ador WELDING

e-Weldone

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MECHANISED WELDING

WHY WELDING MECHANISATION / AUTOMATION.....?

The main objective is to reduce the manufacturing cost by:

- Controlling the welding parameters mechanically and electronically (simple programming).
- May be manually varied during welding to maintain the required welding position.
- By the use of standard and simple Welding Aids, such as: Columns and Booms, Welding Rotators, Seamers, Welding Positioners etc.
- Utilisation of SPMs for repeated welding like LPG Cylinders, Milk Cans, Valve Seats, Trolley Wheels, Wheels of heavy vehicles, Hydraulic Cylinders, Pipes to Flanges, Axles, Silencers, Shock Absorbers, etc.....and more sophisticated SPMS requiring integration of Robots and material handling.

It can be achieved as follows:

- Controlling Heat Input and the HAZ.
- Increasing productivity i.e. higher output.
- Improving Consistency, Quality, Reliability, & Integrity of the welds.
- Reduction of Scrap.
- Reduction of Reworking to almost 'Nil'.
- Reduction of Man hours/ton.
- Reduction of skilled welders.
- Reduction of power consumption.
- Creating quick turnaround cycles, saving space & time on fixtures. Reduction of crane handling time.
- The utilisation of portable automatic 'all position' welding carriages, which can be taken to the job, instead of the job taken to the machine.
- Saving the operator from exposure to fumes and eye strain from the arc.
- Most important - RETURN ON INVESTMENT.

Welding Mechanisation / Automation serves as a tool for 'Reverse Engineering'.

In manual welding, normally, the onus is on the welder to cover poor fit-ups by over-welding, & also repair flaws by 'touching-up'.

This not only makes the weld look bad, but can also be dangerous in case of a failure in a part which may be a danger towards human life.

Poorly fit up joints are not acceptable for high quality welds. Secondly, during welding automation the weld arc cuts through the joint causing expensive repairs (Reworking).

In order to achieve good fit-ups, edge preparation has to be accurate, diagonal accuracies to be maintained, etc, as per the specifications laid down.

Typical objections, initially raised by prospective users towards Welding Mechanization & Automation:

"If the machine breaks down, all the work comes to halt".

"One can hire more welders & complete the job cheaper, as compared to the high cost of the equipment".

"Welders & welding machines can be available almost immediately, while there is a lead time of 6-12 weeks or more, for the procurement of the automatic equipment".

The comments mentioned in the foregoing paragraphs can be countered through the following headings: Arc Time, Example 1. BUTT welding (Vertical -3G position), Example 2. Summary Fillet Welding (Horizontal 1-F).

ARC TIME

Example

1. MMAW - the "Arc- time" in India is around 18%.

2. Manual Mig welding - the "arc time" in India is around 23%.

3. Automatic welding (MIG, SAW, Plasma etc.) - the"Arc-Time" is *70%.

(With automation we can achieve arc times up to 70%- 80%, provided handling and setting up time is a minimum, and welding lengths are reasonable long (so that setting up time is absorbed). The balance 20%-30% is used in setting up time, changing wires, replacing gas cylinders, cleaning nozzles, and minor outages etc).

From here, let us move onto some practical figures in weld metal deposition per shift.

- It is difficult to cite a general example due to the wider range of currents that can be used on a particular diameter wire in different positions.
- In order to take a common parameter for all the three "Arc Times" mentioned above, the best compromise is Vertical (3G) welding with 8 swg MMAW electrodes, 1.2mm FCAW wire and Argon/CO_2 mixed gas.
- The common current for all the three processes is around 180 amps, in the 3G Position.
- MMAW - A welder burns an average 60 electrodes per 8 hours shift.
- Average arc time for MMAW in the country is 18-19%.
- Hence for a MMAW welder weld deposition/shift @ 18%arc-time=2kg/8hrshift.
- MIG-1.2mm dia FCAW wire deposition rate @ 180-200amps=2.8kg/hr
- 1.2mm dia FCAW deposition at 25% @ arc-time=5.6Kgs/shift.
- Average arc-time for manual MIG/FCAW in the country is 23%-25%.
- Hence, an Auto- Mig welder's weld deposition/shift @ 70%arc-time=15.7Kgs/8hr.

  Arc times over 80% are quite common, once the set-up time is minimised and there is repeatability in the welding sequence.

SUMMARY (3G Position) BUTT WELDING

• A MMAW welder deposits	2.0 Kgs/8hr shift
• A Manual MIG welder deposits	5.6 Kgs/8hr shift
• An Auto MIG Welder deposits	15.7 Kgs/8 hr shift

EXAMPLE- FILLET WELDING (Horizontal-1F)

Consumables used: 1.2 FCAW wire. Argon/Co2 gas mix

The high productivity through welding automation can be seen by Examples 1 & 2 cited in the foregoing paragraphs.

- A manual Mig welder welds 5mm fillet - 30 metres in an 8 hour shift.
- Mig auto carriage welding speed 450mm/minute
- At 100% Duty cycle, a Mig auto welder welds 5mm fillet
- 27 metres in an hour.
- At 100% Duty cycle, a Mig auto welder welds 5mm fillet - 216 metres in an 8 hr shift.
- At 70%. Duty cycle, a Mig auto welder welds 5mm fillet - 151 metres in an 8 hr shift.
- With Dual torches -302 metres in an 8hr shift.
- We can see why it is important to use a measure like Arc-Time, Man Hour Per Ton, metres per hour, etc, when we talk in terms of automation. This helps us to quantify the savings.
- From the above, it is evident that the weld deposition rates increase considerably by the deployment of simple automation processes. One can imagine the savings in manpower, equipment, power etc. and the increase in arc-time, by using several of these carriages in a fabrication shop, or at a construction site. These carriages can be used for welding and cutting applications.

EFFECTS OF "OVER-WELDING" IN FILLET WELDS

The actual size of the Fillet specified as per the drawings is 6 mm.

Let's examine the extra weld metal used by welding 7mm and 8mm fillet leg lengths respectively.

The area of the 6 mm fillet weld is 18.0 mm^2

The area of the 7mm fillet weld is 24.5 mm^2. (36% Over Welded)

The area of the 8mm fillet weld is 32.0 mm^2 (78% Over Welded)

Just imagine, if the quantity of electrodes planned for 6mm fillet welding is 1 ton.

By welding 7 mm leg length fillet the actual consumption is 1.25 Tons Approx.

By welding 8 mm leg length fillet the actual consumption is 1.78 Tons Approx.

This means wastage of 25% & 78% respectively. This is a criminal wastage of consumables, not to mention the slower welding speed, increase in heat input & hazard, distortion, extra manpower etc.

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