

## Abstract



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### **EFFECT OF IN-PROCESS HEAT SINK ON DISTORTION AND RESIDUAL STRESSES DURING GTAW OF THIN SHEETS**

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Thin plates undergo dimensional changes during and post-fusion welding process as a consequence of localized heating and cooling. Among out-of-plane deformations, most pronounced are longitudinal bending and angular distortion. In the present work, the effect of heat sink on angular and longitudinal distortion on welding of thin plates (2.3mm) (butt joint) has been investigated. Thermo-Elastic-Plastic analysis, with large deformation using finite element method, has been formulated for the analysis. The developed model was validated with existing experimental investigation. Heat sink has been effected by increasing the convection coefficient ( $h_f$ ) on area under the weld zone. Material under investigation is Steel Plate Hot Commercial (SPHC) sheet with tensile strength of 570 MPa. Temperature distribution, distortion and residual stresses are calculated with a varying heat sink (by changing  $h_f$ ) and without the heat sink. Longitudinal Bending increased with increased in power input (Q) (without heat sink) and

decreased with increase in the magnitude of  $h_f$  at constant power input. Angular distortion was not affected by heat sink application. Change in spatial distribution of longitudinal stress on the lateral surface is observed on increasing the value of  $h_f$ . Decrease in longitudinal bending on increasing  $h_f$  can be explained by change in the distribution of longitudinal residual stress.

Keywords: Finite Element Method, Welding Distortion, Residual Stress, Heat Sink, Distortion Mitigation