

Trade of Sheet Metalwork

Module 3: Thermal Processes

**Unit 12: MMA Welding Lap
Joint – Flat Position**

Phase 2

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Document Release History

Date	Version	Comments
05/10/06	First draft	
07/04/14	2.0	SOLAS transfer

Module 3 – Thermal Processes

Unit 12 – MMA Welding Lap Joint – Flat Position

Duration – 7 Hours

Learning Outcome:

By the end of this unit each apprentice will be able to:

- Read and interpret drawing and weld symbol
- Operate and adjust welding power source
- Select suitable electrodes – sizes
- Tack weld plates to form the lap joints

Key Learning Points:

M P	Weld symbol.
D P	Welding technique - electrode angles, electrode manipulation.
Rk P	Joint set-up.
Sc P	Distortion control.
H P	Safety precautions - radiation, arc eye, treatment of burns.
Sk P	Types of joints.

Training Resources:

- MMA welding power source
- Figure 1
- Safety clothing and equipment
- 3 mm mild steel plate
- MMA video

Key Learning Points Code:

M = Maths **D** = Drawing **RK** = Related Knowledge **Sc** = Science
P = Personal Skills **Sk** = Skill **H** = Hazards

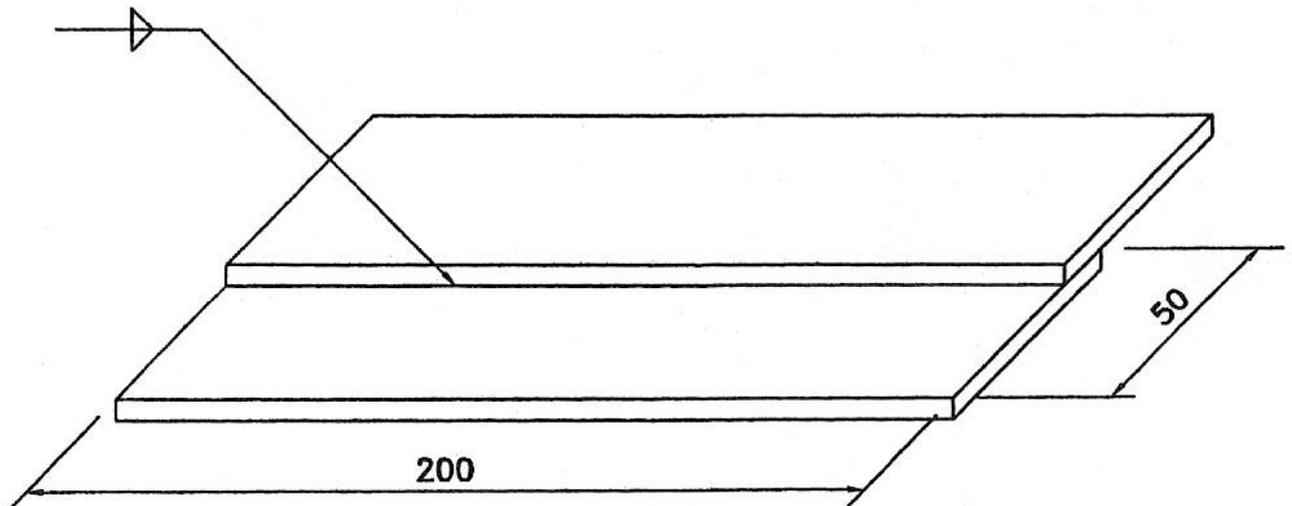


Figure 1 - M.M.A. Welding - Lap Joint

Preparation of Plates

Typical joint preparations are illustrated opposite.

Mild steel plates may be prepared by planning or by machine flame cutting. Shearing is not advisable for plates over 12 mm ($\frac{1}{2}$ in) thick owing to the possibility of shearing cracks appearing. Hand flame cutting is not always sufficiently accurate. Pneumatic chisels may be used for correcting inaccuracies and for chamfering.

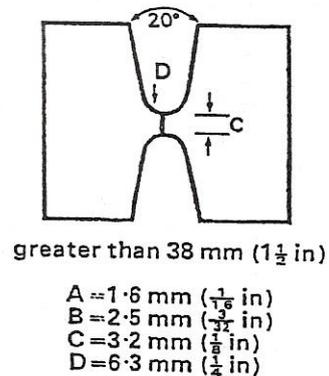
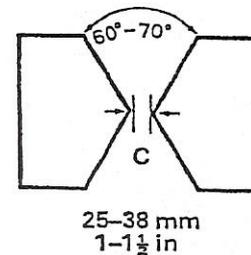
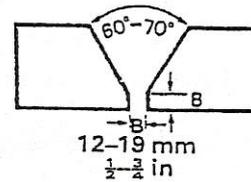
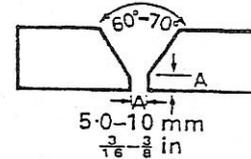
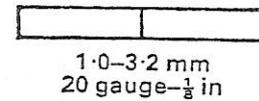
Tacking

When the plates are set up for welding they must be aligned and have a uniform root gap. Tack welds are necessary where the plates are not held by a fixture. They are made with a high current to obtain proper penetration.

The object of tack welds is to hold the plates in alignment and to keep the gap at the correct opening. If the plates are twisted or springy, they must be levered into position and additional tack welds made to hold them. On very thick plates where strong tacks are required, make the tack weld in two layers. Tacks must be de-slugged before the main weld is made.

It is emphasised that tack welds must be strong enough to hold the plates in position. If a tack weld gives way it **MUST** be chipped out and re-welded. Do not weld over the top of a cracked tack weld as the crack may propagate through the joint.

Tack welding of assemblies for fillet welding is carried out in the same way as for butt-welding, but the pitch of the tack welds can be about twice that used for butt joints.



General Welding Hints

Wrought Iron

Wrought iron is sometimes encountered in repair work. It may be laminated, i.e. formed in layers not securely bonded together. For example, a bar 12 mm ($\frac{1}{2}$ in) thick may be in four or more layers. If another bar is welded to the surface it will be attached to the top layer only and may pull this layer away from the others. If a butt weld is made, all layers will be attached and the job will be sound. All strength joints in wrought iron should be butt welds. Fillet welds should only be used for light attachments where there is no danger of pulling the wrought iron apart.

Galvanised Iron

Galvanised iron is mild steel with a thin coating of zinc to provide protection against corrosion. It can usually be welded without difficulty using ordinary mild steel rutile electrodes, but where the edge of the plate is thickly coated or has globules of zinc adhering it is best to clean off the zinc before welding.

The zinc is burned off for a short distance each side of the weld leaving the weld zone unprotected. In order to keep the unprotected area small the heat should be kept to a minimum by using small electrodes at a low current. The welded area must be protected and where possible it is better to galvanise after welding. When welding galvanised iron the welder should be protected from the toxic effect of zinc fumes by wearing a respirator.

Painted Work

Painted work can be welded without difficulty if the paint burns off as welding proceeds. In some types of T and lap joints the paint may run from inside the joint and interfere with the deposition of the weld. It is then best to scrape or burn off the paint before welding starts. Where this is impossible the joint should be sealed by making a very small run with a small electrode at a high current. The main weld can then be made without further difficulty. Some paint pigments have a high sulphur content and this will cause porosity in the weld if the paint is not removed from the surfaces to be welded.

Free/Cutting Steel (High Sulphur Type)

It is very difficult to prevent porosity and brittleness when high sulphur steel is welded, and welds made with ordinary mild steel rutile electrodes, even when they appear to be sound, may fail suddenly in service. If high sulphur steel must be welded, a basic-coated hydrogen-controlled electrode of the BS 1719 class 6 type must be used.

Sulphur printing. To detect high sulphur steel, soak a piece of photographic bromide paper in 5% sulphuric acid for 10-20 seconds and then press it on to a clean bright part of the steel for 2-4 seconds. A dark brown stain on the paper indicates high sulphur steel, whereas a light stain indicates a normal sulphur content. The test can be carried out in daylight, and if desired the print may be fixed by using ordinary photographic hypo.

Arc Blow

“Arc Blow” is encountered with D.C. welding equipment. The arc is forced away from the weld point notably when welding in corners. The conductors carrying the current namely the welding lead from the set, and the return lead from the work piece are carrying current in opposite direction so that a repulsive magnetic force is set up which effects the D.C. Welding Arc.

This conditions occurs most when using currents above 200 or below 40 amps. The best methods of connections are:

1. Weld away from the earth connection.
2. Change the position of the earth wire on the work.
3. Wrap the welding cable a few turns around the work, if possible on girders etc.
4. Change the position of the work on the table if working at a bench.

The Advantages and Disadvantages of A.C. and D.C. Welding

The Advantages of A.C. Welding Plants

- (a) They are cheaper to buy than D.C. Sets. The initial cost is approx. $\frac{1}{2}$ of that required for a D.C. set of equivalent rating.
- (b) Little or no maintenance cost, this is because there are no moving parts in an A.C. Transformer.
- (c) There is no "Arc Blow" as with D.C.

The Disadvantages of A.C. Welding

- (a) Non ferrous electrodes are not so well deposited.
- (b) The electric shock hazard is more pronounced with A.C. than with D.C.

The Advantages of D.C. Welding

- (a) They can be used to deposit both ferrous and non-ferrous electrodes.
- (b) Smoother welding giving an advantage when welding thin sheet metal.
- (c) Safer to use in damp conditions where risk of electric shock is greater i.e. boiler work etc.
- (d) Petrol or diesel sets can be used in remote areas where there is no mains supply. Site work etc.

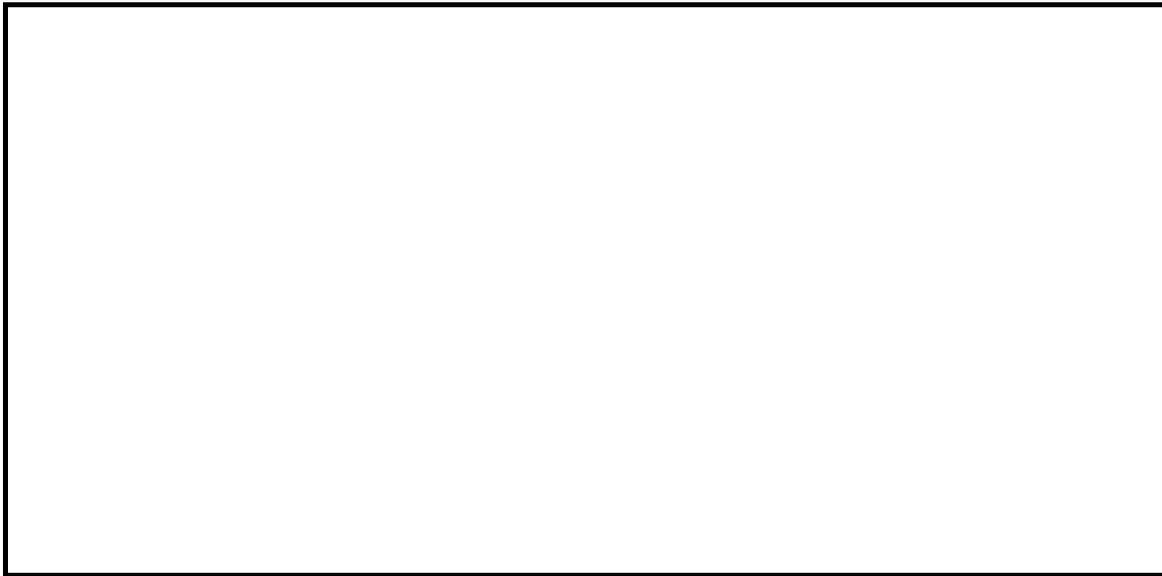
The Disadvantages of D.C. Welding

- (a) More expensive to purchase than A.C. Sets.
- (b) Periodic maintenance of the plant is necessary because of the moving parts.
- (c) Troubles from "Arc Blow".

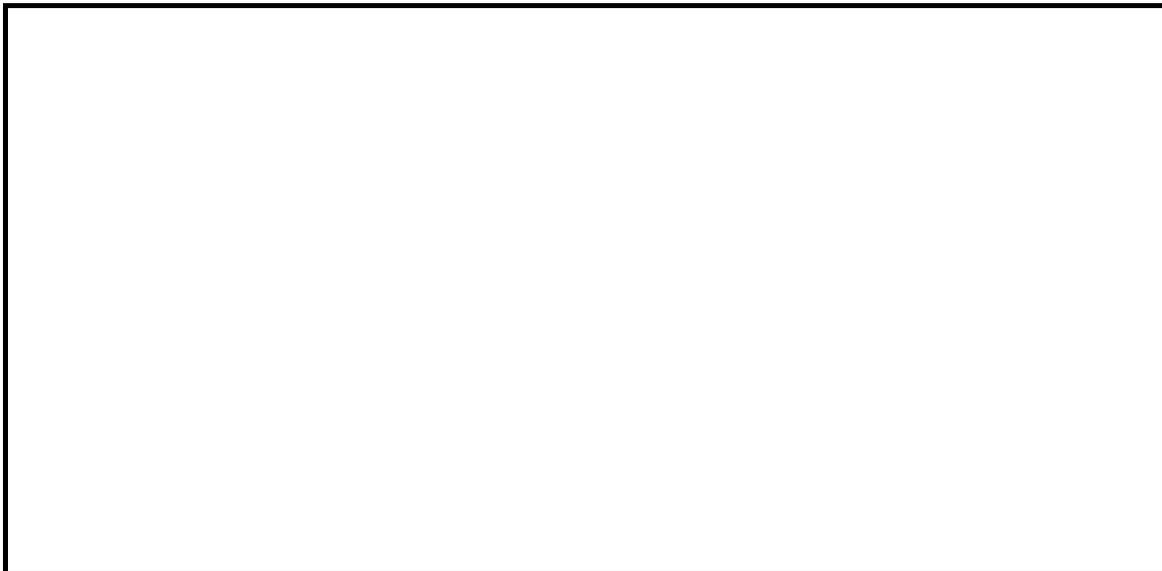
Self Assessment

Questions on Background Notes – Module 3.Unit 12

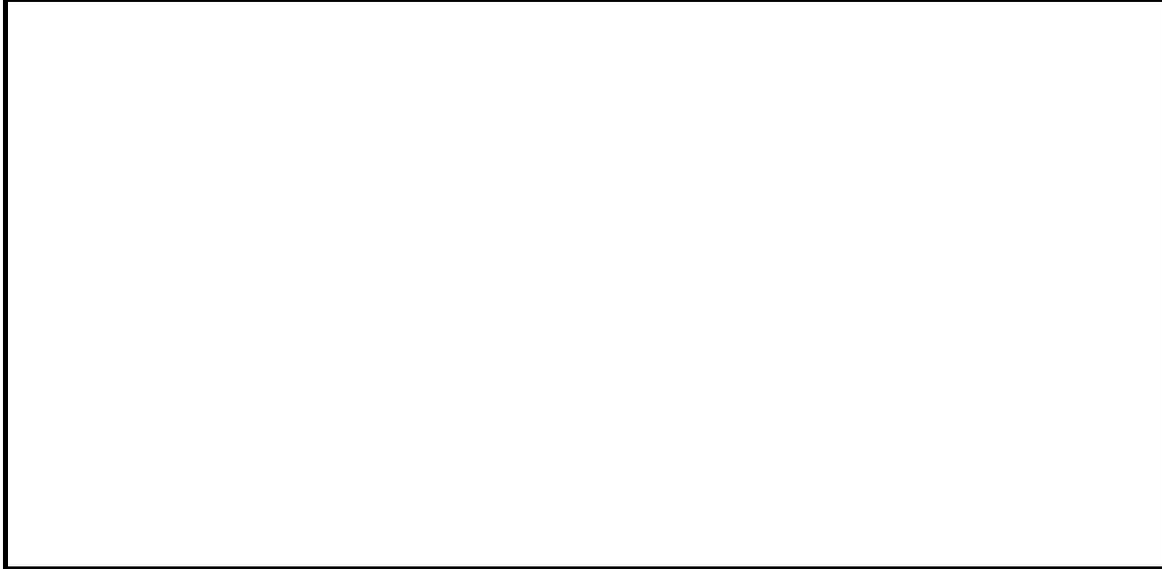
1. Give two ideas as to how you would eliminate Arc Blow.



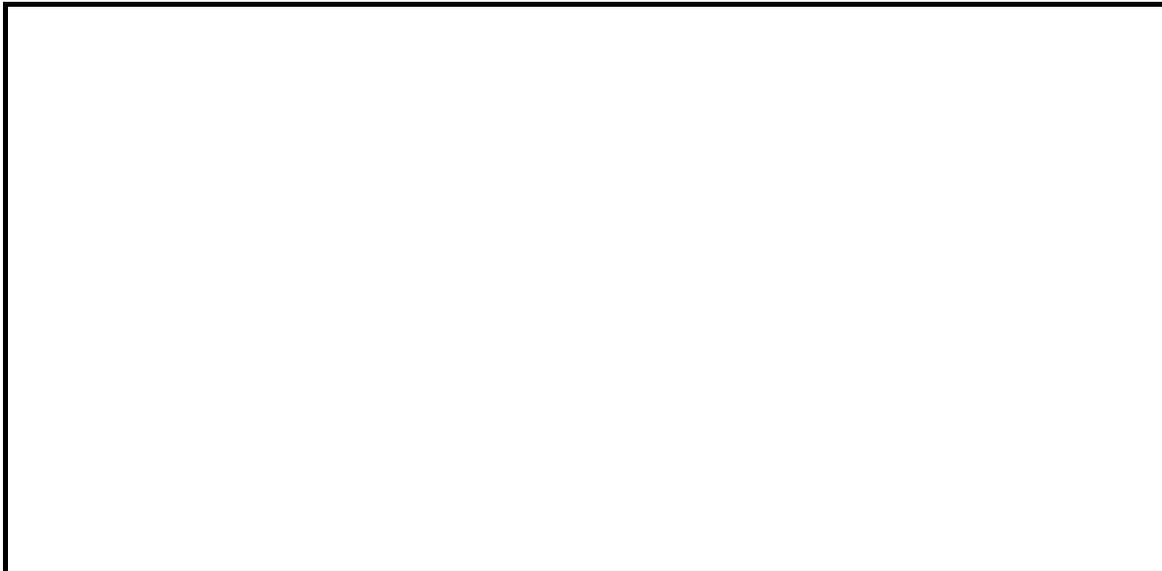
2. Give two advantages of A.C. over D.C. equipment; and two disadvantages.



3. Give two advantages of D.C. over A.C. and two disadvantages.



4. What is the best method/joint to use when welding wrought iron?



Answers to Questions 1-4. Module 3. Unit 12

1.

Arc blow:

Arc blow is encountered with D.C. welding equipment. The arc is forced away from the weld point notably when welding in corners.

To avoid arc blow:

- a. Weld away from the earth connection.
- b. Change the position of the earth wire on the work.
- c. Wrap the welding cable a few turns around the work, if possible on girders.
- d. Change the position of the work on the table if working on a bench.

2.

Advantages of A.C.

- They are cheaper to buy than D.C.
- Little or no maintenance costs.
- There is no arc blow with D.C.

Disadvantages of A.C.

- Non ferrous electrodes are not so well deposited.
- The electric shock hazard is more pronounced with A.C. than D.C.

3.

Advantages of D.C.

- They can be used to deposit both ferrous and non ferrous electrodes.
- Smoother welding giving an advantage when welding thin sheets.
- Safer to use in damp conditions where the risk of electric shock is greater.
- Petrol or diesel sets can be used in remote areas where there is no mains supply.

Disadvantages of D.C

- More expensive to buy than A.C.
- Periodic maintenance necessary because of moving parts.
- Trouble from Arc Blow.

4.

Wrought iron may be laminated i.e. formed in layers. A 12mm bar may be in 4 or more layers. If another bar is welded to the surface it will be attached to the top layer only and may pull this layer away from the others. By using a butt weld all layers are attached and the job secure.

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