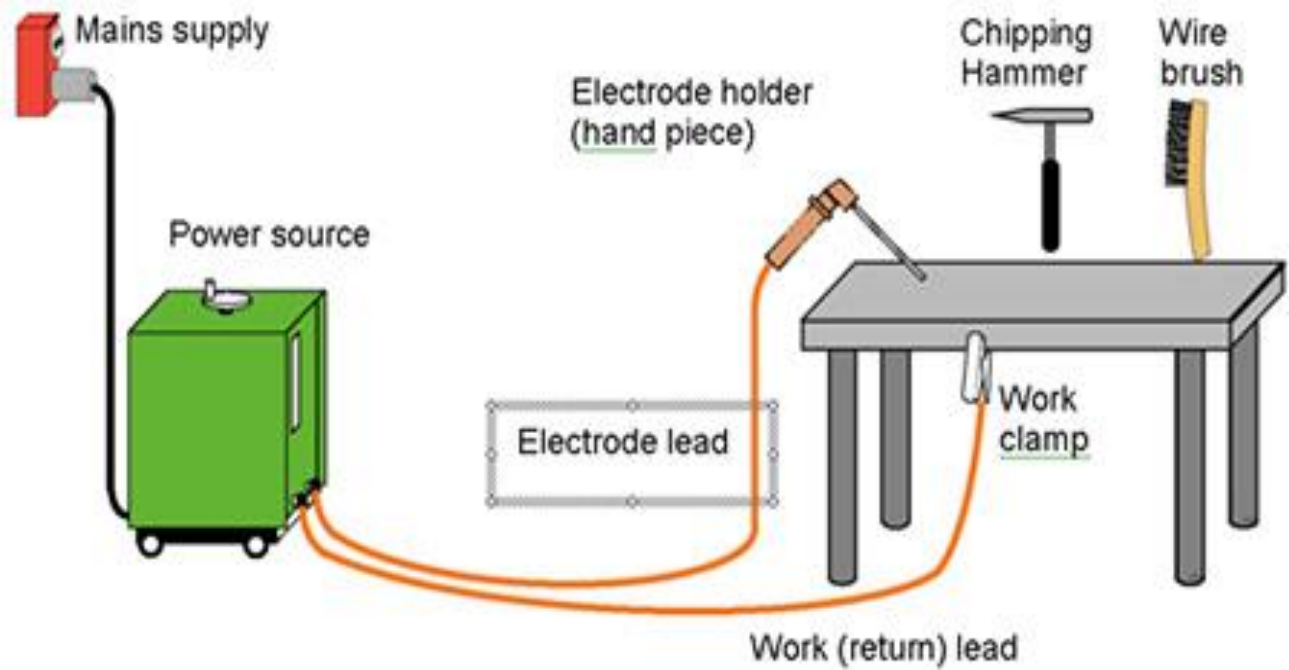


WELDING SHOP



SAFETY PRECAUTION

1. If you can smell gas – don't light any gas torches or use electric welding equipment, but don't rely wholly on your sense of smell to warn you.
2. Wear eye protection and cover bare skin. Be aware that:
 - arc flash can occur through the side of the eye.
 - arc flash can cause 'sunburn' on exposed skin.
3. Mark hot surfaces as such. Better still, assume everything is hot.
4. Know how to use gas equipment safely.
 - Oxygen under pressure can cause the spontaneous combustion of oil or grease.
 - Keep all regulators and air hoses free of oil and grease, and avoid getting grease/oil on hands, gloves and overalls.
 - Use the right gases for the situation. *Never* substitute oxygen for compressed air.
5. Ensure the equipment has the correct current capacity.
6. Provide an isolating switch.
7. Where a flammable gas or solvent is present, an electrical spark might cause an explosion, so welding should not occur.
8. Check the electrical safety of the rod holder or welding hand-piece regularly – maintain or replace as required.
9. Use the shortest possible leads and ensure they are capable of carrying the required current safely.
10. Dry your hands before welding. If you get sweaty, dry off, take a break and use a wooden duckboard to insulate yourself.

LIST OF EXPERIMENT

- (1) To study the different type welding processes, welding defect and hand tools used in welding shop.
- (2) To prepare a Lap joint by the use of Electric Arc Welding process.
- (3) To prepare a Butt joint by the use of Electric Arc Welding process.

EXPERIMENT NO. 1

Objective: To study the different type welding processes, welding defect and hand tools used in welding shop.

VARIOUS TYPES OF WELDING

Forge Welding: This welding is done by the black-smiths. In this two similar metal pieces are heated upto the plastic stage in the furnace. Then it is hammered so that a homogeneous mixture is formed at the joint. The surface to be joined should be cleaned and made free of any foreign particle, this is done by brushing.

Gas Welding: Gas welding is the process in which a gas flame is used to raise the temperature of the metals to be joined. The metals are heated up the melting. The metal flows and on cooling it solidifies. A filler metal may be added to the flowing molten to fill up cavity made during the end preparation. Many combinations of gases are used in gas welding. But the most common of these is oxygen and acetylene.

Arc Welding: The welding in which the electric arc is produced to give heat for the purpose of joining two surfaces is called electric arc welding.

Principle: Power supply is given to electrode and the work. A suitable gap is kept between the work and electrode. A high current is passed through the circuit. An arc is produced around the area to be welded. The electric energy is converted into heat energy, producing a temperature of 3000°C to 4000°C.

➤ **Two Basic Types of AW Electrodes**

1. **Consumable**—consumed during welding process.
Source of filler metal in arc welding.

Forms of consumable electrodes: Welding rods are 9 to 18 inches and 3/8 inch or less in diameter and must be changed frequently

- Weld wire can be continuously fed from spools with long lengths of wire, avoiding frequent interruptions.
- In both rod and wire forms, electrode is consumed by arc and added to weld joint as filler metal (See fig. 1)

2. **Non-consumable** – not consumed during welding process.

- Filler metal must be added separately.
- Made of tungsten which resists melting.
- Gradually depleted during welding (vaporization is principal mechanism).
- Any filler metal must be supplied by a separate wire fed into weld pool.



Fig. 1

FLUX

A substance that prevents formation of oxides and other contaminants in welding, or dissolves them and facilitates removal

- Provides protective atmosphere for welding
- Stabilizes arc
- Reduces spattering

Resistance Welding: Resistance welding is a group of welding processes wherein coalescence is produced by the heat obtained from resistance of the work to the flow of electric current in a circuit of which is the work is a part and by the application of pressure. No filler metal is needed.

Different types of Welding Defect

- A weld defect is any physical characteristic in the completed weld that reduces the strength and/or affects the appearance of the weld.
- Defects that are not visible must be detected by using destructive or nondestructive testing.

Incomplete joint:

The depth of the weld is less than specifications (See fig.2).

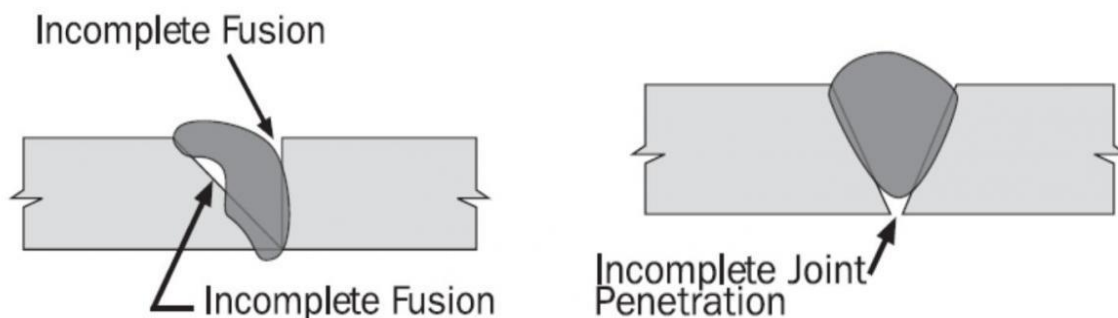


Fig.2

Improper fusion: The weld metal is not completely fused to base metal or passes are not completely fused (See fig.3)

Overlap: The weld metal is not completely fused to base metal or passes are not completely fused (See fig.4)

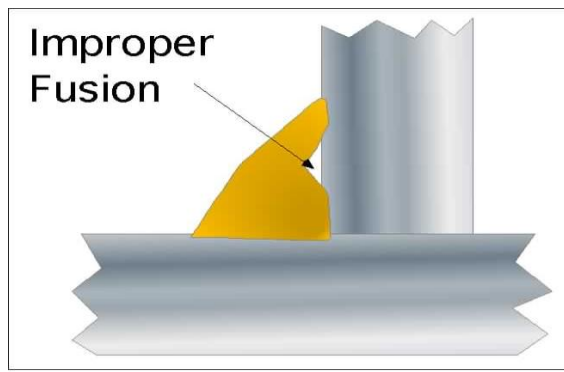


Fig.3

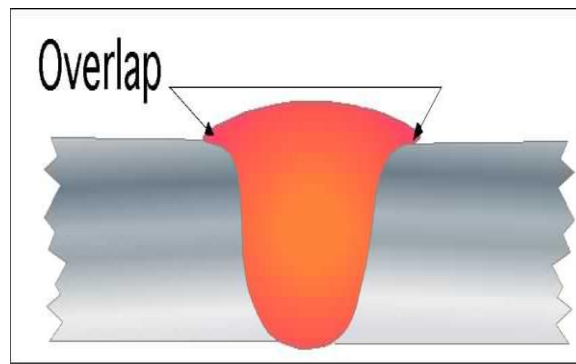


Fig.4

Insufficient Penetration: Weld bead does not extend to the desired depth.

Pits: Small indentions in the surface of the weld (See fig.5).



Fig. 5

Porosity: Small voids throughout the weld material (See fig.6)

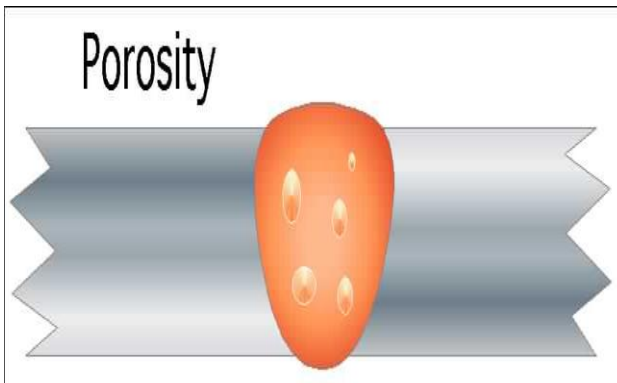


Fig. 6

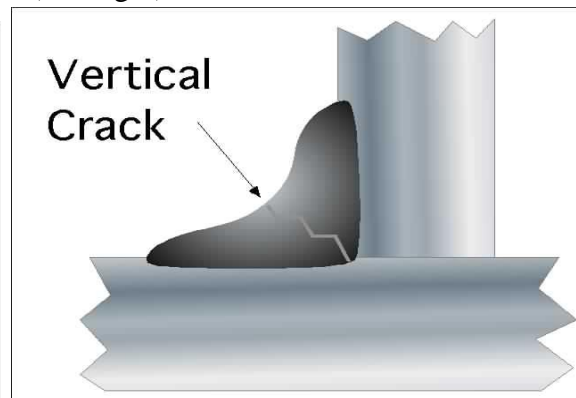


Fig.7

Vertical Cracks: Usually visible cracks on the surface or through the weld (See fig.7)

Irregular Weld: Misshapen and/or uneven ripples (See fig.8).

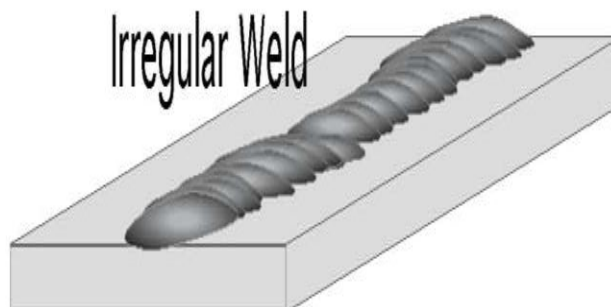


Fig. 8

TOOLS USED IN WELDING SHOP

Welding Helmet: A welding helmet is a type of headgear used when performing certain types of **welding** to protect the eyes, face and neck from flash burn, ultraviolet light, sparks, infrared light, and heat. (See fig.9)

Welding Goggle

Green glass goggles are needed use for torch welding and also have ANSI standards.(American National Standards Institute) When viewing metal that is visibly hot (even before)(or the torch) for longer periods protection is needed for the eyes. While it seems to be low light the wavelengths are bright in non-visible spectrum. These are easier to see through and wear than helmets (See fig. 10)



Fig. 9



Fig. 10

Chipping hammer: A chipping hammer is a tool used to remove welding slag from a weld and welding spatter from alongside welds.

It is used to remove slag when standard arc welding is performed as slag is not produced when MIG or TIG welding is performed. Also used to remove welding spatter in all welding processes (See fig.11).

Wire brush:- A **wire brush** is a tool, consisting of a handle, usually wood or plastic. The brush is usually made from a large number of steel wire bristles.

This is used for cleaning rust and removing paint. It is also used to clean surfaces and to create a better conductive area for attaching electrical connections (See fig.12).



Fig. 11



Fig. 12

Electrode Holder: An electrode holder, commonly called a stinger, is a clamping device for holding the electrode securely in any position. The welding cable attaches to the holder through the hollow insulated handle. The design of the electrode holder permits quick and easy electrode ex-change. Two general types of electrode holders are in use: insulated and non-insulated. The non insulated holders are not recommended because they are subject to accidental short circuiting if bumped against the work-piece during welding. For safety reasons, try to ensure the use of only insulated stingers on the jobsite (See fig. 13).



Fig.13

Outcomes: - On successful completion of this experiment, the students will be able to understanding the different welding process and working of hand tool.

EXPERIMENT NO. 2

OBJECTIVE: To prepare a Lap joint by the use of Electric Arc Welding process.

MATERIAL USED: MS Plate of size (48x48x7)mm – Two Piece.

DRAWING:- See fig.14

TOOLS & EQUIPMENTS REQUIRED: Arc welding machine with all the accessories, electrode holder, earth clamp, try square, hacksaw, steel rule, hammer, pair of tongs, chipping hammer, face shield etc

MATERIAL REQUIRED:

Electrode: MS Electrode 3.15 mm dia. [SWG 10] length 350 mm.

Theory:- **Lap Joint:** This type of joint is used in joining two overlapping plates so that the corner of each plate is joined with the surface of other plate. Common types of lap joints are single lap, double lap or offset lap joint.

Procedure:

1. Marking and cutting the MS Flat
2. Start the welding transformer machine, and then set the current to approx. 100 amps.
3. Tack both the sides of joints. Keeping the flat position of the job, complete the layer.
4. Clean with a chipping hammer and a wire brush and then check the welding layer.

Precaution:

1. Never look at the welding arc without face shield.
2. Always wear flexible gloves and leather apparels.
3. Never touch the hot job with hands.
4. Use specified current and electrodes for arc welding.

Outcomes: - On successful completion of this experiment, the students will be able for fabrication work with the help of electric arc welding process.

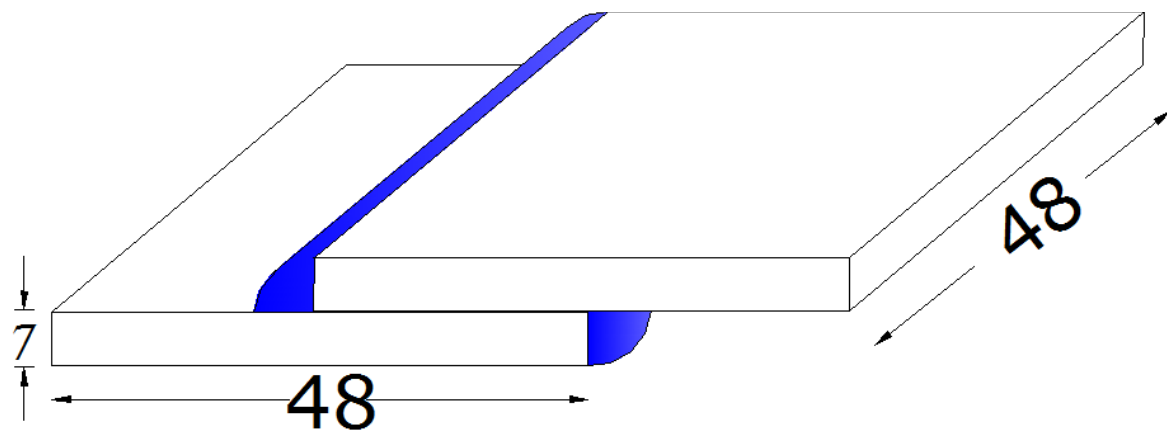


Fig. 14

EXPERIMENT NO. 3

OBJECT: To prepare a Butt joint by the use of Electric Arc Welding process.

MATERIAL USED: MS Plate of size (100x50x7)mm – Two Piece

TOOLS & EQUIPMENTS REQUIRED: Arc welding machine with all the accessories, electrode holder, earth clamp, try square, hacksaw, steel rule, hammer, pair of tongs, chipping hammer, face shield etc.

Material Used:

Electrode: MS Electrode 3.15 mm dia. [SWG 10] length 350 mm

Drawing: See fig.15

THEORY: - **Butt Joint:** In this type of joint, the edges are welded in the same plane with each other. V or U shape is given to the edges to make the joints strong (See fig.32).

Procedure:

1. Marking and cutting the MS Flat
2. Start the welding transformer machine, and then set the current to approx. 100 amps.
3. Tack both the sides of joints. Keeping the flat position of the job, complete the layer.
4. Clean with a chipping hammer and a wire brush and then check the welding layer.

Precaution:

1. Never look at the welding arc without face shield.
2. Always wear flexible gloves and leather apparels.
3. Never touch the hot job with hands.
4. Use specified current and electrodes for arc welding.

Result: - Butt joint is successfully prepared by the use of electric arc welding process.

Outcomes: - On successful completion of this experiment, the students will be able for fabrication work with the help of electric arc welding process.

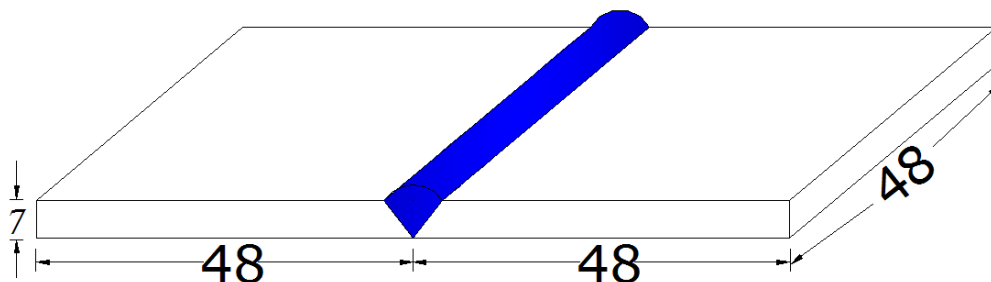


Fig.15