Experiment No.: 6

Experiment title: Arc Welding Processes

Objectives:

- Knowledge of the technical and engineering terminology used in arc welding
- Familiarity with the type of equipment and tools used for welding operations
- Appreciation of the different types of arc welding processes
- Appreciation of specific hazard and safety issues related to welding processes
- Appreciation of the different types of welding joints and positions
- Appreciation of the effects of welding parameters on the characteristics and quality of welded joints
- Knowledge of weld testing techniques

Expected outcomes: at the end of this experiment the students should be able to:

- Select and use safety equipment related to welding operations
- Test welded specimens mechanically and visually
- Relate weld's quality to welding setup and process parameters
- Differentiate between different arc welding processes and their characteristics

Background:

Observe the terminology shown in Figure (1) for arc welding

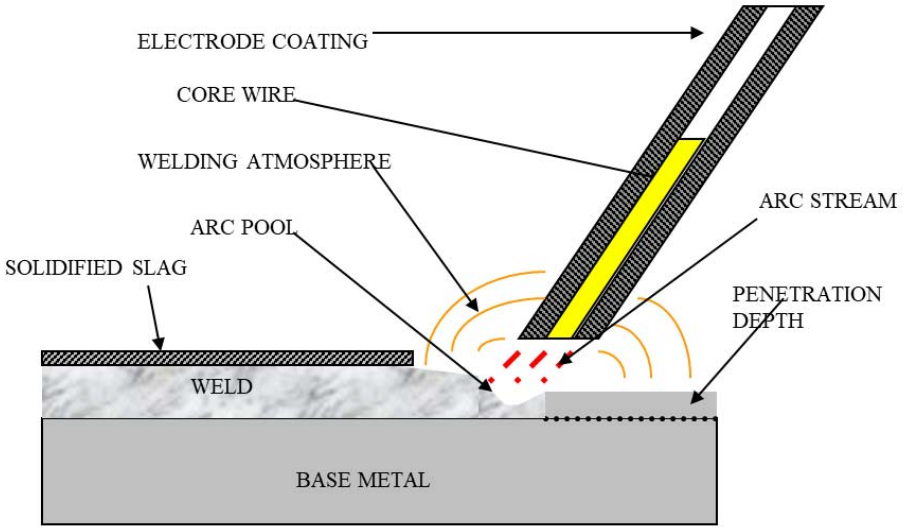


Figure (1): Terminology for the manual arc welding process

Types of arc welding

- **Shielded metal are welding (SMAW); Consumable electrode**
- **Gas metal arc welding (GMAW); Continuous wire electrode**
- **Flux-cored arc welding (FCAW); Continuous wire electrode**
- **Gas tungsten arc welding (GTAW); Manual rod**

Electrical setup of the arc welding process

- **DC-** (Direct Current Electrode Negative): straight polarity
- **DC+** (Direct Current Electrode Positive): reverse polarity
- **AC** (Alternating Current)

Materials and Equipment:

- Arc welding machine, Figure (2)
- A set of steel plate-strips of different thicknesses (4 mm, 6 mm and 8 mm)
- Welding electrodes
- Personal safety equipment (welding mask, gloves, lab coat and safety shoes)
- Universal tensile machine (UTM)

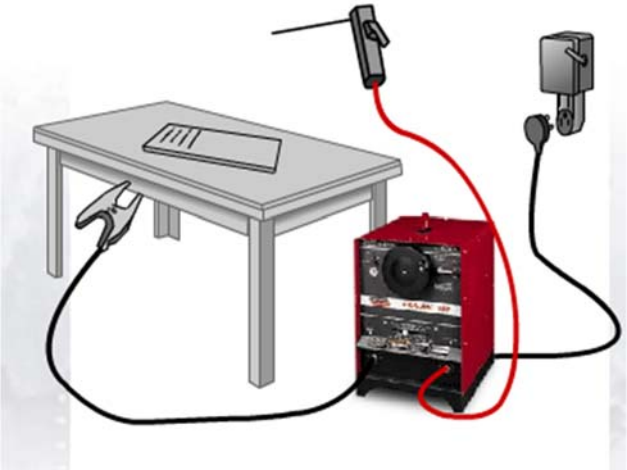


Figure (2): Arc welding machine

Experimental Procedure:

a- Effect of welding parameters

1- Make sure you wear the proper personal protective equipment (PPT) as instructed by the lab engineer

2- Start with the thinner plate strips (4 mm)

3- Observe the lab technician setting up the welding operation and loading the welding electrode into the welding gun.

4- Before the technician starts welding two strips together make sure you record the following in Table (1);

- Electrode diameter
- Welding current
- Welding voltage

5- Watch the technician repeat step 4 at higher speed

6- Watch the technician repeat step 4 at higher current

7- Take a photo of each welded specimen, observe and note down any differences or special features on the welded specimens

8- Watch the lab technician loading the welded specimens onto the UTM and record the following in Table (1); brakeage load and failure position (weld or base metal)

9- Discuss your results and write your own conclusions

Table (1): Values for thin welded plates

Specimen No.	Thickness (mm)	Electrode diameter (mm)	Current (A)	Voltage (V)	Speed (high/low)	Breakage load (kN)	Failure position

a- Effect of polarity

1- Take the thicker plates (6 and 8 mm)

2- Watch the technician welding the plates using the straight polarity

3- Make sure you record process parameters (electrode diameter, current and voltage) in Table (2)

4- Watch the technician welding the plates using the reverse polarity

5- Observe the difference between the two sets of welded specimens, take photos of each specimen

6- Measure the depth and width of each weld joint and record your date in Table (2)

7- Discuss your results and write your own conclusions

Table (2): Values for thick welded plates

Specimen No.	Thickness (mm)	Electrode diameter (mm)	Current (A)	Voltage (V)	Polarity	Weld depth (mm)	Weld width (mm)