

An Analytical and Experimental Investigation of Welded Joint Strength for Energy Storage Devices

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The paper analyzes the failure case of welded joint for energy storage device. The energy storage devices are made up of AISI 1040 steel cases or boxes. Bulging effect in these boxes exerts tensile load on welded joint and breaks them. Root cause analysis is done and the root cause is found out to be improper throat thickness of weld. To find out the solution, problem is analyzed theoretically and simulated in ANSYS R18.1 software for a constant tensile load of 16 KN. The results show that there is a linear correlation between strength of welded joint and throat thickness. These results are validated in actual experimentation by taking tensile test on the sample specimens. The design of experiment by Taguchi is done on three variables, viz., weld current, arc voltage and wire feed rate. The results of experimentation are compared with the result from theoretical calculation and ANSYS result. Optimized parameters are selected for implementation in welding of boxes. The performance of the device under modified parameters is examined, presented and discussed.

Keywords: Energy storage devices, AISI 1040, Tensile test, Bulging, Taguchi, UTS, Yield strength, ANSYS

Introduction

Energy storage devices are generally used at locomotives converter to store the energy or to improve the power factor. These devices consist of electrical parts which are covered with insulated sheet of polypropylene. This assembly is then inserted into the hollow case of AISI 1040 steel and finally it is closed with Metal Inert Gas (MIG) welding. These devices are subjected to high voltage continuously. The SF₆ gas

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