

# ANALYSIS OF HEAT TREATMENT IN CUTTING MACHINE WELDING JOINTS BETWEEN SPRING STEEL AND CARBON STEEL ON MECHANICAL PROPERTIES

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## ABSTRACT

One method that is widely applied in joining is the welding method. Carbon steel and spring steel materials need to be joined by welding methods for proper tool development. However, these two steels have poor properties when welded, but can be improved by heat treatment. Welding in the manufacture of machine blades made of spring steel welded with medium carbon steel often suffers from poor weldability accompanied by high dynamic loads. The solution to this problem is to optimize the strength of the welded joint by carrying out heat treatment, both preheating and Post Weld Heat Treatment (PWHT), so that strength increases and brittleness can be reduced.

The research method used was experimental with initial heating treatment at temperatures of 300 °C and 400 °C, followed by PWHT treatment at a temperature of 800 °C. The specific objectives of the research are: a) to obtain the best preheat and PWHT welding variables on the mechanical properties of medium carbon steel and leaf springs, b) to determine the effect of impact toughness, tensile strength, bending resistance and hardness on medium carbon welding and spring steel.

The research results show the highest impact strength values of 278 Joule/cm<sup>2</sup> and 285 Joule/cm<sup>2</sup> respectively for preheat welded joints at a temperature of 400°C and preheat welded joints at a temperature of 400 °C + PWHT 800 °C. The highest weld metal hardness value occurred in untreated welded joints, namely 188 VHN each. The highest tensile strength value of 500 MPa occurs in 300 °C preheat welded joints. The highest impact toughness was found in the combination treatment of preheat 400 °C + PWHT 800 °C which was followed by a tendency to decrease tensile strength and decrease hardness, resulting in suboptimal mechanical strength. The increase in impact toughness with 400 °C preheat treatment is quite high and 400 °C preheat treatment has good tensile strength and hardness in the weld metal. Thus, preheating treatment of 400 °C is the best alternative treatment to increase the life of welded joints against impact loads and fatigue loads.

Kata Kunci: *Carbon steel, spring steel, heat treatment, welding, preheating*