REDUCTION OF WELDING REWORK IN PEMA MEK PANEL WELDING MACHINE

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Abstract: PEMA MEK panel welding machine provides operator friendly working environment. Normally, two operators can operate a PEMA MEK panel welding line. The operator working area is open, and welding torch adjustment is easy. Compared with MIG/MAG welding, submerged arc welding ensures good working conditions without welding fumes, welding spatters or arc radiation. This welding machine can be used for sub- and full-panel welding and economiser tube welding. High welding quality and perfectly straight tube panels are achieved with proper material preparation and heavy-duty tube and fin-bar guiding during the welding phase. PEMA MEK panel welding machine has few welding defects which prevent it from attaining perfection. The purpose of our project is to reduce these welding defects and to increase the machine efficiency and increase the quality of the welding done in terms of labour force.

Keyword: Burn-Through, Porosity, spatter, Undercut, Welding defects.

1. Introduction

Welding is defined by American welding society (AWS) as a localized coal essence (the fusion or growing together of grain structure of the materials being welded) of metals or non-metals produced by heating the materials to necessary to the welding temperature with or without application of pressure alone and with or without the use of filler metals. In other style welding could be defined as a process of joining of similar metals by application of heat with or without application of pressure and addition of filler metals. The result is a continuity of homogenous material of the composition and characteristics of two parts which are being joined together. The applications of a welding is varied and extensive that it would be no overstatement to say that there is no industry and branch of engineering that does not bring into play of welding in one form or another. The use of welding in today’s technology is extensive. It had a phenomenal rise since about this growth has been faster than the general industrial growth. Many common daily-use items, automobile cars, aircraft, ships, electronic equipment, machinery, household appliances, depend upon welding for their economical construction. At present time, welding practice is divided into about 70% arc welding with balance divided between resistance welding and oxyacetylene welding. In detail, the future of any new metal may depend on how far it would lend itself to fabrication by welding.

2. Experimental Setup

PEMA MEK is stationary welding lines are designed according to customer requirements as shown in Fig.1. Standard panel widths are 900, 2000 or 2500 mm. Depending on the required production capacity welding machines can be mounted with 2–6 welding torches, and the line capacity can be easily doubled with a second machine working in the same conveyor line. With an advanced panel welding line equipped with one welding machine, even 3 km of seam can be welded on an 8-hour shift. This welding machine can be used for sub- and full-panel welding and economiser tube welding. High welding quality and perfectly straight tube panels are achieved with proper material preparation and heavy-duty tube and fin-bar guiding during the welding phase. The conveyor line is designed based to the required panel length and width. An automatic tube and fin-bar in-feeding line can be used for welding capacity requirements. Normally, two operators can operate a PEMA panel welding line. Operator working area is open, and welding torch adjustment is very comfortable. Compared with MIG/MAG welding, submerged arc welding ensures good working conditions without welding fumes, welding spatters or arc radiation.

Figure 1. PEMA MEK Welding Machine
3. Experimental Procedure

3.1. Flux Cored Arc Welding

Flux cored arc welding (FCAW) is similar to that of GMAW as far as operation and apparatus are concerned as shown Fig 2. The most important difference is FCAW utilizes an electrode that is very different from the solid electrode used in GMAW. The flux cored electrode is a fabricated electrode and since the name implies, flux material is deposited into its core.

The flux cored electrode starts as a flat metal strip that is formed first into a U shape. Flux and alloying elements are deposited into the “U” and then the model is closed into a tubular configuration by a series of forming rolls. Flux cored arc welding (FCAW) has the high deposition rate due to stub elimination. Flux cored wire gives less spatter and improved weld finish due to arc stabilization & slag-forming compounds at the core, which leads to less porosity. Flux core wires use standard tube materials and the required chemistry is achieved through alloy powder introduced in the core. Flux core wires have great advantage in continuous hard facing work & also in welding steel pipes involving 360° welding. The core will have a mixture of elements whose functions are different. The following gives the important common core elements & their functions.

3.2 Flux Cored Arc Welding Electrode

Gas shielded flux cored electrode for welding carbon steels were developed this 1950 and were made commercially available in 1957. This process was developed to combine the best of submerged arc welding. In an addition of ingredients in the core and the external CO2 gas shield produce high quality welds and a stable arc with a low spatter level. Initially these electrodes were available only in the larger dimension diameter of (5/64”-5/32”) and were for use in the flat or horizontal positions on heavy weldments. In 1972 miniatures diameter gas shielded flux cored electrodes for welding in each position were developed and this significantly expanded the flux cored arc welding field.

3.3 Function of a Flux

As with coated ingredients, each manufacturer has own formulas for the flux ingredients. The mixture of composition flux core can be varied to provide electrodes for specific applications.

3.4 Defects in PEMA MEK Welding Machine

3.4.1 Porosity

Porosity is a determination of void empty spaces in a material and is a fraction voids over the total volume, between 0 and 1, or as a percentage between 0 and 100%. Strictly speaking some research measure the accessible void the total amount of void space accessible from the surface. It has many ways to test porosity in a substance or part such as industrial CT scanning.

3.4.2 Blow Holes

Blowholes refer to cavity-type discontinuities or pores formed by gas entrapment during the solidification of molten weld metal as shown in fig.4. Porosity reduces the strength of a weld. In arc welds, it caused by dissolved gases that are regularly present in a molten weld metal.

3.4.3 Skip

This will start welding the panel only after the panel start moving some distance. Hence some portion of the panel which will not be welded. This is called skip as shown in fig.5.
3.4.4. Undercut

Undercuts are grooves melted into the parent metal adjacent to the toe of a weld and left unfilled by weld metal, as shown in fig. 6.

3.4.5. Lack of Fillet

Due to improper examination of filler rod in the coil, when the filler rod gets over the welding torch will shut down but the machine won’t get shut down so the panel will keep on moving this cause rework.

3.4.6. Burn-Through

Burn-through is the holes burned through the parent metal in a single pass weld or the root in multi-run welds. The causes for their occurrence may include excessive root gap, an insufficient root face, or excessive welding current coupled with low welding speed.

3.4.7. Offline Weld

It was mainly caused by welding is either completely flat side or tube side. The welding is not exactly engage between flat and tube.

4. Results and Discussion

Discussions were made along with experts and few ideas were suggested to avoid the rework, idea implementation is not an easy process to install at once so basic ideas are implemented such us

✓ Use the flow sensor to reduce the porosity
✓ Use perfectly clean, dry welding equipment and electrodes
✓ Using newer moisture resistant SMAW stick electrodes with hydrophobic (water-hating) flux coatings
✓ Always purge the shielding gas line before welding
✓ Excessive welding current and too long arc lengths should also be avoided
✓ The wire feeding rate was normally torch stick at set in the range of 15-20mm.
✓ This range was the correct range for non-forming of worm crack.
✓ Placing another tube of same outer diameter and inner diameter in such a manner that it moves along with the tube to be welded to avoid skip
✓ Since weld offline and undercut are less than 1 % we can ignore it

After implementing ideas rework levels reduced to
5. Conclusion

Our remedial suggestions are commonly applied in the welding of PEMA MEK panel welding machine. After using these suggestions the reworks are commonly reduced. This is tested and the new sequence is being optimized by trial and error method. The optimization of the sequence reduces the operation time for welding.

(i) Reduces the overall cost of production,
(ii) Increases the productivity of the company

Due to these changes the overall equipment effectiveness has also been increased.

References
