



CODE - 440

Trade - Welder [Gas and Electric]

Unit I: Introduction and Definition of Welding



1. Shielded Metal Arc Welding (SMAW)

✓ Safety Precautions:

- 1. Protective Clothing – Wear fire-resistant clothes, leather gloves, and apron to prevent burns from sparks and molten metal.**
- 2. Welding Helmet – Use a helmet with correct filter lens (shade no. 10–14) to protect eyes from arc rays.**
- 3. Ventilation – Ensure proper ventilation/exhaust to avoid inhaling fumes.**
- 4. Insulation – Keep hands, gloves, and the electrode holder dry to prevent electric shock.**
- 5. Fire Safety – Remove flammable materials from the welding area. Keep fire extinguisher nearby.**
- 6. Proper Earthing – Ensure welding machine is correctly grounded.**
- 7. Workpiece Handling – Use tongs; avoid touching hot metals.**
- 8. Check Equipment – Inspect cables, holders, and electrode before starting.**

Equipment, Tools, and Accessories:

- **Welding Power Source – AC or DC welding machine.**
- **Electrode Holder – Holds the electrode and conducts current.**
- **Welding Electrodes – Coated rods that supply filler metal.**
- **Ground Clamp – Connects workpiece to the circuit.**
- **Cables and Leads – Carry current from machine to electrode holder.**
- **Welding Helmet / Goggles – Eye and face protection.**
- **Chipping Hammer – Removes slag after welding.**
- **Wire Brush – Cleans weld bead.**
- **Pliers/Tongs – For handling hot workpieces.**
- **Measuring Tools – Steel rule, square, gauge for accuracy.**

2. Oxy-Acetylene Welding (OAW)

Safety Precautions:

- 1. Cylinder Handling – Store oxygen and acetylene cylinders upright and away from heat.**
- 2. Check for Leaks – Use soapy water to detect leaks; never test with flame.**
- 3. Flashback Arrestors – Must be fitted on both regulators and torches.**
- 4. Proper Lighting – Use a friction lighter, never a match, to ignite flame.**
- 5. Ventilation – Work in well-ventilated areas to prevent gas accumulation.**
- 6. Personal Protection – Wear goggles (shade 4–6), gloves, and flame-proof clothing.**
- 7. Close Valves Properly – After use, close cylinder valves tightly.**
- 8. Fire Safety – Keep a fire extinguisher nearby; remove oil/grease from oxygen fittings (risk of explosion).**

Equipment, Tools, and Accessories:

- **Gas Cylinders – Oxygen cylinder (black/blue) & Acetylene cylinder (maroon).**
- **Pressure Regulators – Control gas flow from cylinders.**
- **Hoses – Rubber tubes (red for acetylene, blue/green for oxygen).**
- **Welding Torch – Mixes gases and produces flame.**
- **Nozzles/Tips – Different sizes for different welding thickness.**
- **Flashback Arrestor – Prevents reverse flame flow into cylinders.**
- **Goggles – Protect eyes from flame and sparks.**
- **Sparking Lighter – For safe ignition of gases.**
- **Welding Rods (Filler Rods) – Provide filler material for weld joint.**
- **Fluxes – Sometimes used for special metals (e.g., aluminum, brass).**
- **Tongs/Clamps – For handling hot metals.**

1. Shielded Metal Arc Welding (SMAW / Stick Welding)

- **Process:** Uses a consumable electrode (rod) coated with flux. The arc melts both the electrode and base metal; flux forms a protective gas shield and slag.

- **Applications:**

1. **Construction (bridges, buildings)**

2. **Pipelines**

3. **Heavy steel structures**

4. **Shipbuilding**



2. Gas Welding (Oxy-Acetylene Welding – OAW)

- **Process:** A flame is produced by burning oxygen and acetylene gas in a torch. Filler rod may be added.

- **Applications:**

1. **Repair works (automobile, small workshops)**

2. **Thin sheet metal joining (bicycles, small tanks)**

3. **Cutting and brazing operations**

3. Gas Tungsten Arc Welding (GTAW / TIG Welding)

- **Process:** Uses a non-consumable tungsten electrode. Argon/Helium gas shields the weld. Separate filler rod may be used.
- **Applications:**
 1. Aerospace (aluminum, titanium alloys)
 2. Stainless steel fabrication
 3. Thin sheet welding
 4. Food and chemical equipment

4. Gas Metal Arc Welding (GMAW / MIG Welding)

- **Process:** A consumable wire electrode is fed continuously through a gun, shielded by inert gas (argon, CO₂, or mixture).
- **Applications:**
 1. Automobile industry (car bodies, chassis)
 2. Manufacturing industries
 3. Pressure vessels
 4. Stainless steel and aluminum products

5. Submerged Arc Welding (SAW)

- **Process:** An arc burns beneath a layer of flux powder, which shields and stabilizes the weld. High deposition rate.
- **Applications:**
 1. Shipbuilding
 2. Pressure vessels and boilers
 3. Large pipes
 4. Heavy plate fabrication

6. Resistance Welding (Spot, Seam, Projection Welding)

- **Process:** Uses heat produced by electrical resistance and pressure to join metals without filler.
- **Applications:**
 1. Automobile body assembly (spot welding)
 2. Fuel tanks (seam welding)
 3. Electrical parts (projection welding)

7. Plasma Arc Welding (PAW)

- **Process:** Similar to TIG but uses a constricted plasma arc, giving high precision and deeper penetration.
- **Applications:**
 1. **Aerospace & nuclear industries**
 2. **Medical devices**
 3. **High-quality stainless steel welding**

8. Friction Welding (Solid-State Welding)

- **Process:** Heat generated by friction between workpieces, then pressure applied to weld. No filler.
- **Applications:**
 1. **Shafts and axles**
 2. **Drill pipes**
 3. **Tool attachments**
 4. **Aircraft engine parts**

9. Electron Beam Welding (EBW)

- **Process:** Uses a focused beam of high-velocity electrons in a vacuum chamber to fuse materials.
- **Applications:**
 - 1. Aerospace components**
 - 2. Automotive gears and turbochargers**
 - 3. Nuclear reactor parts**
 - 4. Precision instruments**

10. Laser Beam Welding (LBW)

- **Process:** Uses a highly concentrated laser beam to melt and fuse materials.
- **Applications:**
 - 1. Medical instruments (surgical tools, pacemakers)**
 - 2. Electronics (micro parts)**
 - 3. Automotive industry**
 - 4. Aerospace components**

Arc Welding Terms & Definitions

- **Arc** – The discharge of electricity between the electrode and the workpiece that produces heat for welding.
- **Arc Length** – The distance between the tip of the electrode and the workpiece.
- **Electrode** – A rod/wire that conducts current and may supply filler metal.
- **Electrode Holder** – A clamp that holds the electrode in SMAW.
- **Ground Clamp (Work Clamp)** – Connects the workpiece to complete the electrical circuit.
- **Flux** – Coating on electrodes that produces shielding gas and slag.
- **Slag** – A layer of solidified flux covering the weld bead, protects it while cooling.
- **Weld Bead** – The deposit of filler material on the work surface after welding.
- **Filler Metal** – Additional metal supplied to fill the joint gap.
- **Welding Current** – The flow of electricity (AC or DC) used for welding.

- **Polarity – The direction of current flow (DCEN – Direct Current Electrode Negative, DCEP – Direct Current Electrode Positive).**
- **Penetration – Depth of fusion of the weld into the base metal.**
- **Porosity – Small gas pockets/holes formed inside the weld bead.**
- **Spatter – Small metal droplets scattered around the weld zone.**
- **Weld Defects – Imperfections such as cracks, undercut, porosity, lack of fusion.**
- **Tack Weld – A small temporary weld to hold parts before final welding.**
- **Duty Cycle – Percentage of time a welding machine can operate continuously before cooling.**
- **Arc Blow – Deflection of welding arc due to magnetic forces.**

Gas Welding (Oxy-Acetylene) Terms & Definitions

- **Oxygen Cylinder – Supplies pure oxygen for combustion.**
- **Acetylene Cylinder – Supplies acetylene gas to produce flame with oxygen.**
- **Regulator – Controls gas pressure from the cylinder.**
- **Hose Pipes – Flexible tubes carrying gases (red = acetylene, blue/green = oxygen).**
- **Torch (Welding Torch) – Device that mixes oxygen and acetylene and produces flame.**
- **Nozzle / Tip – Opening at the torch end through which flame comes out.**
- **Flashback – Reverse flow of flame into the torch/hose – very dangerous.**
- **Flashback Arrestor – Safety device to prevent flame from entering hoses/cylinders.**
- **Neutral Flame – Equal oxygen and acetylene, used for most welding jobs.**
- **Carburizing Flame – Excess acetylene, used for welding high-carbon steels.**

- **Oxidizing Flame – Excess oxygen, used for welding brass and bronze.**
- **Filler Rod – Rod used to add material to the joint during welding.**
- **Flux – Chemical used to clean the metal surface (especially for non-ferrous metals like aluminum).**
- **Backfire – A loud pop when the flame momentarily goes out.**
- **Cutting Torch – Special torch used for oxy-fuel cutting, has extra oxygen jet.**
- **Preheat Flame – Flame used to heat the metal before cutting or welding.**
- **Pressure Gauge – Instrument on the regulator showing gas pressure.**
- **Safety Cap – Protective cover placed on gas cylinders during transport.**

1. In SMAW, which device is used to hold the electrode?

SMAW-ல் எலக்ட்ரோடை பிடிக்க எந்த சாதனம் பயன்படுகிறது?

- A) Welding torch**
- B) Electrode holder**
- C) Ground clamp**
- D) Regulator**

2. What is the main function of flux coating in SMAW electrode?

SMAW எலக்ட்ரோடில் உள்ள பிளக்ஸ் பூச்சின் முக்கிய பணி என்ன?

- A) To give color**
- B) To form protective gas shield**
- C) To supply current**
- D) To cool the arc**

3.In TIG welding, the electrode is made of:

TIG வெட்டிங்கில் எலக்ட்ரோடை எதனால் செய்யப்படுகிறது?

A) Copper

B) Aluminum

C) Tungsten

D) Steel

4.MIG welding is widely used in which industry?

MIG வெல்டிங் அதிகம் பயன்படும் தொழில் எது?

A) Agriculture

B) Automobile manufacturing

C) Food processing

D) Mining

5. Spot welding is a type of:

ஸ்பாட் வெல்டிங் எந்த வகை வெல்டிங்கில் சேர்ந்தது?

- A) Arc welding**
- B) Gas welding**
- C) Resistance welding**
- D) Laser welding**

7.Which defect is caused by trapped gas pockets in the weld?

வெல்டில் சிக்கிய வாயுக்களால் ஏற்படும் குறைபாடு எது?

- A) Crack**
- B) Porosity**
- C) Lack of fusion**
- D) Undercut**



THANK YOU

