Welding Processes : Principle

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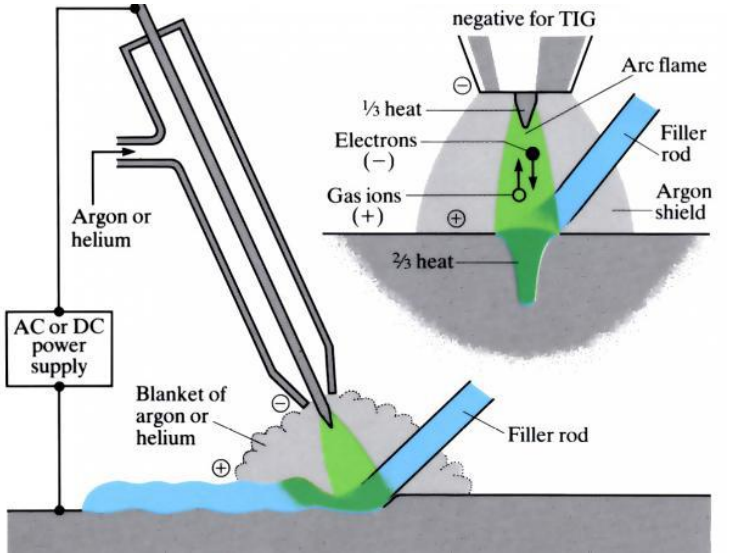
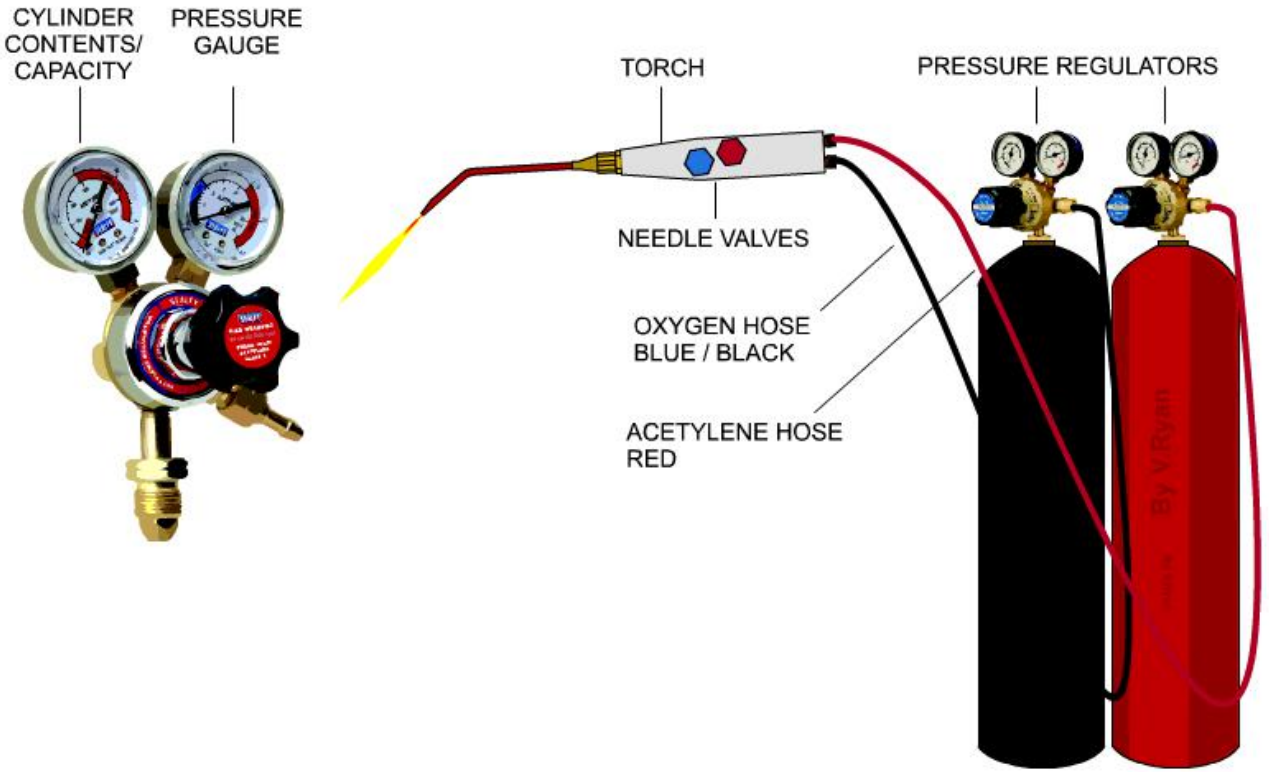
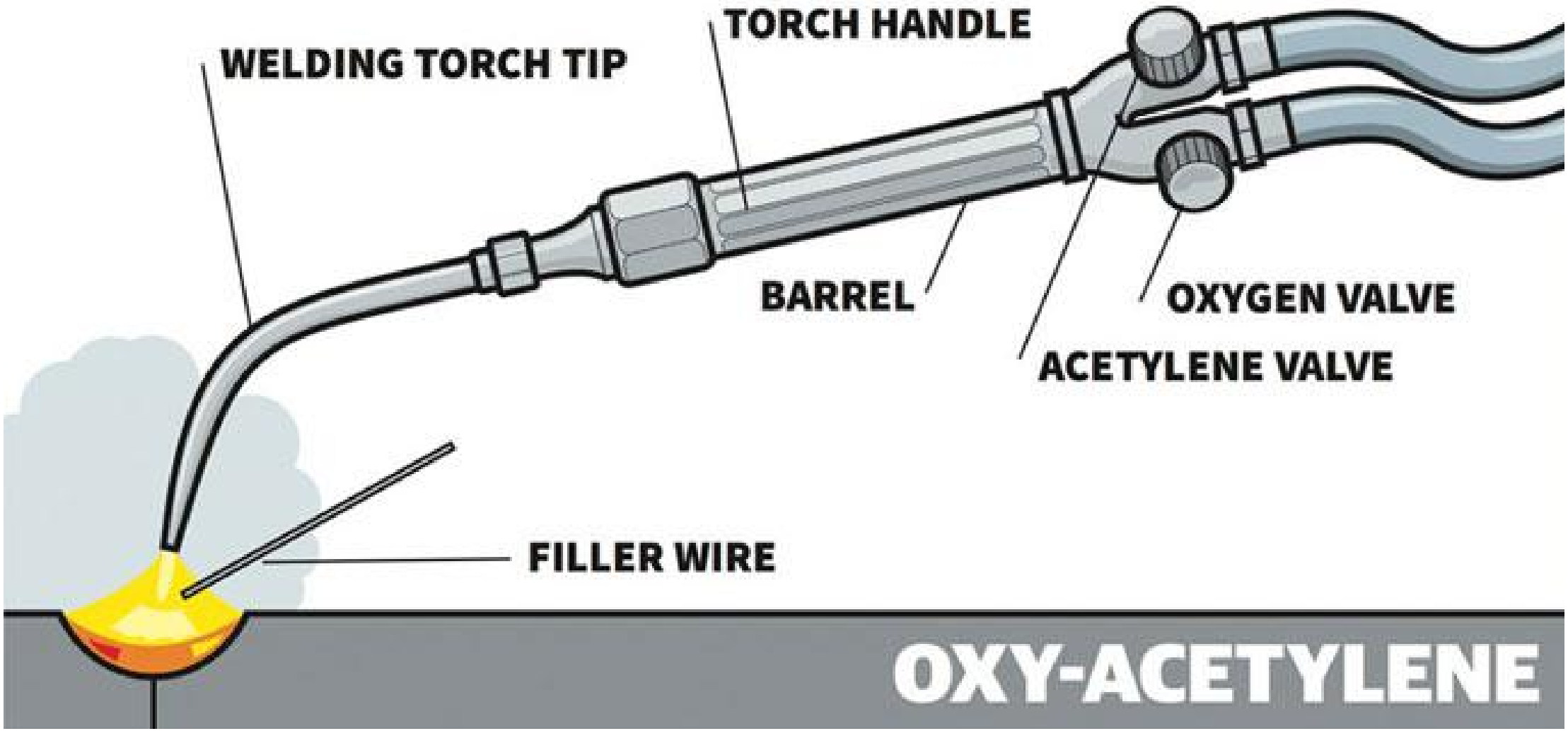


Lesson Objectives

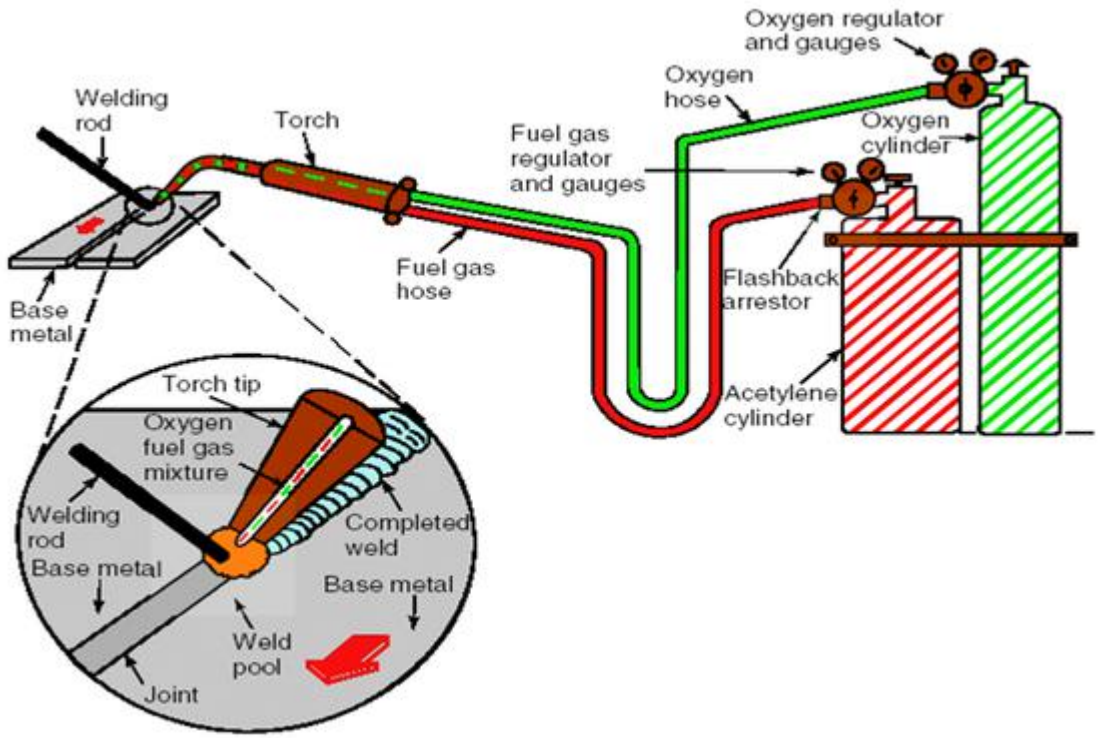
- Principles of different welding techniques
- Youtube Videos of Welding Principle

GAS WELDING - OXYACETYLENE

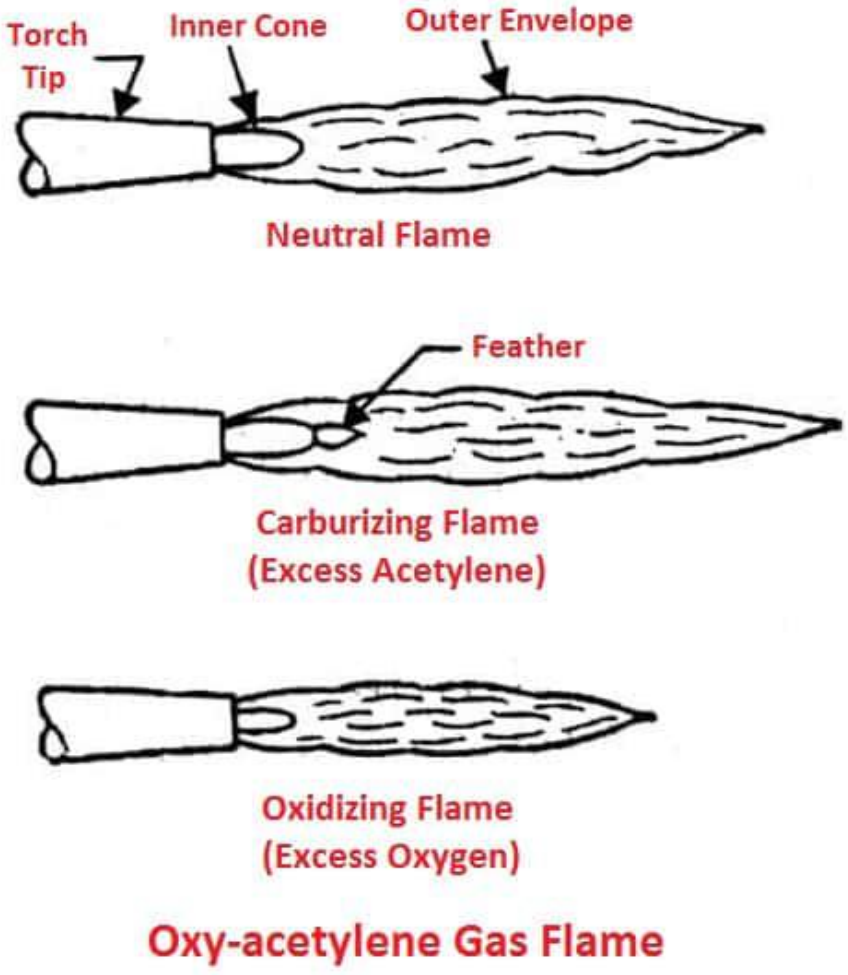


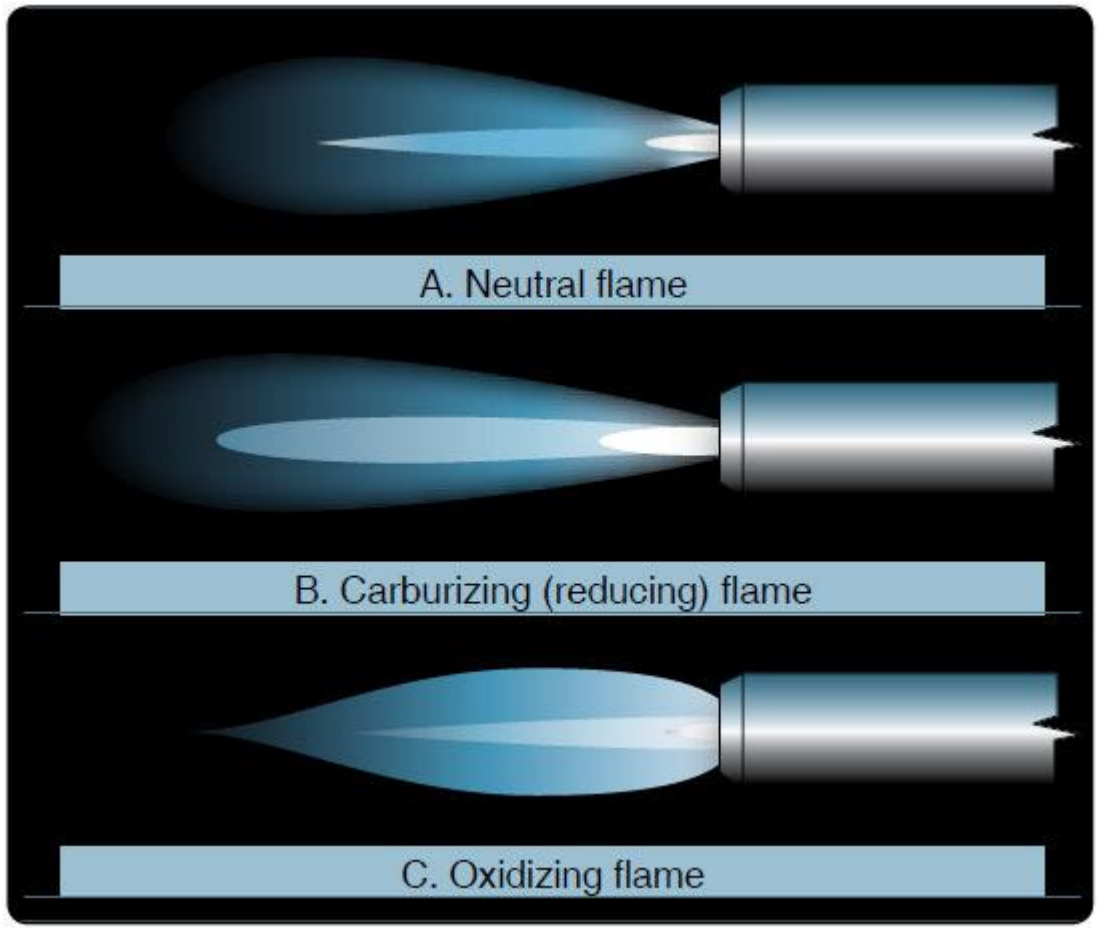

WELDING TORCH TIP
TORCH HANDLE
BARREL
OXYGEN VALVE
ACETYLENE VALVE
FILLER WIRE
OXY-ACETYLENE

GAS WELDING - OXYACETYLENE

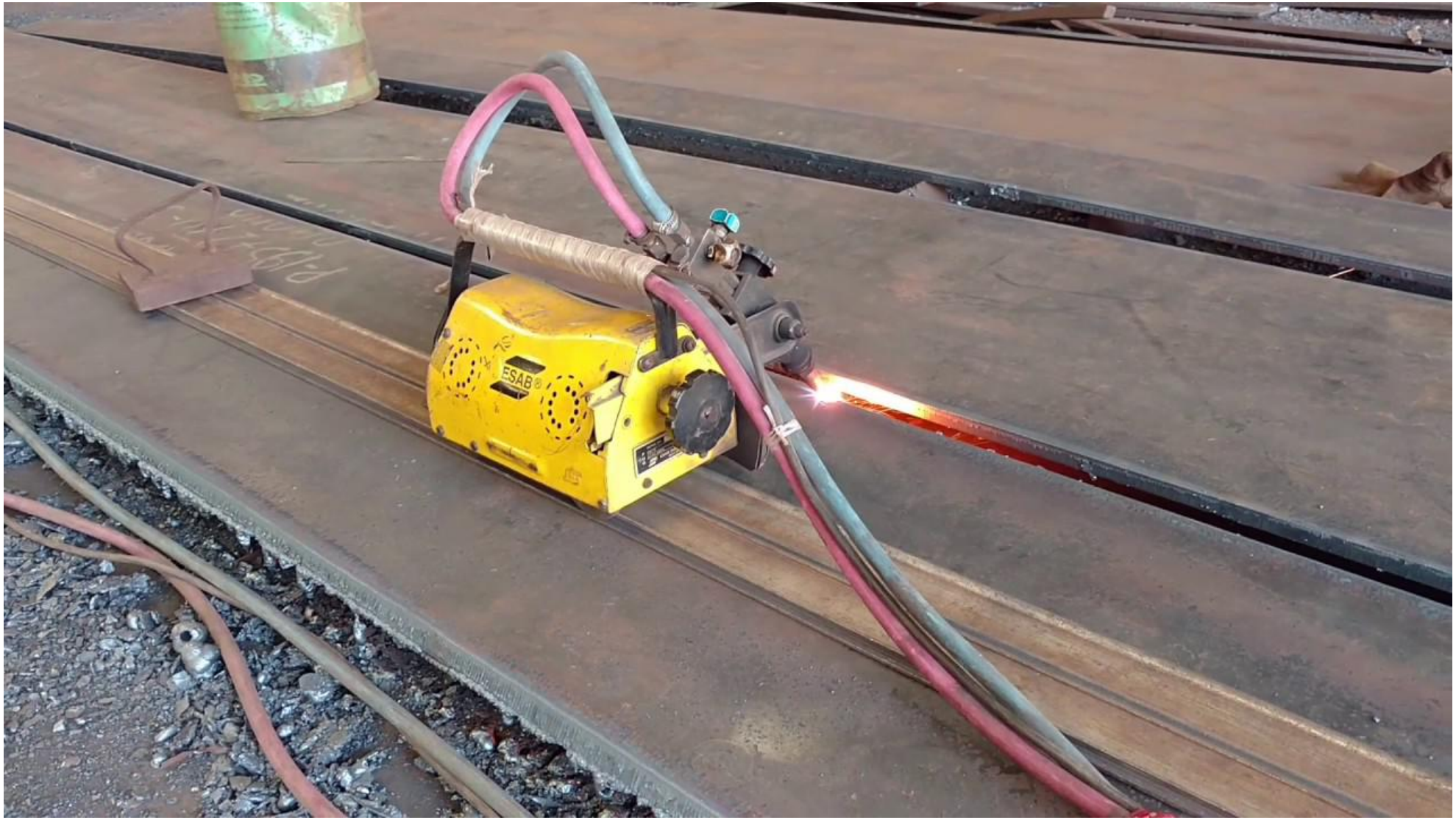


Different types of Flames

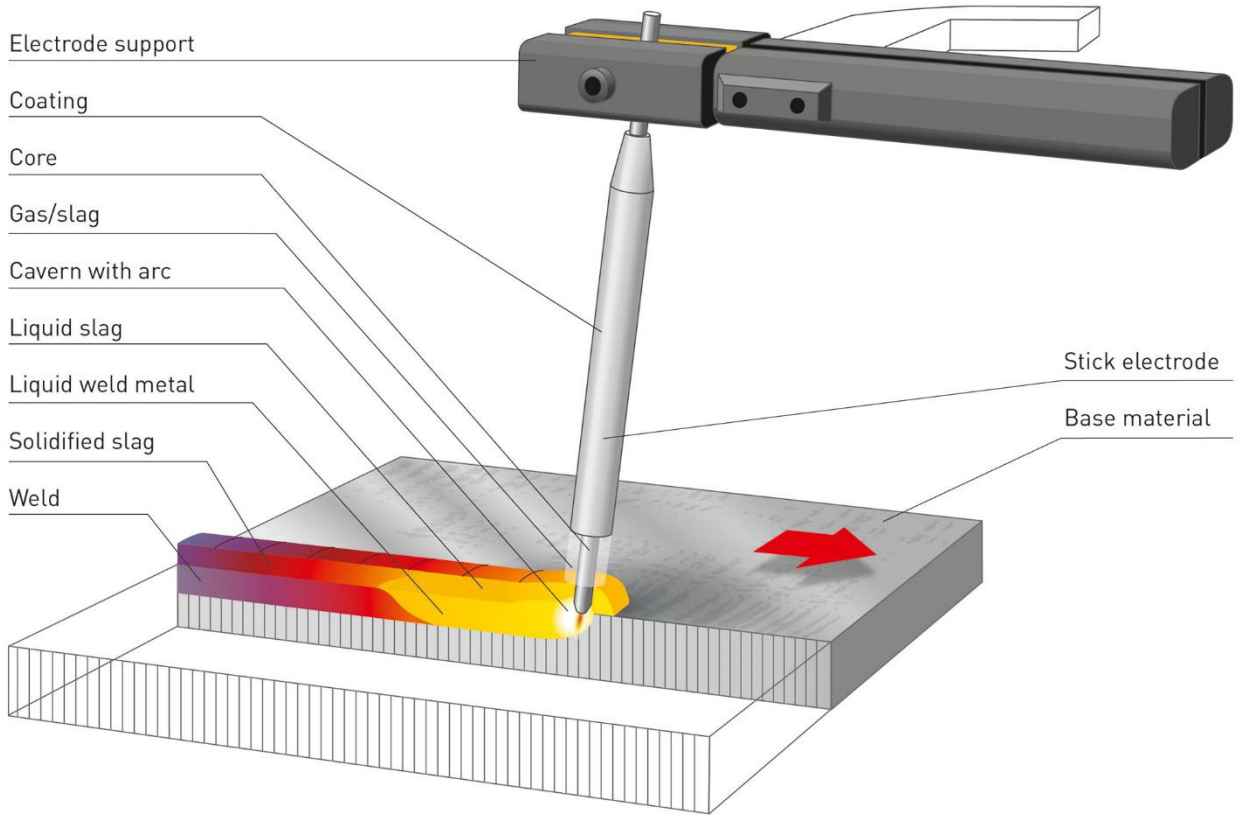




Cutting of steel plates using PUG cutting machine



Manual Metal Arc Welding (MMAW)



MANUAL METAL ARC WELDING

- This manual method is one of the most widely used arc welding processes.
- It requires considerable skill to produce good quality welds.
- The electrode consists of a steel core wire and a covering flux containing alloying elements, e.g. manganese and silicon.
- The arc melts the parent metal and the electrode.

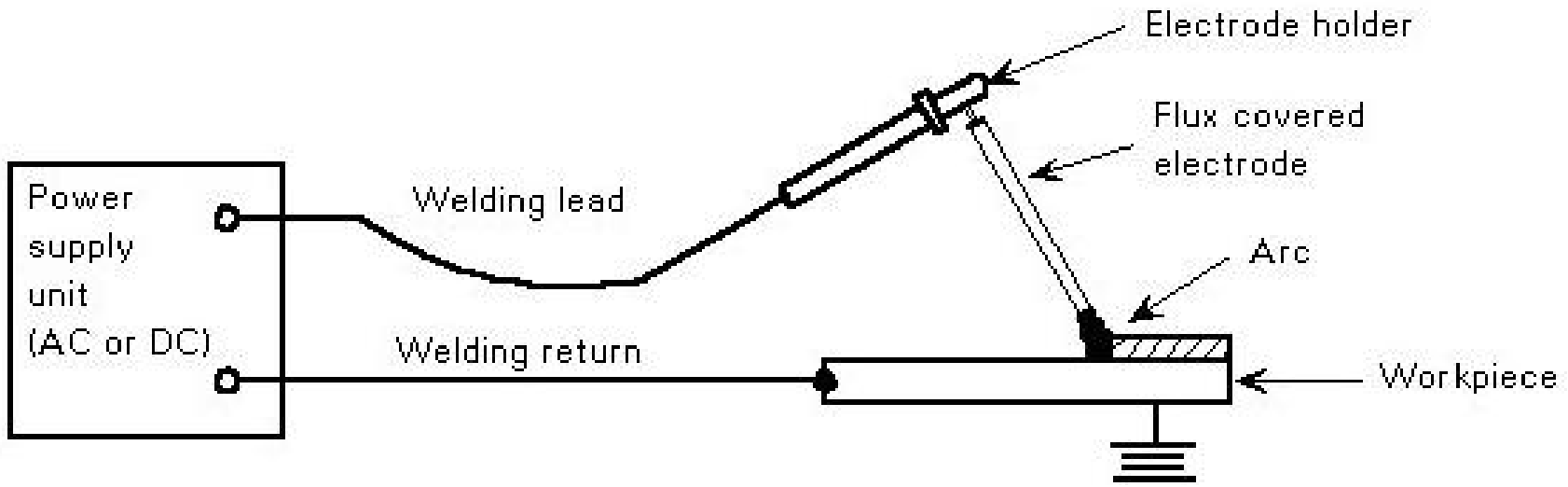
MANUAL METAL ARC WELDING

- As metal is transferred from the end of the core wire to the weld pool, the welder moves the electrode to keep the arc length constant.
- This is essential as the width of the weld run is largely governed by the arc length.
- The flux melts with the core wire and flows over the surface of the pool to form a slag, which must be removed after solidification.

Functions of the slag produced include

- It minimises impurities in the weld
- To form a coating which protects the weld from oxidation
- It ensures a slow cooling rate for the weld
- It prevents cracking and brittleness

MANUAL METAL ARC WELDING



Circuit

Electrode : Flux covered steel wire; 450mm long; diameter to match current level; limited range for each diameter

Controls : Current - preset at power unit
Voltage - controlled manually by welder (arc length)
Electrode feed - controlled manually by welder
Travel speed - controlled by welder

Transformer circuit

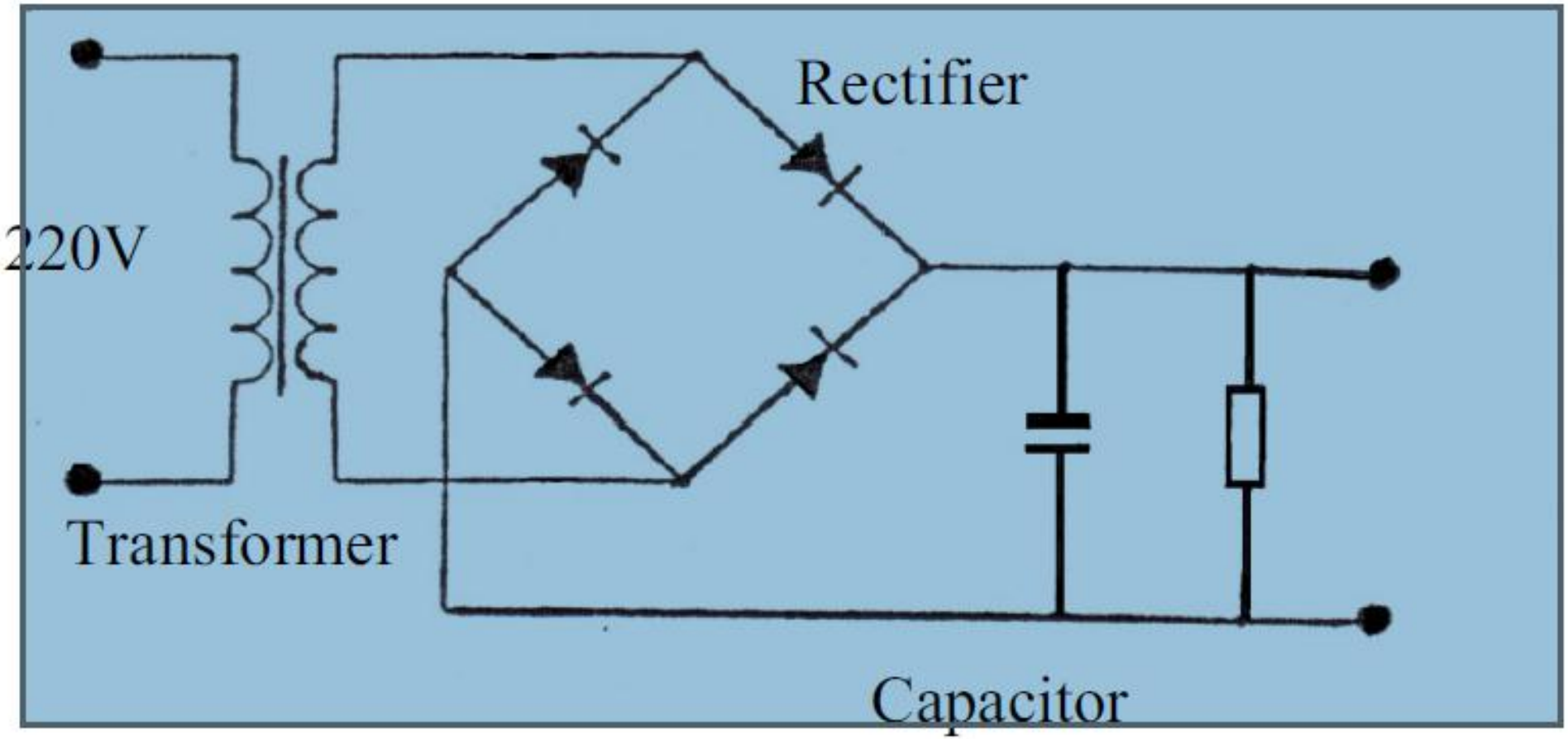
- A step-down transformer is used to change the mains voltage from 220V to a suitable level (80-100V) for welding.
- This will provide the high current needed for welding.
- This type of transformer has more turns on the primary coil than the secondary coil and will induce alternating current (AC) at a lower voltage.

Transformer circuit

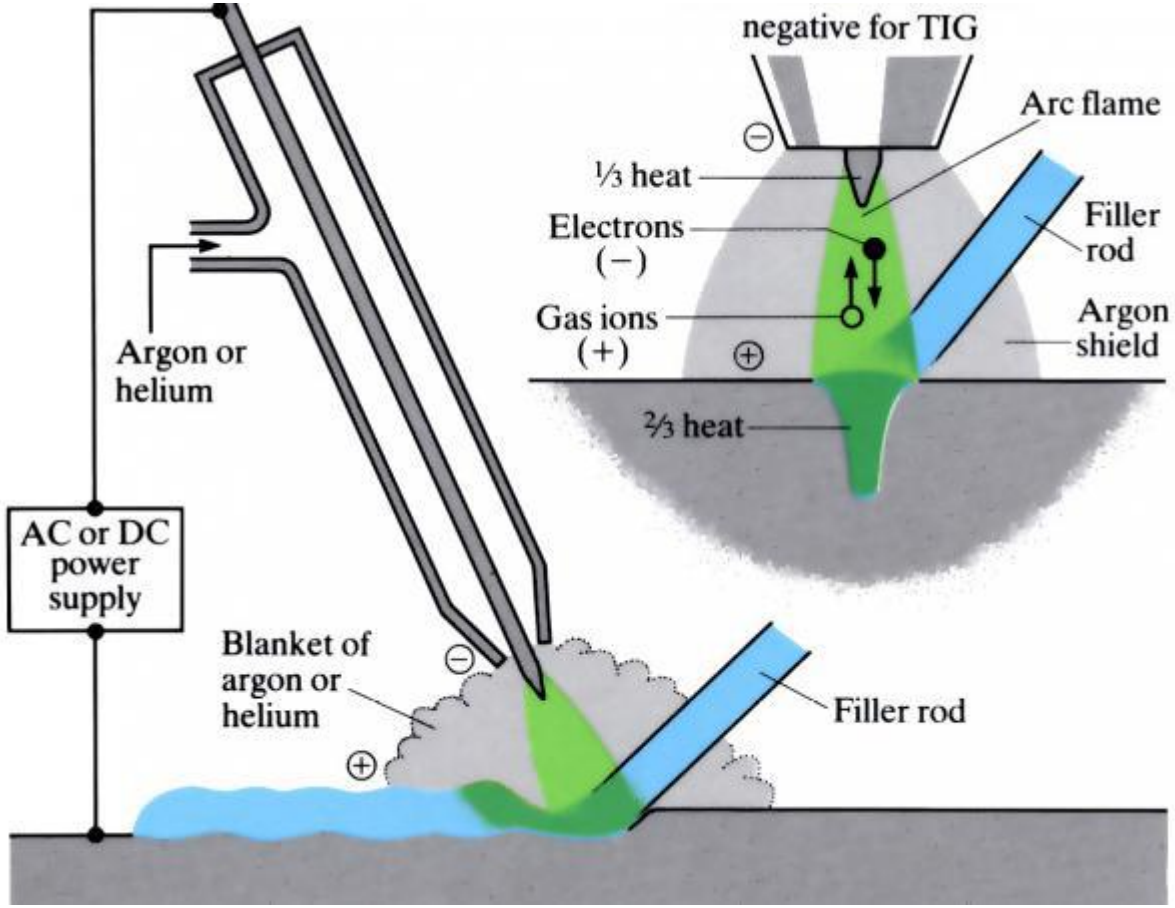
- The rectifier changes alternating current (AC) to direct current (DC).
- It consists of four diodes which allows two of the diodes to conduct on each half-cycle of the AC supply.
- The capacitor is employed to provide a smooth supply of low voltage DC.

Circuitry

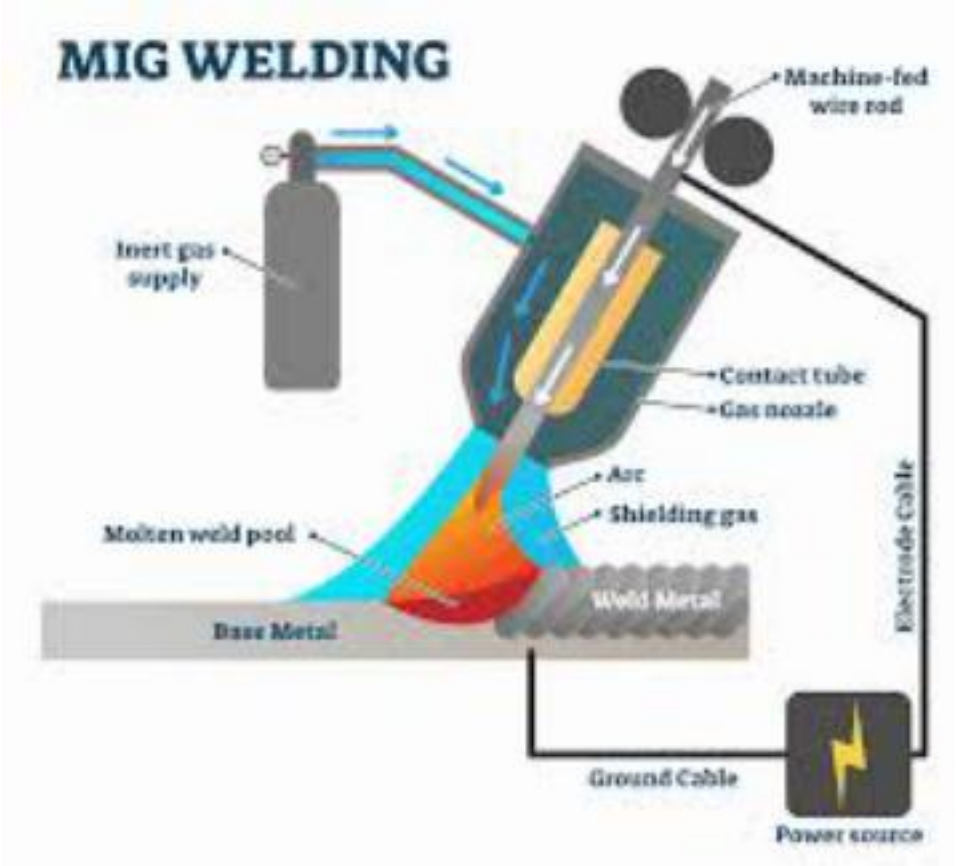
Transformer circuit:

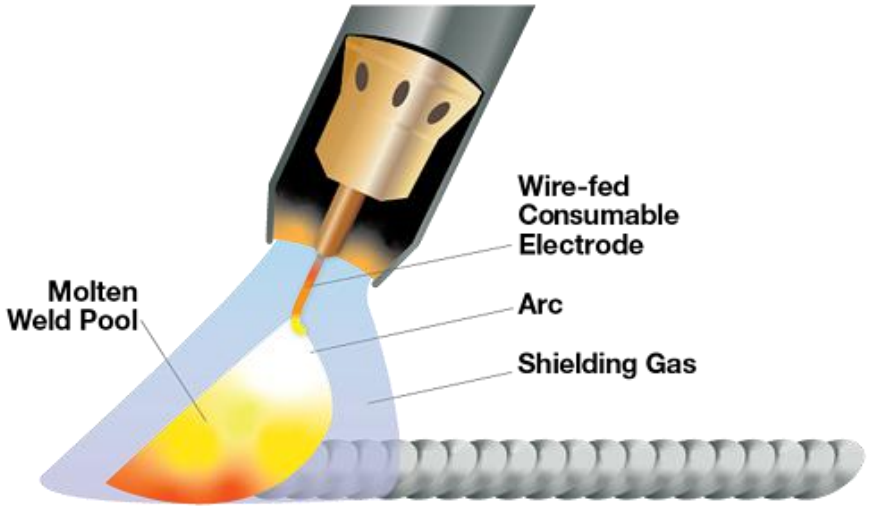


Gas Shielded Arc Welding



MIG Welding


MIG WELDING
Machine-fed wire rod
Inert gas supply
Contact tube
Gas nozzle
Arc
Shielding gas
Molten weld pool
Weld Metal
Base Metal
Electrode Cable
Ground Cable
Power source

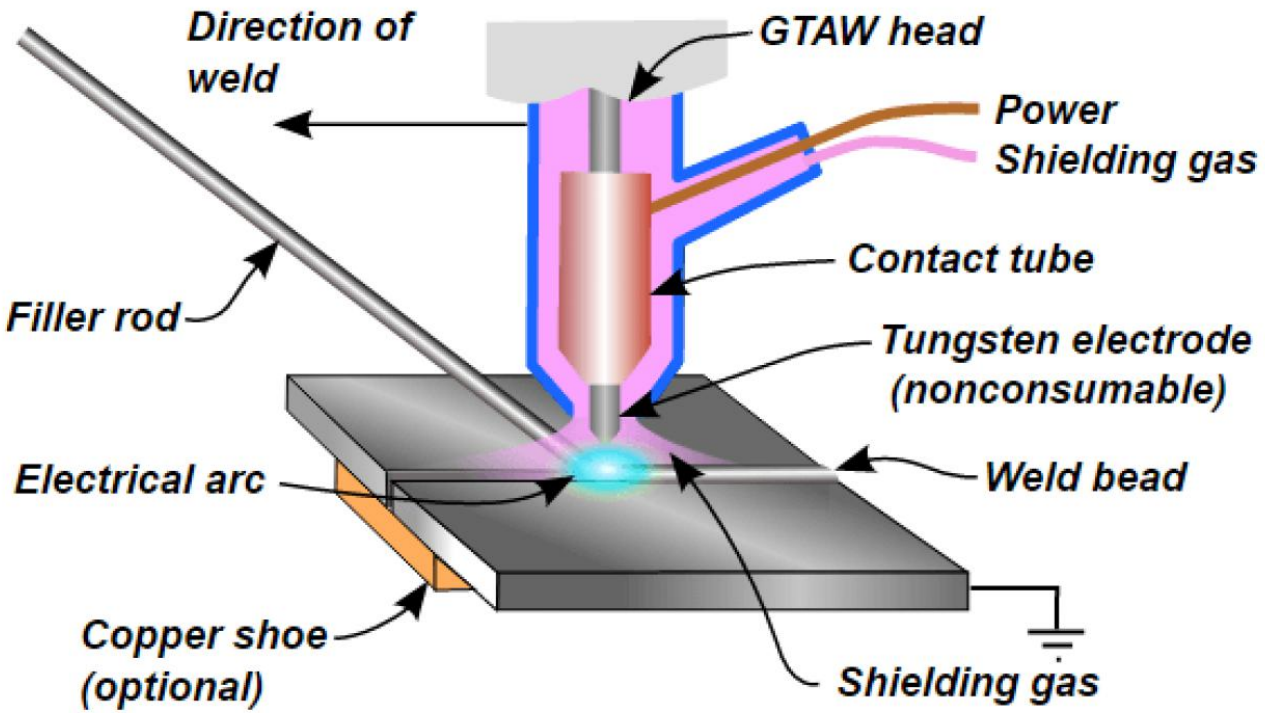


- MIG and TIG welding both use an electric arc to create the weld. The difference between the two is the way the arc is used. MIG (metal inert gas) welding uses a feed wire that constantly moves through the gun to create the spark, then melts to form the weld. *TIG (tungsten inert gas) welding uses long rods to fuse two metals directly together.

MIG Welding

- In MIG, a spool of solid-steel wire is fed from the machine, through a liner, then out of a contact tip in the MIG gun.
- The contact tip is hot, or electrically charged, when the trigger is pulled and melts the wire for the weld puddle.
- This is accomplished in several ways.

TIG


Direction of weld
GTAW head
Power
Shielding gas
Contact tube
Filler rod
Tungsten electrode (nonconsumable)
Electrical arc
Weld bead
Copper shoe (optional)
Shielding gas

TIG

Difference between MIG and TIG

- **DIVERSITY**
- A number of reasons make MIG welding the superior choice.
- First, it’s more diverse.
- While TIG welding can be used on more types of metals, it’s limited in its effectiveness on thicker jobs.
- MIG welding can be used on aluminum, stainless steel and steel, and on every thickness from 26-gauge sheet metal to heavy-duty structural plates.

Difference between MIG and TIG

- MIG welding holds this big advantage over TIG because the wire feed acts not only as an electrode, but also as filler.
- As a result, thicker pieces can be fused together without having to heat them all the way through.
- And because it uses filler rather than fusing, MIG welding can be used to weld two different materials together.

Difference between MIG and TIG

- **SPEED**
- Another reason for choosing MIG vs. TIG is speed.
- A MIG gun is designed to run continuously for long periods of time, making them more efficient and productive than its counterpart.
- For large, industrial operations that require high production rates, MIG is the go-to choice. (It also lends itself well to automation).
- Oppositely, TIG welding is much slower process that's focused on detail.

Difference between MIG and TIG

- **QUALITY**
- If MIG welding is known for quantity, TIG is its quality counterpart.
- It produces a fine, clean, beautifully crafted weld that's the clear winner when details matter.
- It works very well on a wide variety of thinner-gauge materials like aluminum and stainless steel alloys, and is the process of choice for fine-tuned smaller projects like gunsmithing, tool boxes, repairs or ornamental pieces.
- It's also growing in popularity across larger industries that require precision parts and equipment like transportation, aerospace and the military.

Difference between MIG and TIG

- **PRECISION**
- TIG welding can achieve this level of precision because the operator has more control over the gun vs.
- MIG welding. Unlike the MIG gun, which contains both the electrode and filler metal in one system, TIG welding uses a non-consumable tungsten electrode to form the arc.

Difference between MIG and TIG

- The filler metal must be added in separately, which allows the operator to precisely control the speed and depth of the weld.
- Detail also comes from the operator's control over the heat of the arc.
- Using a foot pedal, the heat can be brought down so that it doesn't cause damage to thin, fine metals.
- As one can imagine, however, this level of precision doesn't come quickly or easily.
- Using two hands and a foot takes more specialized training and experience than operating a MIG gun -- it also takes a lot longer to create the weld.

Difference between MIG and TIG

- **CLEANLINESS**
- TIG welding is a cleaner process on a number of levels. In the weld itself, the manual control of the filler metal eliminates the spatter than can come from MIG. And sometimes, TIG can be performed without using filler metal at all.
- TIG welding is also better for the environment, and for its operators. MIG welding can cause a lot of smoke, fumes, and even sparks.

Difference between MIG and TIG

- **STRENGTH**
- TIG welding is used in high-tech, high-impact industries like automotive and aerospace because of its ability to produce strong, quality welds on thin materials.
- Since the operator has manual control over the filler metal, the beads can be much smaller and cause less disruption in the surrounding metal.
- And control over the heat output means that the weld can be strong without burning through the parent metal and requiring rework.

Difference between MIG and TIG

- **MAINTENANCE**
- TIG welding setups do use consumables, and they do need to be cleaned between jobs.
- In fact, a pristine torch, workpiece and workspace are essential to achieving the artistic finish that so many people love about TIG.
- But, since it doesn’t use a continuously fed wire, TIG welding eliminates the headaches that can come with using a number of moving parts, such as contact tip burnback and bird nesting.

Video on

- https://www.youtube.com/watch?v=NBxp-9n_xjg
- Gas cutting through Pug Citter
- https://www.youtube.com/watch?v=VnDGk8Q0e4w
- Gas cutting machine handmade
- https://www.youtube.com/watch?v=9bs5-9tPO2w