

**DEVELOPMENT AND VALIDATION OF CUSTOM-BUILD TESTING
MACHINE FOR PVC PIPE QUALITY CONTROL USING DMADV**

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STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.



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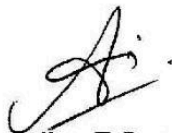
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ABSTRACT

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PVC pipe quality control at PT Bhinneka Plastik Indonesia relied entirely on subjective operator judgment with no instrument-based measurement for tensile or impact strength. This study applied the DMADV methodology to design, fabricate, and validate two custom-built mechanical testing machines, a Universal Testing Machine (UTM) for tensile strength and a Charpy impact tester for impact strength. Validation was conducted using Nested Gage R&R analysis with 2 operators, 5 pipes, and 4 specimens per operator per pipe. The UTM achieved a Total Gage R&R %Contribution of 4.38%, zero reproducibility, a %Study Var of 20.92%, and an NDC of 6, meeting AIAG conditional acceptance criteria, with a pass/fail threshold established at 20.79 MPa. The Charpy machine failed validation on all primary metrics (%Contribution 41.36%, %Study Var 64.31%, NDC of 1) due to mechanical inconsistencies in the first-generation prototype, and requires redesign before production deployment. The UTM is confirmed ready for objective quality control use.

Keywords: PVC pipe, quality control, DMADV, tensile strength, impact strength, Gage R&R, Measurement System Analysis, custom-built testing machine



DEDICATION

I dedicate this work to my thesis company and all my friends and family, especially
my partner who has supported me along the way.



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I would like to express my deepest gratitude to my family for their unwavering support throughout the completion of this thesis. Through every difficult moment and period of doubt, they never stopped believing in me, and their encouragement carried me further than they may realize. In particular, I wish to thank my partner, whose constant motivation and presence gave me the strength to push through when it mattered most.

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