Laboratory Manual

MANUFACTURING TECHNOLOGY LABORATORY (MTI-191)

1.0 Title of the Experiment: Submerged Arc Welding.

1.1 Aim: To measure weld deposition rate at various current setting and determine corresponding mechanical and metallurgical properties.

1.2 Performance Objectives

Students will be able to

1.2.1 Compare this process with other arc welding methods and judge its applicability.

1.2.2 Visualize the effect of submerged arc on base plate and weld metallurgy.

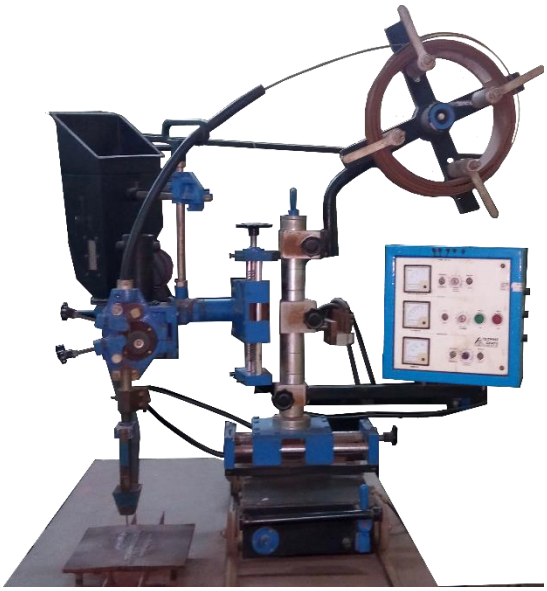
1.2.3 Analyze joint properties and determine welding parameters required to get a desired output.

1.3 Theory

Submerged Arc Welding (SAW) is a fully automated high productive process. A bare electrode is continuously fed through contact tube connected to the power source. Wire feeding is done by a motor connected with the controller. Roller guide draws wire from a reel. The wire where it meets the work piece and surrounding area always remain covered with granular flux continuously fed from the flux hopper. The arc is generated when the electrode comes closer to the job piece. For this welding process DCEP i.e., electrode connected to positive terminal of the power source and job piece connected to negative is most preferred.
Due to flux covering the arc is not visible. Hence the name submerged arc applies. The heat generated, melts portion of the flux above the arc. This molten flux acts as a protective covering as well as thermal insulation during and after the welding process. The molten flux solidifies to form slag as the arc propagates along the weld line. After the welding is done, unused/unsolidified granular fluxes can be collected for reuse. The slag is removed by chipping. The flux also acts as a thermal insulator by promoting deep penetration of heat into the work piece. The unused flux can be recovered (using a recovery tube), treated, and reused. The consumable electrode is a coil of bare round wire 1.5 to 10 mm in diameter; it is fed automatically through a tube (welding gun). Electric currents typically range from 300 to 2000 A. The power supplies usually are connected to standard single- or three-phase power lines with a primary rating up to 440 V. Because the flux is gravity fed, the SAW process is limited largely to welds in a flat or horizontal position having a backup piece. Circular welds can be made on pipes and cylinders—provided that they are rotated during welding.

1.4 Equipment Used

Give Specification of the machine

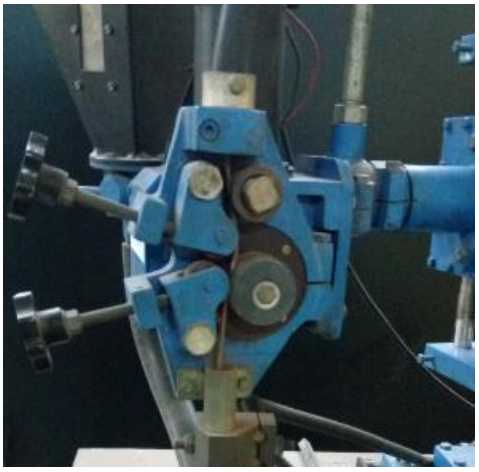


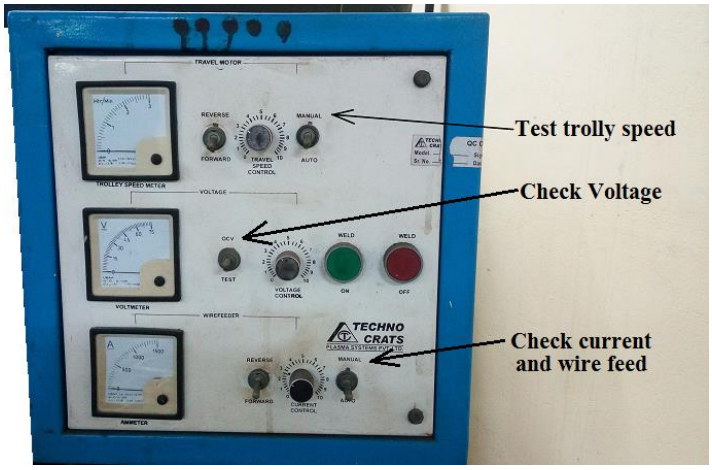
1.5 Specimens to be welded:

Give material specification and give joint preparation detail if any.
Give specification of the filler material used.

1.6 Recommended Procedure

1.6.1 First check the power connections and polarity.
1.6.2 Fill the flux hoper with granular flux and check continuity of flux flow by opening the stopper.
1.6.3 Fit the electrode wire through the drive and guide roller.





1.6.4 Turn on the power and check travel and wire feed as well as mark the welding line.

1.6.5 Clamp the two pieces to be welded along the weld line.

1.6.6 Now set operating parameters on the control panel.

1.6.7 Release the flux stopper to cover the plates and electrode with fluxes.
1.6.8 Engage the auto travel lever and start the process.
1.6.9 Check for the sound of welding as a signal that welding is going on.

1.6.10 After completion of travel turn off the process from the controller and close the flux stopper.

1.6.11 Collect the unused flux and then remove the solidified slag by chipping.

1.6.12 Unclamp the job after cooling and extract test pieces by cutting it for mechanical and metallurgical testing.

1.7 Precautions

1.7.1 Ensure that the joint line exactly matches with the electrode travel path.
1.7.2 Appropriate clamping must be there to prevent distortion during welding.
1.7.3 Granular flux should be free of moisture.
1.7.4 Bare electrode must be free from rust and irregularities.

1.8 Observation

Perform mechanical and metallurgical characterization of the welded joint and record data.

1.9 Results:

Interpret the result obtained with respect to welding parameters and material used.

1.10 Discussion/Conclusion:

1.10.1 Discuss any difficulty or/inaccuracy introduced while performing the test.

1.10.2 Mention different areas/ field of application of results.

1.11 Objective type and short answer type questions:

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1.12 Bibliography / References:

1.12.1 Kalpakjian, S.; Steven, R. S. Manufacturing Engineering and Technology; Prentice Hall: New Jersey, 2010; 6th ed.

1.12.2 ASM Handbook: Vol. 9 Metallography and Microstructures; Materials Park, OH: ASM International, 2004