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A REVIEW ON TROUBLE SHOOTING, TESTING AND SAFETY PRECAUTIONS PROCEDURE FOR WELDING PROCESS

[1]R.Raja, [2]M.Rajkumar

[1]Assistant Lecturer, St. Joseph College of Engineering and Technology, St. Joseph University-Tanzania, Dar Es Salaam, Tanzania, East Africa. Email: rrajanrm@gmail.com
[2]Assistant Professor, Dhanalakshmi Srinivasan College of Engineering and Technology, Mamallapuram, Chennai

Abstract: – This paper deals with the basic of Trouble shooting and testing procedure for welding process. In addition Arc and Gas welding process equipment was discussed. This paper also covers the concept of safety precaution for welding process with simple figure. This paper would be helpful for the Diploma and UG Mechanical students to study the concept of Trouble shooting, Testing and Safety Precautions Procedure for Welding Process.

Keywords: - Welding, Testing, soldering, safety

1. WELDING - INTRODUCTION

Welding is the process of joining similar metals with the application of heat, with (or) without the application of pressure and filler metal. Welding are used for joining the parts automobiles, aircraft, ships, railways, wagons, machineries, tools, household components, building equipments etc.

Classification of metal joining process
1. Welding
2. Brazing
3. Soldering

Type of welding Process
1. Plastic welding
2. Fusion welding

1.1 Plastic Welding

The pieces of metal to be joined are heated to the plastic state and then forced together by external pressure without the addition of filler material.

1.1.1 Forge welding

The work pieces are placed in a forge or other appropriate furnace and heated within the area to be joins to the plastic condition. Then part are quickly superimposed and worked in to a completed union by hand or power hammering or by pressing together.

1.1.2 Resistance Welding

In resistance welding a heavy electric current is passed though the metals to be joined over area, causing them to be locally heated to plastics state and the welding is completed by the application of pressure for the prescribed period of time.

1.2 Fusion Welding

In fusion welding the metal parts to be joined are melted and the allowed to solidify. In this pressure is not applied. So, the fusion welding is also called as non-pressure welding. Filler metals may be (or) may not be required for fusion welding

1.2.1 Classification fusion welding

i. Gas welding
ii. Electric arc welding
iii. Termite welding

1.3 Types of welding joints

i. Butt Joint – In this process the ends of the two plates kept in the same plan are joined.
ii. Lap joint – In this two overlapping plates are joined.
iii. T-joint – Is used for joining sheets those are kept in the form of T and at ninety degree to each other.
iv. Flange joint – In this, the edges of the joining plates are and forms the flange.
v. Corner joint – In corner joint, the two plates kept at ninety degree to each other is joined at the corners of sheet.

2. GAS WELDING

Gas welding is the process of joining similar metals with gas flames with or without application of pressure and with or without the filler material.

2.1 Basic Principle of GAS welding

The edges or surfaces of the metals to be joined are melted by the gas flame and the molten metal's is allowed or flow together which forms a permanent joint on cooling.

2.2 Types of GAS welding

The welding heat was obtained by burning a mixture of oxygen and a combustible gas.
i. Oxy-Acetylene welding
ii. Oxy-Hydrogen welding

2.3 Necessity of Filler Rod Flux

2.3.1 Filler Rod

The filler rods are made of low carbon steels. Filler rod is a metal rod added to the welding for filling the grooves. The diameter of filler rod depends upon the thickness of work pieces rod be joined.

2.3.2 Flux

Flux is the material used for preventing oxidation and for removing impurities in the weld. The slug is removed from the metal by cleaning. Slag slowly the cooling rate of flux.

2.4 Gas Welding Equipments

The following Figure 1 shows the Oxy-Acetylene Gas welding equipment**.**

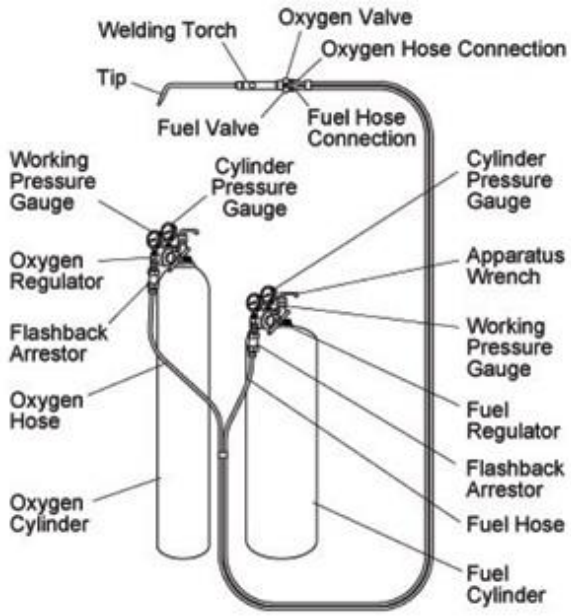

Figure 1 Oxy-Acetylene Gas welding equipment

2.4.1 Gas cylinders

The oxygen cylinder was pained in black colour. Acetylene cylinder was painted in maroon colour. Both the cylinder was made up of steel. Pressure of oxygen in the cylinder is 1200 N/cm^2.

2.4.2 Pressure regulators

Pressure regulators are placed on the top of both oxygen and hydrogen cylinder. Pressure regulators and controls the working pressure of the gases.

2.4.3 Pressure gauges

It consists of two pressure gauges. One pressure gauge indicates the pressure of the inside cylinder and the other indicates the pressure of the working gas supplied.

2.4.4 Welding torch

It was used to mix the gases in right proportion and to deliver the mixture to the nozzle or tip. Control valves are provided in the torch for controlling the flow of the oxygen and acetylene gases.

2.4.5 Welding tip

It was screwed are the end of gas pipe. The gas mixture leaves through this narrow tip. The flame was produced at the end of tip. It is also called as Nozzle. Nozzles of different sizes are used based on the thickness of the metal to be welded.

2.4.6 Hoses

Hoses are made of rubber. It carries the oxygen and acetylene gases from the cylinder for welding. Blog and Green house was used for carrying oxygen and Red hose used for acetylene.

2.4.7 Spark lighter

a. It is used for igniting the flame.

2.4.8 Goggles

Goggles are used to protect the eyes from the heat light radiated from the flame.

2.4.9 Gloves

Gloves protect the hands from the heat and light radiation of flame.

2.5 Gas Welding Techniques

i. Leftward technique or Forehand welding method

ii. Rightward technique or Backhand welding method

2.6 Procedure Sequence for Shutting off the Gas welding plant

The following figure 2 shows the Procedure Sequence for Shutting off the Gas welding plant at the end the work.

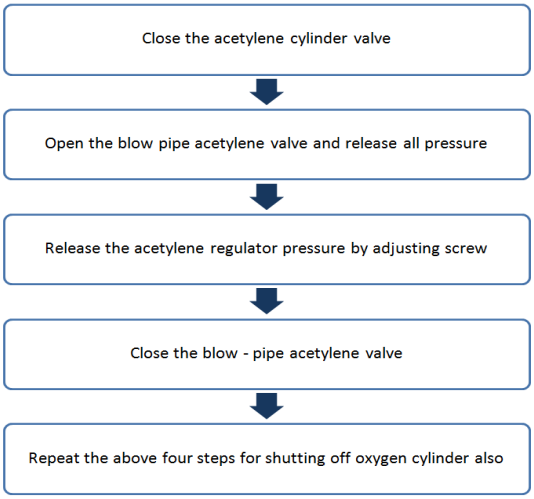

Figure 2 Procedure Sequence for Shutting off the Gas welding plant

3. ELECTRIC ARC WELTING

Arc welding is the process of joining two parts melting their edges by an electric arc without the application of pressure and with or without the use of filler metals. The temperature of the arc is of the order of 3600 ^{o}C. The following figure 3 shows the equipment of Arc welding.

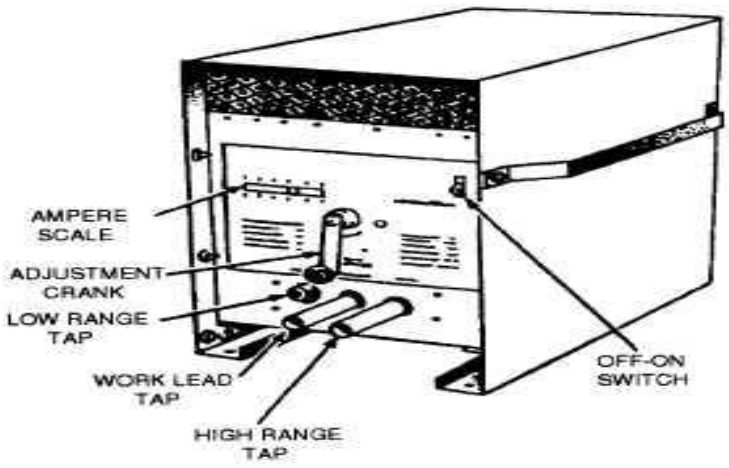

Figure 3 Arc welding equipment

3.1 Basic Principle of Arc welding

An electric arc is generated between the anode and cathode conductors. When there is a small separation in the path of flow of current. The electric arc trucks between the electrode and metal and large amount of heat is generated. This heat melts the metal.

3.2 Arc Welding Equipments

The following equipments are used for Arc welding process

i. A.C Transformer (or) D.C Generator.
ii. Electrode (or) filler rod with electrode holder.
iii. Safety devices
iv. Chipping hammer and wire brush

3.2.1 A.C Transformer (or) D.C Generator

AC transformer supplies the AC current and DC generator supplies the DC current by controlling the current in the transformer winding.

3.2.2 Electrode

Filler rods used in arc welding are called as electrodes. The Electrodes are made of metallic wire called core wire. It was coated uniformly with a protective coating called flux. There are two of electrodes used for are welding. Electrode holder is used for holding electrode.

i. Consumable electrodes

They are made up of copper, steel, brass

ii. Non consumable electrodes

Carbon and graphite varieties are used for Non consumable electrodes

3.3 Safety Devices used for Arc welding

i. Hand Screen
ii. Helmet
iii. Tongs
iv. Goggles
v. Hand Gloves

3.4 Chipping Hammers and Wire Brush

Chipping hammers are used to remove the slag from the weld bead. Wire brush is made up of stiff wire, embedded in wood used removes small particles of slag.

4. SAFETY PRECAUTIONS

Several electrical equipments and inflammable gases like oxygen and acetylene are used in welding. Accidents may occur due to carelessness. So safety precautions are necessary during welding. The following section neatly shows the Safety Precautions for ARC welding and gas welding process.

4.1 Safety Precautions for ARC welding

The following figure 4 shows the Safety Precautions for ARC welding.

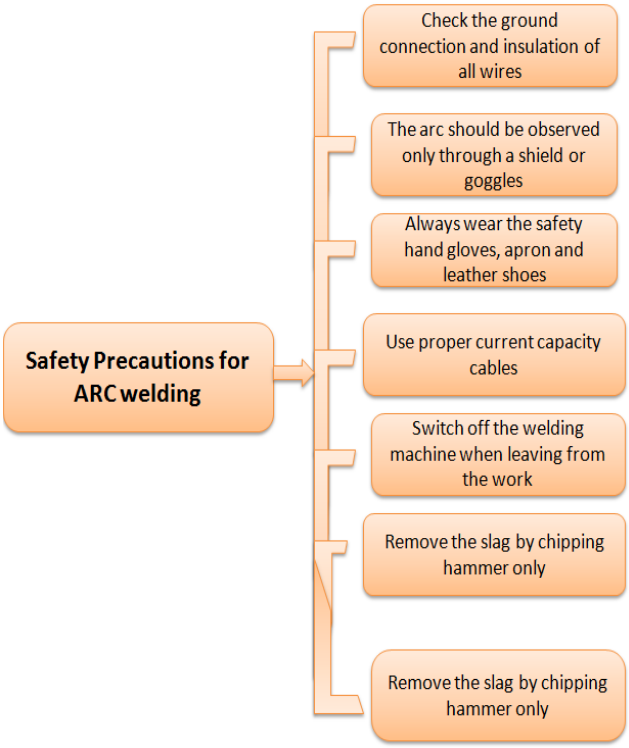

Figure 4 Safety Precautions for ARC welding

4.2 Safety Precautions for GAS welding

The following figure 5 shows the Safety Precautions for GAS welding.

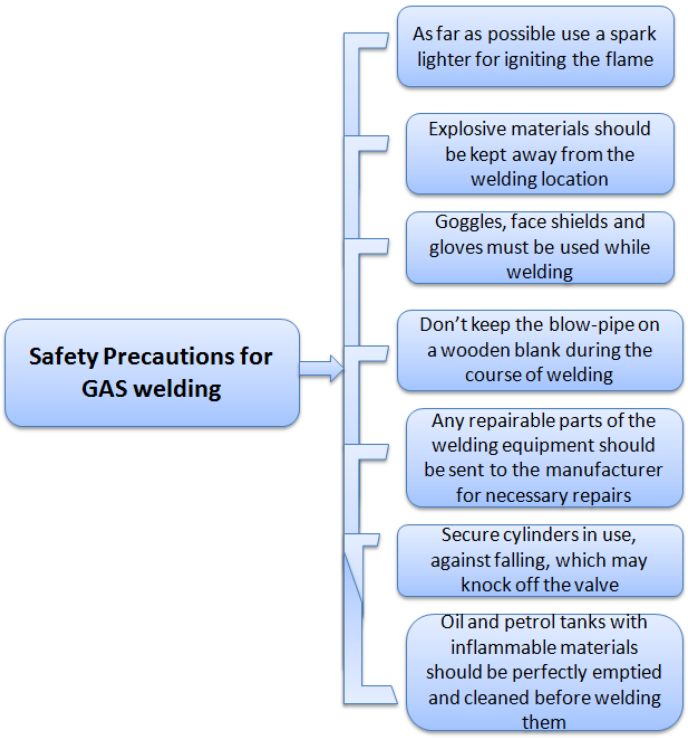

Figure 5 Safety Precautions for GAS welding

4.3 DO'S and DONTS While Soldering

The following figure 5 shows the DO'S and DONTS While Soldering.

Figure 5 DO'S and DONTS While Soldering

5. TESTING WELDED JOINTS

The strength and defects in welded joint are found out by conducting various tests. Non – Destructive Testing and Destructive Tests are used to find out the strength and defects in welded joint.

5.1 Non – Destructive Testing

i. Magnetic particle test
ii. X-Ray test
iii. Ultrasonic test

5.2 Destructive Tests

i. Nick brake test
ii. Bend test
iii. Tensile test

5.1.1 Magnetic particle test

Magnetic particle test is used to find out cracks and slag inclusions. The work piece was magnetized and fine iron powder was sprayed over the surface of work piece. If there was a crack, magnetic poles will be formed at that place. The iron powder will be attracted more at that place and the crack is identified. This test is suitable only for ferrous metals.

5.1.2 X-Ray test

X-ray test is used to fine out defects like porosity, blow holes and cavities. In this method the test piece was placed in front of x-ray tube. The x-ray was passed through the test piece. If there was no defect, the image in the film will be uniform. If there was any defect like porosity or blow holes, it will be shown in the film as bright spots. Drawback of this method is costly and X-rays affect the human health.

5.1.3 Ultrasonic test

This test was used to find out defects like cracks, blow holes and porosity by using ultrasonic waves are high frequency vibrations. In this method, the ultrasonic waves produced by a transducer are passed in to the test piece. If there was no defect, the waves will pass up to the bottom and come back. If there was a defect, the waves will be returned from that place. The returned waves are received by a receiver and converted into electric signals. This signal was projected into a Cathode Ray Tube. By referring the signals, the size and place of defect in test Piece was found out.

5.2.1 Nick brake test

This test was used to find out defects like blow holes, flash eye and slag inclusion. A test piece of length 200mm was used. Two slots of 6mm depth are cut at the opposite sides of the welded portion. It is called nicking. The test piece is placed on two roller supports. The nicked portion of the test piece was broken by applying excessive force. The broken surface of the welded portion was inspected to find defects.

6. DEFECTS IN WELDING - CAUSES AND REMEDIES

Different types of defects and their Causes and Remedies are explained neatly in simple figure as follows.

6.1 Incomplete Fusion Defect – Causes and Remedies

The following figure 6 shows the Incomplete Fusion Defect – Causes and Remedies.

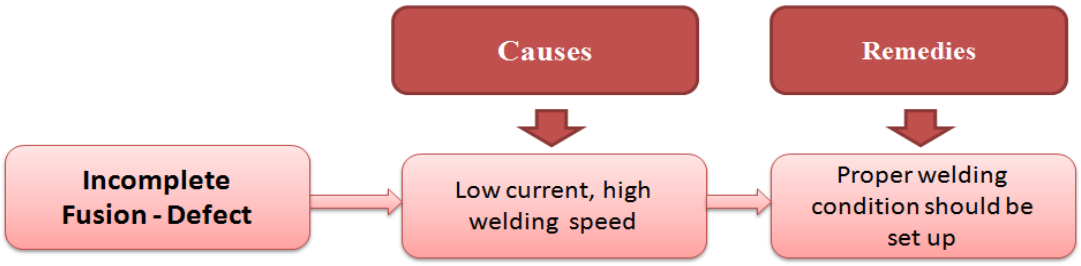

Figure 6 Incomplete Fusion Defect – Causes and Remedies

6.2 Slag inclusions Defect – Causes and Remedies

The following figure 7 shows the Slag inclusion Defect – Causes and Remedies

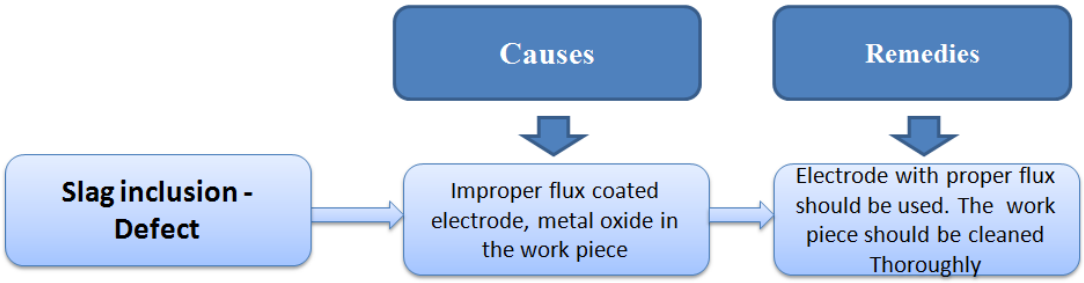

Figure 7 Slag inclusions Defect – Causes and Remedies

6.3 Porosity and blow holes Defect – Causes and Remedies

The following figure 8 shows the Porosity and blow holes Defect – Causes and Remedies

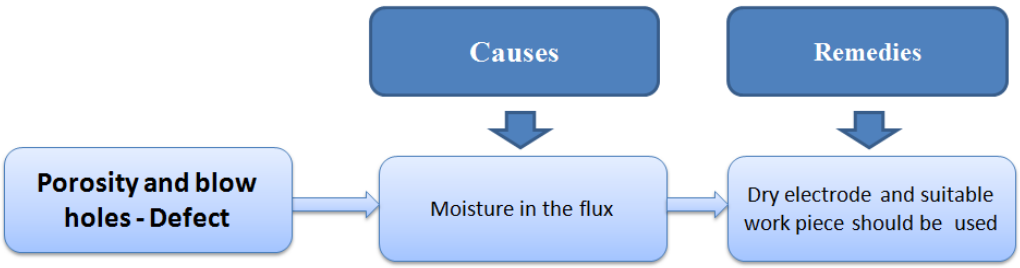

Figure 8 Porosity and blow holes Defect – Causes and Remedies

6.4 Cracks Defect – Causes and Remedies

The following figure 9 shows the **Cracks Defect – Causes and Remedies**

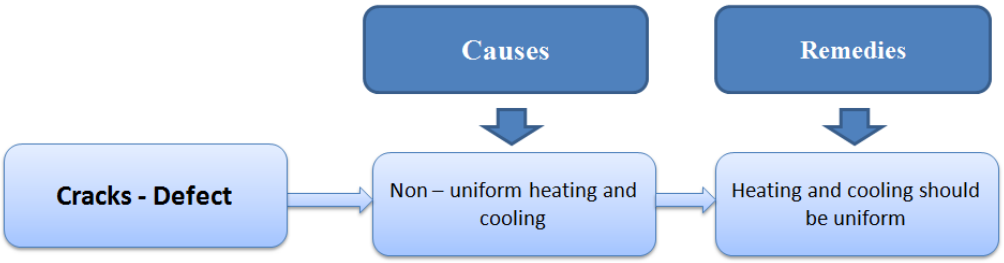

Figure 9 Cracks Defect – Causes and Remedies

6.5 Undercut Defect – Causes and Remedies

The following figure 10 shows the Undercut Defect – Causes and Remedies

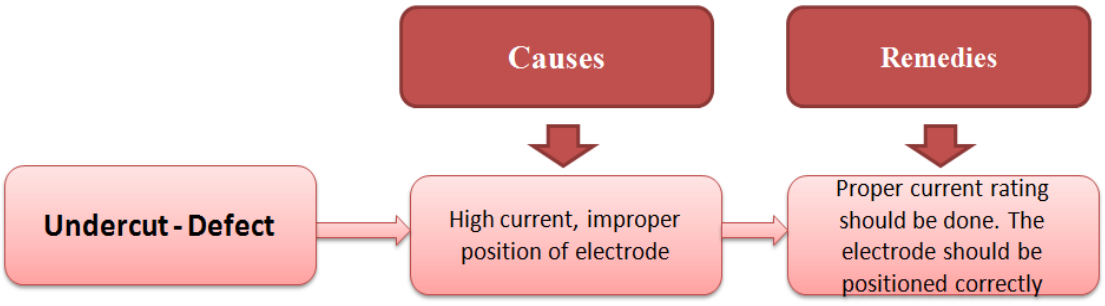

Figure 10 Undercut Defect – Causes and Remedies

Conclusion

This paper would be helpful for the Mechanical Engineer to provide the basic concept of Gas and Arc welding. The Arc and gas welding equipments were explained with necessary diagram. The Testing, Safety precautions and Troubleshooting procedure of Arc and Gas welding process were explained in simple manner.

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