MINIMIZATION OF WELD DEFECTS IN MIG AND TIG WELDING

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Abstract

Our project work done for minimizing the welding defects that occur during MIG welding at brake unit in Brakes India Ltd. Welding is the process of joining two similar or dissimilar metals permanently, where MIG welding uses inert gas for shielding and consumable metal for joining two metals. In Brake unit, the welding is performed for joining the web with the rim to form brake shoe. This welding should be very strong so as to resist the distortion due to shear force under dynamic condition. To eradicate frequent occurrences of defects such as blow hole, pin blow hole and start weld. Some of the TQM tools such as cause and effect diagram, Pareto chart, 4 M Methodology and why-why analysis are used to identify the root cause. Hence remedial action taken such as liner cleaning, nozzle cleaning, stopper at the machine bed and tensionner at the feeding unit, helps in reducing the rework rate from 5% to 3%.

Key words: MIG welding, weld defects, TIG welding, TQM tools, cause and effect diagram, Pareto chart, 4 M Methodology and why-why analysis

1. Introduction

Welding is a process of joining two metal pieces by the application of heat. Welding is the least expensive process and widely used now a days in fabrication [1-4]. Welding joints different metals with the help of a number of processes in which heat is supplied either electrically or by mean of a gas torch. Different welding processes are used in the manufacturing of Auto mobiles bodies, structural work, tanks, and general machine repair work. In the industries, welding is used in refineries and pipe line fabrication. It may be called a secondary manufacturing process [5-10]. TIG and MIG welding are the most common processes for welding non-ferrous alloys [11-13].

The typical defects caused by melting and solidification such as pores, pinholes, shrinkage cracks, segregation, grain coarsening and cast structure are therefore avoided and the risk of gas pickup is low due to the short welding cycles [14-15]. As far as friction stir welding is concerned, Past experiences reveals difficulties faced during joining of Al to Cu. Linear motion of the tool profile leads to the increase in feed rate value, which causes tunnel defects and voids due to the improper stirring time [16-18].

2. MIG Welding Parameters on Fusion

This defect causes a minute hole in the fused portion, when the hole is single it is called pin blow hole if

there are numerous holes then it is called blow holes and is shown in Fig. 1.

Figure 1. Blow hole defect

The starting portion of the weld region is not welded in this defect thus the starting portion remains un-welded. This is shown in Fig. 2.

Figure 2. Start weld defect

A weld in which the continuity is broken by recurring un-welded spaces is an intermittent weld as shown in Fig. 3.

Figure 3. Intermittent weld

When the weld stops in between and leaves the rest of the portion un-welded then it is termed as In-complete weld as shown in Fig.4.

Figure 4. Incomplete weld defect

3. Factors Responsible for Defects

The defects are studied and analyzed to get the various possible reasons that cause the defects. The reasons are segregated in their respective groups as shown below.

i. Factors responsible for Pin blow hole and blow holes are

- 1) Variation in gas composition.
- 2) Irregular supply of gas.
- 3) Inclusion of foreign bodies.
- 4) Presence of oil in the rim or web.
- 5) Leakage of lubricating oil on to the weld area.
- 6) Moisture content in the gas that is being supplied.

ii. Factors responsible for Start weld

- 1) Delay infusion.
- 2) Insufficient starting voltage.
- 3) Providing excessive Dwell time.

iii. Factors responsible for Intermittent Weld

- 1) Irregular wire feeding.
- 2) Fluctuation in voltage.
- 3) Error in transformer.
- 4) Dust in liner.
- 5) Dust in contact tip.

iv. Factors responsible for Incomplete weld

- 1) Completion of weld wire in midway of welding operation.
- 2) Struck weld wire

4. Validation of causes

Table 1. Validation of Causes

CAUSES	SOURCE	SIGNIFICANCE
Completion of weld wire	Welding wire barrel	Significant
Leakage of oil on welding region	Lubrication oil	Significant
Nozzle dust	Welding fumes and spatters	Significant
Variation of voltage	transformer	Significant
Oil on the job	supplier	Significant
Dust in the liner	Copper coat on weld wire	Significant

5. Countermeasures

Ring sensor is being installed for governing the availability of welding wire. This ring senses the presence of welding wire in it and alarms when the wire doesn't pass through its passage. By providing this sensor we can lessen the incomplete weld defect jobs. The name of this sensor is Ring Style Inductive Proximity Sensor.

Figure 5. Operating conditions of sensors

This will also lead to reduce the defect rate. The wire needed for welding one cycle is about 5 meters so the sensor should be placed before 4 meters so that there won't be any incomplete weld defect.

The next counter measure is for cleaning the liner that allows the weld wire to pass through it so that the weld wire passes through the liner smoothly and continuously. For accomplishing this we provide a T-Joint before the feeder unit where two opposite passage are for the provision for weld wire inlet and outlet. The third passage is for the inlet of pressurized air the third passage is supplemented with paint thinner using a container, this container is provided with small hole at the top of the container so as to maintain the pressure on the thinner. This setup is shown in the fig. 6 shown below.

Figure 6. Recommended setup

For cleaning the torch liner after the feeder unit we provide a solenoid valve, this solenoid valve is used to provide an alternate supply of air and gas that is when air is supplied gas flow is shut and vice-versa. Here the paint thinner is not used because it will cause voltage fluctuation or it may leak on to the weld area thus creating a pin blow-hole. This setup is shown in the Fig.7.

Figure 7. Recommended setup

6. References

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