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Rancang Bangun Engine Test Bench Komatsu SAA6D107E Dengan Fuel Flow Velocity Menggunakan Metode ADDIE
Nasrul Fuad, Dr. Eng. Yosephus Ardean Kurnianto Prayitno S.T., M.Eng.
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ABSTRACT

This study aims to design and develop an engine test bench for the Komatsu SAA6D107E-1 common rail diesel engine capable of varying fuel flow velocity (FFV) and conducting low power condition testing on the test bench. The research employed the Analysis, Design, Development, Implementation, Evaluation (ADDIE) method. The test bench was realized using UNP 80 steel profile frame validated through static simulations (safety factor > 2.5), a hybrid monitoring system (digital sensors integrated with ESP32 and web dashboard, along with analog pressure gauges), and an FFV variation mechanism through a manual valve on the low pressure circuit with four opening levels (100%, 75%, 50%, 25%). Based on theoretical calculations using Specific Fuel Consumption (SFC) data of 215 g/kWh and reference power of 110 kW, the reduction in valve opening proportionally decreases fuel flow rate, fuel flow velocity, and engine power. The significant low power threshold occurs at fuel flow velocity of 0.138 m/s (50% opening), where power drops to 55 kW and RPM decreases to the range of 1000–1200 rpm. This research has produced a fabricated test bench prototype integrated with a monitoring system, though it still requires troubleshooting completion during the engine commissioning stage before actual testing can be conducted.

Keywords: ADDIE, *common rail, engine test bench, fuel flow velocity, Komatsu SAA6D107, low power*

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INTISARI

Penelitian ini bertujuan untuk merancang dan mengembangkan *engine test bench* untuk mesin diesel *common rail* Komatsu SAA6D107E-1 yang mampu memvariasikan *fuel flow velocity* (FFV) serta melakukan pengujian kondisi *low power* pada test bench tersebut. Penelitian menggunakan metode pengembangan *Analysis, Design, Development, Implementation, Evaluation* (ADDIE). Test bench direalisasikan dengan rangka profil baja UNP 80 yang divalidasi melalui simulasi statis (*safety factor* > 2,5), sistem monitoring hibrida (sensor digital terintegrasi ESP32 dengan dashboard web serta *pressure gauge* analog), dan mekanisme variasi FFV melalui katup manual pada saluran *low pressure* dengan empat tingkat bukaan (100%, 75%, 50%, 25%). Berdasarkan perhitungan teoritis dengan data *Specific Fuel Consumption* (SFC) 215 g/kWh dan daya referensi 110 kW, diperoleh bahwa penurunan bukaan katup secara proporsional menurunkan *fuel flow rate*, *fuel flow velocity*, dan daya engine. Ambang batas *low power* signifikan terjadi pada *fuel flow velocity* 0,138 m/s (bukaan 50%), di mana daya turun hingga 55 kW dan RPM turun ke kisaran 1000–1200 rpm. Penelitian ini menghasilkan prototipe test bench yang telah di fabrikasi dan terintegrasi dengan sistem monitoring, namun masih memerlukan penyelesaian *troubleshooting* pada tahap *commissioning* engine sebelum pengujian aktual dapat dilaksanakan.

Kata Kunci: ADDIE, *common rail, engine test bench, fuel flow velocity*, Komatsu SAA6D107, *low power*