Reduction of Rejection in Orbital Tig Welding

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***Abstract*:- In the current scenario one of the major concerns in all the industries is reducing the defects and wastes in an optimized manner. Coil manufacturing process in one which produces the lot of defects over time. So we had studied the orbital TIG welding process and in analysis we found that in preparing and welding process lot of defects and money wastages will occur.**

This has made us for a thorough study on the process of coil manufacturing. After studying the process closely, it was found that by orbital TIG welding method the defects like porosity and lack of penetration will occur. Ultimately the solution to this problem is the application of flux material on the weld tube surface before welding will result in reduction of above defects, through which the enormous number of defects and cost occurring in this process, could be reduced.

1. INTRODUCTION TO TIG WELDING

TIG Welding is an arc welding process wherein coalescences produced by heating the job with an electric struck between a tungsten electrode and the job. A shielded gas (argon, helium, nitrogen, etc.) is used to avoid atmospheric contamination of the molten weld pool. A filler metal may be added, if required. Welding current, water and inert gas supply are turned on. The arc struck either by touching the electrode with a scrap tungsten piece or using a high frequency unit. In the first method arc is initially struck on a scrap tungsten piece and then broken by increasing the arc length. This procedure repeated twice or thrice warms up the tungsten electrode. The arc is then struck between the electrode and pre-cleaned job to be welded. This method avoids breaking electrode tip, job contamination and tungsten loss. In the second method, a high frequency current is superimposed on the welding current. The welding torch (holding the electrode) is brought nearer to the job. When electrode tip reaches within a distance of 3 to 2 mm from the job, a spark jumps across the air gap between the electrode and the job. The air path gets ionized and arc is established. After striking the arc, it is allowed to impinge on the job and a molten weld pool is created. The welding is started by moving the torch along the joint as in oxy-acetylene welding. At the far end of the job, arc is broken by increasing the arc length. The shielding gas is allowed to impinge on the solidifying weld pool for a few seconds even after the arc is extinguished. This will avoid atmospheric contamination of the weld metal.

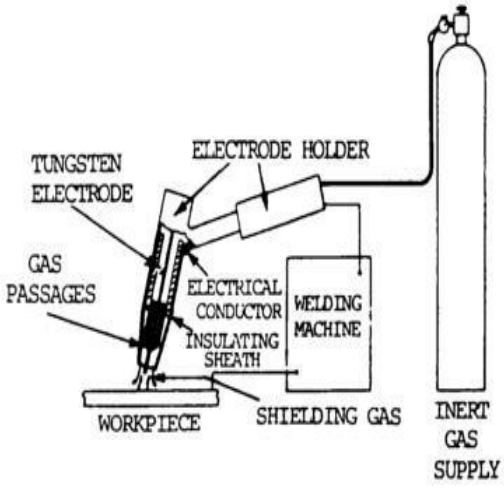

Fig 1.1 Schematic Diagram of TIG Welding

The welding torch and filler metal are generally kept inclined at angles of 70-80˚ and 10-20˚ respectively with the flat work piece. A leftward technique may be used. A flux (derived from Latin fluxes meaning “flow”), is a chemical cleaning agent, flowing agent, or purifying agent. Fluxes may have more than one function at a time. They are used in both extractive metallurgy and metal joining. The role of a flux in joining processes is typically dual: dissolving of the oxides on the metal surface, which facilitates wetting by molten metal, and acting as an oxygen barrier by coating the hot surface, preventing its oxidation. In some applications molten flux also serves as a heat transfer medium, facilitating heating of the joint by the soldering tool or molten solder.

Of all the welding processes TIG, by reason of its cleanness and controllability, is probably the most suitable for machine and automatic use. Some most ingenious and economical solutions have been found for producing consistent automatic welds of' full strength and good cosmetic appearance.

2. INTRODUCTION TO ORBITAL TIG WELDING

Orbital welding was first used in the 1960s, when the aerospace industry recognized the need for a superior joining technique or aerospace hydraulic lines. A mechanism was developed in which the arc from a Tungsten electrode was rotated around the tubing weld joint. The arc welding current was regulated with a control system thus automating the entire process. The result was a more precision and reliable method than the manual welding method it replaced. Modern day orbital welding systems offer computer control, where welding parameters for a variety of appli-cations can be stored in memory and later called up for a specific application. Hence, the skills of a certified welder are thus built into the welding system, producing enormous numbers of identical welds and leaving significantly less room for defects.

Fig 2.1 Orbital TIG Welding equipment

In the orbital welding process, tubes/pipes are clamped in place, and an orbital weld head rotates an electrode and electric arc around the weld joint to make the required weld. An orbital welding system consists of a power supply and an orbital weld head.

The power supply/control system supplies and controls the welding parameters according to the specific weld program created or recalled from memory This supply provides the control parameters, the arc welding current, the power to drive the motor in the weld head, and switches the shield gas(es) on/off as necessary.
Orbital weld heads are normally of the enclosed type, and provide an inert atmosphere chamber that surrounds the weld joint. Standard enclosed orbital weld heads are practical in welding tube sizes from 1/16 inch (1.6 mm) to 6 inches (152 mm) with wall thicknesses of up to .154 inches (3.9 mm). Larger diameters and wall thick-nesses can be accommodated with open style weld heads. Orbital welding is having number of applications in different fields. Their applications are increases day by day now. Some of their applications are listed below.

- Aerospace
- Boiler Tube
- Food, dairy and beverage industries
- Nuclear Piping
- Off shore applications
- Pharmaceutical Industry
- Semi-Conductor Industry
- Tube/Pipe fittings, valves and regulators

3. DEFECTS IN ORBITAL TIG WELDING

Gas Tungsten Arc Welding (GTAW), or TIG, is often specified to meet strict aesthetic, structural, or code/standard requirements. The TIG process is complex, and it is undisputedly the most difficult process to learn. The most common errors occurring in Orbital TIG Welding are Poor Gas Coverage Leads to Contamination

- Welding Aluminum in the Wrong Polarity/Adjusting Balance
- Weld Graininess
- Lack of Fusion in the Root
- Craters
- Dirty Base and/or Filler Metal
- Poor Color on Stainless
- Sugaring on Stainless
- Too Much Amperage on Aluminum
- Proper Arc Length Control

3.1 LACK OF FUSION

It occurs due to improper penetration of the joint. The parameter mainly affects the welding current. If the current is very low, it is not sufficient to heat the metal all over the place. The wrong design of the weld also causes defects. Lack of fusion results from too little heat input and too rapid traverse of the welding torch.

3.2 EXCESS PENETRATION

If the current is very high, it will produce the Excess penetration. It arises from too high heat input and too slow traverse of the welding torch.

3.3 POROSITY

It is due to presence of gases in the solidifying metal which are producing porosity. The gases are oxygen, nitrogen, hydrogen. The parameters which are causing porosity are

- Arc speed
- Coating of the electrode
- Incorrect welding technique
- Base metal composition

4. ORBITAL TIG WELDING SPECIFICATIONS:

Tube materials: CS, AS, SS
Type of edge preparation: V Style (J Style)
Welding power source: Pipe master 5/6 micro controller
Current rating of torch: 200 Amperes Welding Head: D Head
Welding torch speed: 0.2 cm/min Welding wire size: Diameter 0.8 or 1mm Wire feed rate: 0 to 100 IPM
Number of passes: maximum 6 passes Purge time: 5 sec.

5. FLUX MATERIALS

In metallurgy, a flux is a chemical cleaning agent, flowing agent or purifying agent. Fluxes may have more than one function at a time. They are used in both extractive metallurgy and metal joining. Some of the earliest known fluxes were carbonate of soda, potash, charcoal, coke, borax, lime, lead sulphide and certain minerals containing phosphorus. These agents served various functions, the simplest being a reducing agent which prevented oxides from forming on the surface of the molten metal, while others absorbed impurities into the slag which could be scraped off the molten metal.

In high temperature metal joining processes (welding, brazing, soldering) the primary purpose of flux is to prevent oxidation of the base and filler material. Flux is substance which is nearly inert at room temperature, but which become strongly reducing at elevated temperatures, preventing the formation of metal oxides.The role of a flux in joining process is typically dual: dissolving of the oxides on the metal surface, which facilitates wetting by molten metal and acting as an oxygen barrier by coating the hot surface, preventing its oxidation. The flux in the form of powders is made into a paste by mixing with acetone and the paste applied on the surface to be welded by means of a brush. The acetone evaporates with in the seconds leaving a layer of flux on the surface.

6. CONCLUSION

Now a day's competition in the production industries is increasing. The customers are demanding the products having good/high quality. There are no chances for defects now in the product. To sustain in this competitive life there is a need of the change in the production. Optimizing the welding process improves weld quality; increases weld speed, and reduce scrap and rework costs. By achieving these goals, the companies can realize the lower cost per product with a good quality and minimum delivery time. From various literature survey efforts in TIG welding process most of welding parameters like welding flux, welding current, welding speed, depth to width ratio are generally used in research work are identified. Based on the results of implementing the project, the following conclusions are made

1. Reduction in defects and overall cost up to 50%.
2. Energy has been saved.
3. Total cycle time reduction.
4. Increased Orbital TIG welding equipment life and effective material utilization.
5. Less operator fatigue.

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