ME209 PRINCIPLES OF MANUFACTURING PROCESSES

Strongest Bond (Not 007)

INTRODUCTION

The purpose of this task is to test the bond strength of three different mild steel samples that were joined by the three primary joining methods, namely adhesives, fasteners and welding process. Two mild steel samples were joined using single joint and Universal testing machine (UTM) is used for testing the strengths of samples.

DESIGN CONSIDERATIONS

Design considerations for evaluating the bond strength of three joining methods—adhesive bonding, fasteners, and welding—on mild steel plates include ensuring uniform specimen preparation, consistent application of each method, and accurate alignment in a single lap joint. The universal testing machine (UTM) should provide reliable and repeatable results to assess bond strength effectively.

CHOICE OF PROCESS PARAMETERS

1. In **fastening**, using a 6.5 mm drill bit that matches the chosen fastener size, ensuring joint strength. Placing diagonal holes distributes stress evenly, reducing the risk of shearing or displacement under pressure, thus improving durability.

2. In **welding**, TIG welding with argon gas ensures a stable, oxidation-free environment for high-quality welds. Using a 1.5 cm torch diameter allows precise heat control, which is crucial for intricate joints. Consistent gas flow at 15 psi enhances shielding and penetration while minimizing contamination risks, resulting in strong, clean welds on mild steel plates.

3. Regarding **adhesive bonding**, surface preparation is vital, involving cleaning, roughening, or applying primers to enhance bonding strength.

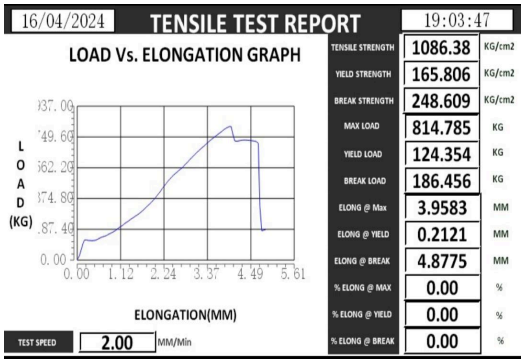
PROCESS

- The process began by cutting the mild steel using metal cutting saw to have the samples of 100 mm each and then file that sample to have a better surface finish. Six samples were obtained.
- For the welding process, firstly we have done several practice on test pieces before actual welding. Then the lap joint length was standardized by 30 mm for each joints for actual welding for proper measured strengths.
- For the fastening process, the mild steel samples were first drilled up and down using 6.5 mm drill bit for the 6mm nuts. They were then tightened securely with a lap joint length of 30 mm.
- Surface preparation was meticulously conducted to achieve optimal adhesion for adhesive bonding, maintaining a lap joint length of 30mm. Adhesive(Bond

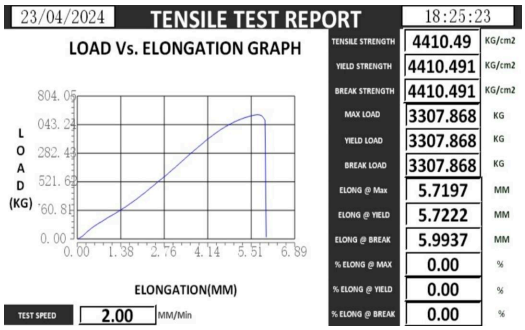
tite) was applied between the prepared plates, followed by precise alignment and application of pressure to ensure consistent bonding. The assembly was then allowed to be fitted for 24 hours.

LEARNING FROM THE OUTCOME

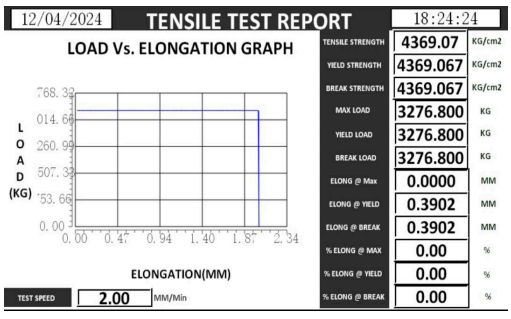
Fasteners:



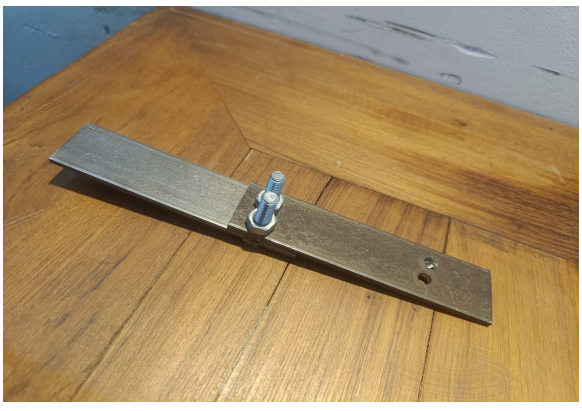
Welding:



Adhesives:



The graph analysis highlights welding as the most robust bonding method, followed by adhesives and then nut-and-bolt fasteners as the least resilient. Notably, the welded plates demonstrated exceptional strength, enduring loads exceeding 3307 kg, boasting a tensile strength of 4410.49 Kg/cm^2 and a yield strength of 4410.491 Kg/cm^2, despite the typical yield strength of mild steel being around 250 MPa. Conversely, the fasteners bond exhibited the lowest strength, fracturing under a load of 800 kg without significant ductility, indicating minimal plastic deformation and a rapid separation process. Adhesives samples yielded promptly but withstood more load than fasteners, potentially due to the early yielding of the material.



PEER REVIEW GRADES

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