CERTIFICATE

DELHI COLLEGE OF ENGINEERING
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Date: _____

This is certified that the work contained in this dissertation entitled **"DETECTION AND CHARACTERIZATION OF DEFECTS IN WELD JOINT BY USING ULTRASONIC NON-DESTRUCTIVE TESTING TECHNIQUE"** by **Mr. BRIJESH KUMAR** is the requirement of the partial fulfillment for the award of degree of **Master of Engineering (M.E.)** in **Production Engineering** at **Delhi College of Engineering**. This work was completed under my direct supervision and guidance. He has completed his work with utmost sincerity and diligence. The work embodied in this major project has not been submitted for the award of any other degree to the best of my knowledge.

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CANDIDATE,S DECLARATION

I hereby certify that the work which is being presented in the thesis entitled **"Detection and Characterization of the Defects in Weld Joint by Using Ultrasonic Non-Destructive Testing Technique"** is the partial fulfillment of requirement for the award of degree of Master of Engineering submitted in the department of Mechanical Engineering at Delhi College of Engineering under University of Delhi, Delhi, is an authentic record of my own work carried out during a period from August 2008 to July 2009, under the supervision of **Prof. Dr. C. K. Dutta** (Department of Mechanical Engg.). The matter presented in this thesis has not been submitted in any other University/ Institute for the award of any degree.

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Abstract

In industrial production, the annual production of welded structure is about 45% of steel's, due to the inherent defects in welding technology and the characteristics of metal, there are always certain flaws in welding structure. In addition, welded structure is often used in more important equipment and structure. Therefore, nondestructive testing of welded structures is very necessary and important. The purpose of the non-destructive testing is to detect, locate and size the defect or discontinuities in materials. There are many types of non-destructive testing technique (radiography, ultrasonic, dye penetrant, eddy currents, magnetic particles, etc.), and each type offers advantages and disadvantages, depending on the material being inspected, type of discontinuity, medium in which the material is, etc. Thus, the choice of the most appropriate method depends on the desired application. In the detection of welding defects, it is universally acknowledged that ultrasonic testing is one of the most effective conventional nondestructive testing methods, and has obvious advantages compared with other methods.

Ultrasonic Testing (UT) uses high frequency sound energy to conduct examinations and make measurements. In this method a beam of ultrasonic waves is directed into the object to detect and locate internal defects or discontinuities. When the ultrasonic waves are directed into the object, they reflected not only at the interfaces but also by internal flaws. A receiver probe picks up the reflected ultrasonic wave and an analysis of this signal is done to locate flaws in the object under inspection. Ultrasonic testing has many advantages over other methods that make it especially well suited for weld inspection. It is Capable of detecting the most common weld defects (porosity, pinholes, lack of fusion, lack of penetration, concavity, mismatch, and internal cracking). It gives high accuracy and sensitivity for the detection of small defects. It is capable of inspecting welds without direct access to the weld itself. The UT is safe for both the process and operators.

Key Words: Non- Destructive Testing, Defect, Discontinuities, Ultrasonic, Probe.

Scope of the Study

There is a high occurability of surface and internal defects in the weld zone due to numerous variables in welding process. The strength of the weld joint is depends not only on the presence or absence of the defects in weld zone but also their size, location and distribution. If the size of the weld defect is larger than the acceptable limit, the weld component must be rejected. Similarly, when the size of the defect is smaller than the acceptable limit but it located in high stress region, the weld component rejected again. Therefore, detecting various defects in the weld zone and quantitative evaluating are of great importance in terms of the structure's integrity and stability. The ultrasonic testing technique, which is widely used to detect internal defects of weld zone in many industry fields, plays an essential role as a volume testing method among other non-destructive testing methods. The principal goal for ultrasonic inspection of weld materials is the detection, location and classification of internal flaws and defects as quickly and as accurately as possible. In the present thesis ultrasonic testing of welds is briefly reviewed for evaluating the defect size and its location in welds.

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B. Metal Beam Path.
C. Elastic Constant of the Material
D. Diameter of the Probe.
d. Depth of the Flaw.
Ei. Incident Sound Energy.
Er. Reflected Sound Energy.
Et. Transmitted Sound Energy.
F. Frequency of the Ultrasonic Waves.
L. Length of the Workpiece.
N. Near Field Length.
Rc. Reflection Coefficient.
R. Radius of the Calibration Block.
S. Surface Distance from the Centre of the Probe.
Tc. Transmission Coefficient.
T. Thickness of the Workpiece.
t. time
V. Velocity of the Sound.
V_L. Longitudinal Wave Velocity.
Vs. Shear Wave Velocity.
W. Width of the Workpiece.
Z. Acoustic Impedance.
ρ. Density of the material.
θ. Probe Angle.
λ. Wavelength.
β. Half Bevel Angle of the Weld