

## **CERTIFICATION OF APPROVAL**

Finite Element Analysis of Residual Stresses in 316 Stainless Steel Pipelines SMAW  
Welding

By

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**September 2011**

## **CERTIFICATION OF ORIGINALITY**

This is to certify that, I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contain herein have not been undertaken or done by unspecified sources or persons

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## ABSTRACT

Stainless steel is widely used in pipelines and structural components as the material of choice. When steel undergoes welding process for joining, it receives a lot of heat particularly from the arc of the welding electrode. The particular region which the welding took place is mostly affected by the thermal load. The temperature gradient would create a phenomenon that affects the steel properties. This thermal load will induce several problems at the line of the welding. One of them is residual stress initiation at the particular spot. Residual stress propagation and initiation trend is hard to be determined visually and experimentally.

Using ANSYS software, a simulation has been attempted to evaluate the thermally induced residual stresses using finite element analysis (FEA). A welding process that utilizes SMAW welding was chosen for simplicity. Different values of heat input were used to observe the trend on the residual stresses. The observation was made on the region along the zone of welded area. A thermal analysis was conducted first. Then, the temperature distribution along the welded line was used as input in the structural analysis. Then, a comparison was made to see on how the heat input value affects the size of HAZ and the magnitude of residual stresses there. The stresses in x, y and z component, stress intensity and also the distortion magnitude of the welded region were then analyzed.

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