Metal Inert Gas Welding

Indian Railways STC Ajmer

MIG WELDING

❖ Welding

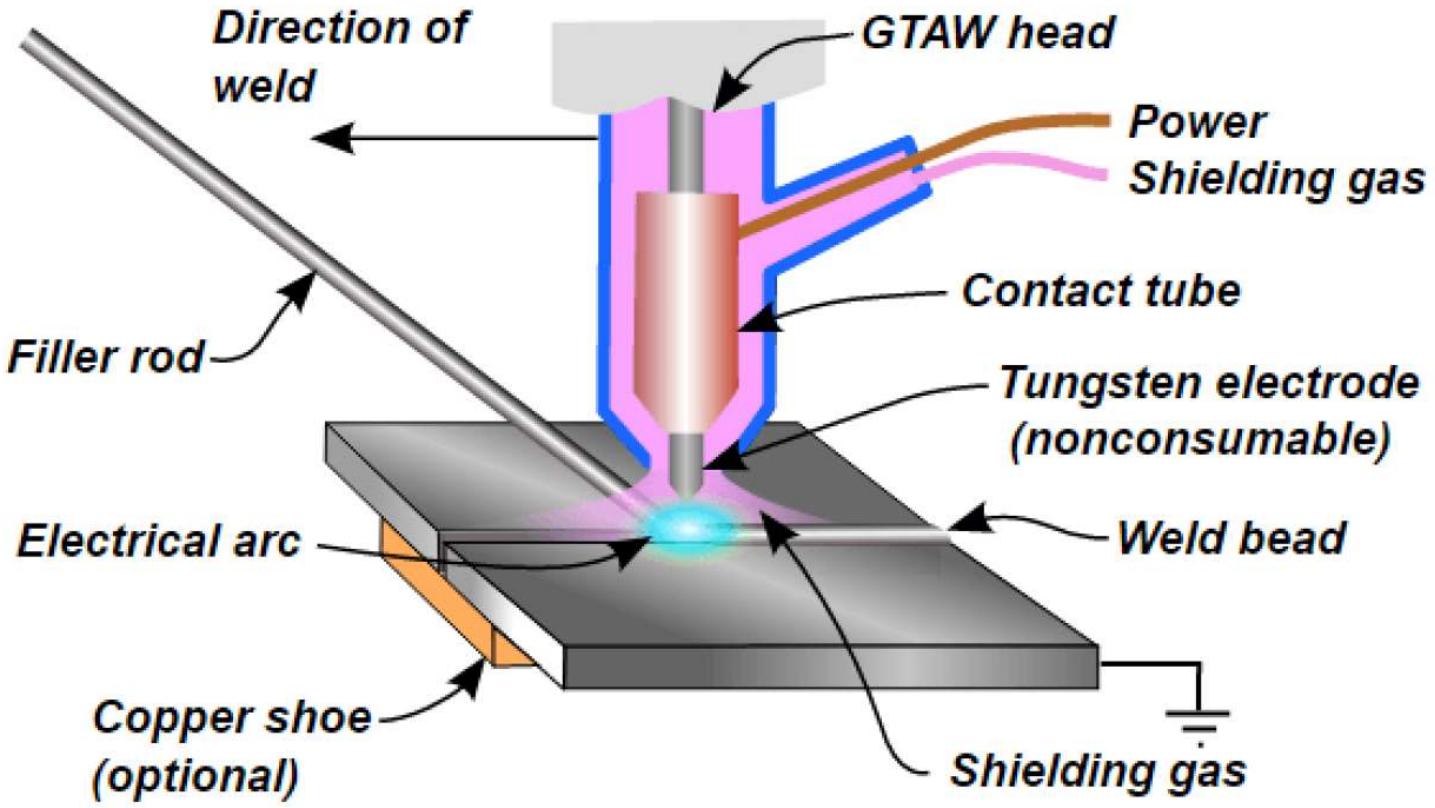
- It is defined as localized coalescence of metal or alloy produced either by heating the materials to the welding temperature with or without using pressure or by application of pressure alone, with or without the use of filler metal.

- Types of welding
  - ❑ Submerged Arc Welding
  - ❑ Tungsten Inert Gas Welding
  - ❑ Metal Inert Gas Welding
  - ❑ Friction Welding

❖ What is MIG Welding?

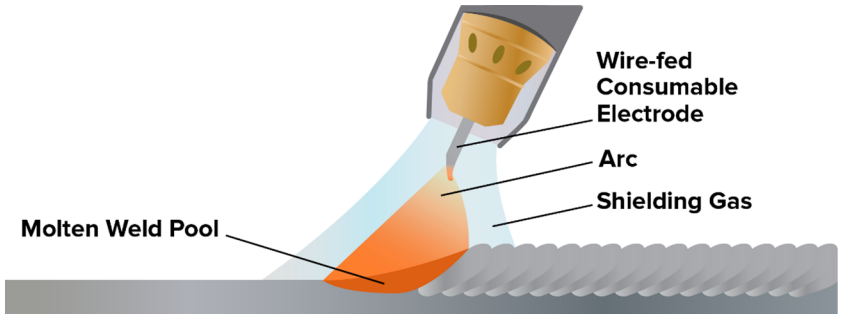
- It is also known as Gas Metal Arc Welding.
- In Gas Metal arc welding,
  If gas used is inert gas like Helium, Argon, then it's called Metal Inert Gas (MIG) Welding.
  If gas used is reactive gas like CO2, O2, then it's called Metal Active Gas (MAG) Welding.
- It is a high deposition rate welding process.
- The metal wire is fed from a spool.
- This is a semiautomatic welding process.
- MIG welding is a gas shielded metal arc welding process using the heat of an electric arc between a continuously fed, consumable electrode wire and the material to be welded.

❖ Schematic Representation of MIG Welding Process



❖ MIG Welding Process (Contd.)

- Metal is transferred through a protected arc column of inert gas to the work.
- A wire of copper coated mild steel is fed continuously from a reel through a gun with melting rate up to 5 m/min.
- Current through wire ranges from 100 to 400 A depending upon the diameter of wire.
- The welding machine is a dc constant voltage machine.



❖ Tools and equipment used in MIG Welding

1. Power source : MIG welding uses a dc constant voltage transformer.

2. Wire Feeder : A wire feeder is required to feed the electrode wire continuously and smoothly to the welding gun.

❖ Tools and equipment used in MIG Welding

3. Conduit and Hoses : Conduit facilitates feeding of wire to the torch and hoses supply the shielding gas.

4. Welding Gun : It transfers the welding current to the wire and provides the gas for shielding the arc and weld pool.

❖ Tools and equipment used in MIG Welding

5. Gas cylinders : They are used to store shielding gases like CO2, Argon etc.

6. Safety Equipments : They are the tools for safety and precaution purpose like helmet, goggles, apron, gloves and boots.

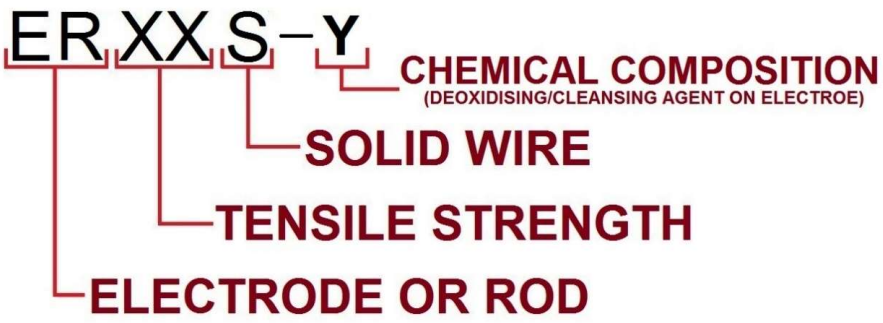
❖ MIG Welding Electrode designation

➢ For stainless MIG wire designation :

ER – 70s-6

Where,

- ER= Electric Rod
- 70 = Tensile Strength
- s = solid wire
- 6 = Chemical Additives



❖ MIG Welding Variables and Parameters

1. Welding Current (I)
2. Arc Voltage (V)
3. Polarity
4. Electrode
5. Gas Flow Rate
6. Length of Stick Out
7. Shielded Gas Composition

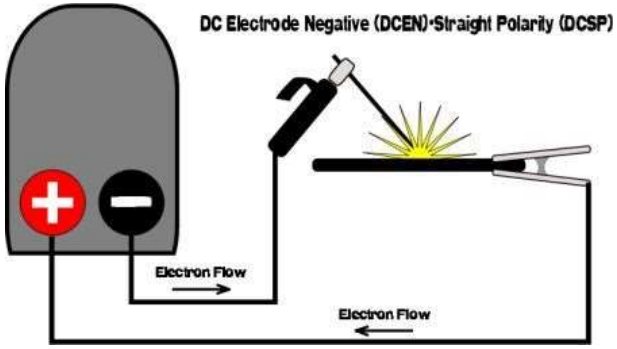
1. Welding Current (I)

- Welding current depends upon welded metal thickness and metal transfer mode required according to the parent metal properties.
- For Metal thickness,

  T < 6 mm = 100-200 amps

  T 6-8 mm = 200-450 amps

  T > 8 mm = 450-700 amps

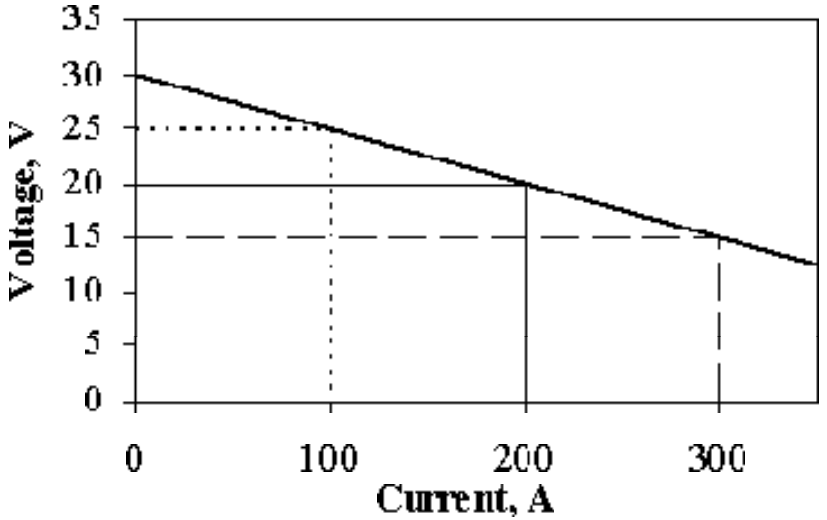


❖ MIG Welding Variables and Parameters

2. Arc Voltage

- In MIG welding process, we generally use constant voltage.
- This Produce self regulation of arc length.
- For current range 150-200 amp, it is kept in between 20-30 V for mild steel workpiece.

Fig. 1



❖ MIG Welding Variables and Parameters

3. Polarity

- In MIG welding, we use DCEP(Direct current electrode polarity) or reverse polarity.
- Positive terminal to electrode wire, negative terminal to weld fixture.
- DC ensures elimination of arc blow.

4. Electrode Diameter

- Diameter of electrode is dependent on welding current
- With higher current, Diameter is also large and vice versa.
- It ranges from 0.7-2.4 mm depending upon current.
- For current 100-200 amps (dia. 0.8-1.2 mm) is used.
- Electrode is made up of same parent metal coated with deoxidizing agent.

❖ MIG Welding Variables and Parameters

5. Gas Flow Rate

- For different applications, different flow rate is chosen.
- The four primary variation of MIG have differing shielding gas flow requirements
  For small weld pools of the short circuiting and pulsed spray modes – 10 L/min.
  For globular transfer – 15 L/min.

6. Length of stick out

- Length of stick out is generally kept between 10-12 mm.
- For stable arc should not larger.
- It is controlled by self regulation characteristics of MIG.

7. Shielded Gas Composition

- Purpose of shielding gas is to protect the weld area from the contaminants in the atmosphere.
- Gas can be inert, reactive or mixtures of both.
- For MIG welding, inert shielding gases are used. (Argon and Helium)
- For MAG welding, reactive shielding gases are used. (Oxygen, Nitrogen, Carbon Dioxide, Hydrogen)
- The pressure of shielding gas is up to 150 kg/cm^2.

❖ MIG Welding : Weldable Materials

➢ Carbon Steel

➢ Aluminium

➢ Stainless Steel

➢ Magnesium

➢ Copper

➢ Nickel

➢ Silicon Bronze and other alloys

❖ Advantages of MIG Welding

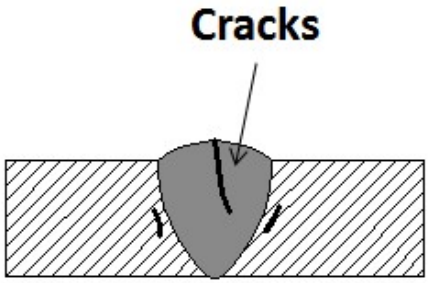
- High quality welds can be produced much faster
- Since a flux is not used, there is no chance for the entrapment of slag in the weld metal resulting in high quality welds.
- The gas shield protects the arc so that there is very little loss of alloying elements. Only minor weld spatter is produced.
- MIG welding is versatile and can be used with a wide variety of metals and alloys.
- MIG process can be operated several ways, including semi and fully automatic.

❖ Disadvantages of MIG Welding

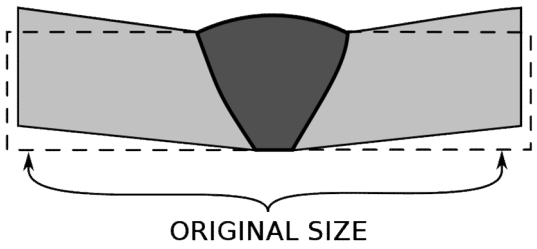
- Cannot be used in vertical or overhead positions because of the high heat input and the fluidity of the puddle.
- The equipment is complex.
- Arc is less stable
- Generates more spatter
- Not suitable for base metal contamination
- Limited to short circuit mode of metal transfer

❖ MIG Welding Defects

Cracks : Cracking occurs when the arc is struck but the spot is not welded properly.

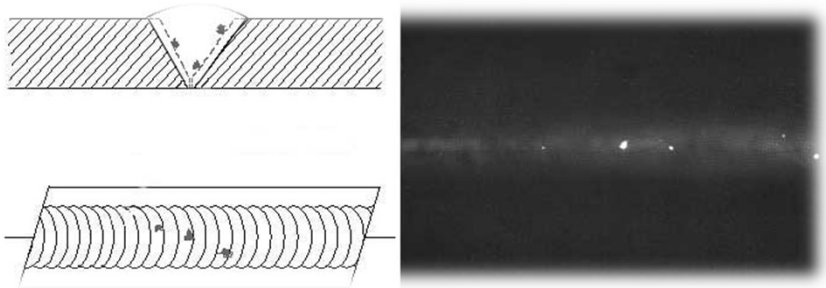


Distortion : This happens due to uneven shrinkage of metal due to heating.



❖ MIG Welding Defects

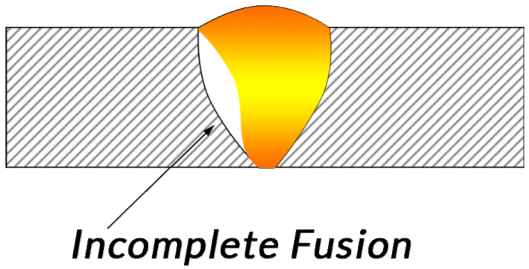
Gas inclusion : Gas inclusion is a wide variety of defects that includes porosity, blow holes and pipes.



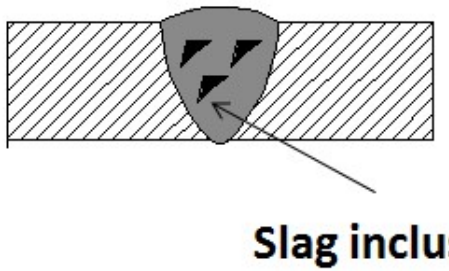
Undercut : This happen when the weld reduces the cross-sectional thickness of base metal.

❖ MIG Welding Defects

Lack of Fusion : Lack of fusion is the poor adhesion of the weld bead to the base metal.



Inclusions : Inclusions occur when there is slag, dirt, flux or other impurities in the weld.



❖ Application of MIG Welding

- The most common application of MIG welding is automotive repair.
- Special welding equipment can be used to weld pipes.
- It can be used to reinforce the surface of a worn railroad truck.
- Because of its high economy and utility it is widely used in various industries.
- Rebuilding equipment
- Overlay of resistant coating

Thank You