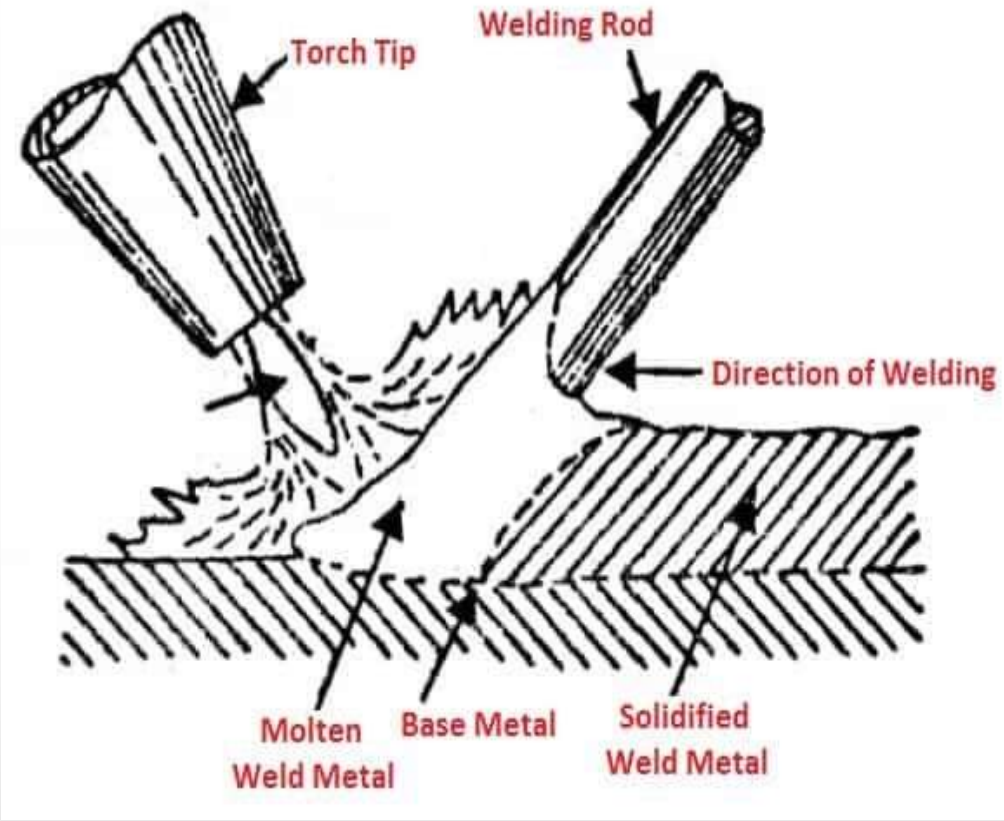
- Attach the appropriate welding tip to the torch based on the desired flame size and application.
- Adjust the torch valves to allow a small flow of acetylene and oxygen.
- Use a spark lighter or striker to ignite the flame at the torch tip, adjusting the gas flow until a stable flame is achieved.

**Adjustment of Flame:**

- Adjust the torch valves to control the ratio of oxygen to acetylene and achieve the desired flame type (neutral, carburizing, or oxidizing).
- A neutral flame is typically used for general welding and brazing applications, while carburizing or oxidizing flames may be suitable for specific materials or processes.

## But how to gas weld?

- Hold the torch at the correct angle (usually around 45 degrees) relative to the workpiece, with the flame directed towards the joint.
- Preheat the base metal by moving the flame evenly over the area to be welded, ensuring it reaches the appropriate temperature for proper fusion.
- Once the metal is heated to the proper temperature, introduce the filler rod into the weld puddle, applying a small amount of filler metal as needed.
- Maintain a steady welding speed and torch angle to achieve consistent penetration and a uniform weld bead.
- Continue welding along the joint, pausing occasionally to adjust flame intensity or add filler metal as necessary.



**Cooling and Inspection:**

- Allow the welded joint to cool naturally or use a suitable cooling method to prevent excessive stress and distortion.
- Inspect the weld for defects such as cracks, porosity, or incomplete fusion, and make any necessary repairs or adjustments.
- Once the weld has cooled completely, clean the surface as needed to remove any flux residue or oxides.

# SAFETY PROCEDURES:

- Always follow proper safety procedures when handling compressed gases, including wearing appropriate PPE such as goggles, gloves, and flame-resistant clothing.
- Ensure adequate ventilation in the work area to prevent the accumulation of flammable or toxic gases.
- Secure gas cylinders properly to prevent tipping or falling, and store them in a well-ventilated area away from heat sources or ignition hazards.

# APPLICATIONS OF GAS WELDING

Following are the applications of gas welding :

- To join most ferrous and non-ferrous metals, e.g., carbon steels, alloy steels, cast iron, aluminium, copper, nickel, magnesium and its alloys, etc.
- To join thin materials.
- To join materials in whose case excessively high temperatures would cause certain elements in the metal to escape into the atmosphere.
- To join materials in whose case excessively high temperatures or rapid heating and cooling of the job would produce unwanted or harmful changes in the metal.
- Automative and Aircraft industries.
- Sheet metal fabricating plants, etc.

# PROS

- It can be used to join many different types of metal
- It does not require the use of electricity
- Cheap Equipment costs
- Reduced risk of arc eye
- Accessibility and Portability
- More quite welding process and many more

YES.

# CONS

NO.

- Not suitable for thick sections.
- Gas welding tends to provide a low surface finish
- Cannot be used for high-strength steel.
- The slow rate of heating and metal joining.
- Cannot reach the temperatures of arc welding
- Doesn’t have a dedicated flux shielding system.

# PRECAUTIONS

- It is a very fast method of welding.
- It consists of holding the parts at a small distance with their end faces opposite to each other, bringing them closer at a fast speed after switching on the current, thus creating an arc between their end faces just before they come in contact and completing the weld under impact. Some of the metal may squeeze out of the joint, but it is very small.
- The use of this process is limited to very thin wires, with their diameters ranging between 0.05 mm and 0.38 mm. It can also be used for joining wire of dissimilar metals, such as copper to nichrome and copper to stainless steel.

# CONCLUSION

- In simpler words, gas welding is the technique of welding which requires gases in order to weld two metal pieces together.
- Despite it being not a common type of welding, it is still relevant and used in many different areas.
- If an individual knows basic safety measures, precautions and have the skill to weld, they can easily operate a gas welding project.

# *REFERENCES:*


- Textbook of manufacturing technology – Er. RK Rajput
- American Welding Society. (n.d.). Oxyfuel Gas Welding. https://www.aws.org/resources/detail/oxyfuel-gas-welding.
- Lincoln Electric. (n.d.). Gas Welding Equipment.
- National Institute for Occupational Safety and Health (NIOSH). (2014). Welding and Cutting Safety. https://www.cdc.gov/niosh/docs/88-110/.

# THANK YOU.