

ABSTRAK
**ANALISIS PENGARUH JENIS *COOLANT* DAN DEBIT ALIRAN UDARA
TERHADAP KINERJA *RADIATOR* PADA *COOLING SYSTEM TRAINER***

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Sistem pendingin merupakan komponen vital pada mesin alat berat yang berfungsi menjaga temperatur kerja mesin agar tetap optimal. Radiator, sebagai komponen utama sistem pendingin, sangat dipengaruhi oleh jenis *coolant* dan debit aliran udara kipas pendingin dalam melepaskan panas. Penelitian ini bertujuan untuk menganalisis pengaruh jenis *coolant* dan debit aliran udara terhadap kinerja radiator pada *Cooling system trainer*. Penelitian ini merupakan penelitian eksperimental kuantitatif dengan variabel bebas berupa tiga jenis *coolant*, yaitu *coolant* berbasis *propylene glycol* (PG), *coolant* berbasis ethylene glycol (EG), dan air demineralisasi, serta tiga variasi debit aliran udara kipas (40%, 60%, dan 100% kapasitas dimmer). Parameter yang dianalisis meliputi temperatur inlet dan outlet radiator, selisih temperatur (ΔT), efektivitas radiator, laju perpindahan panas, dan hambatan termal, dengan analisis statistik menggunakan uji ANOVA *Two-Factor With Replication*. Hasil penelitian menunjukkan bahwa jenis *coolant* dan debit aliran udara berpengaruh signifikan terhadap kinerja radiator ($P\text{-value} < 0,05$). *Coolant* berbasis *propylene glycol* menghasilkan performa pendinginan terbaik dibandingkan *coolant* berbasis ethylene glycol dan air demineralisasi. Nilai ΔT dan efektivitas radiator tertinggi diperoleh pada kombinasi *coolant propylene glycol* dengan debit udara 100%, yaitu ΔT sebesar 18,43°C dan efektivitas sebesar 0,39. Semakin besar debit udara, semakin tinggi kemampuan radiator melepaskan panas dan semakin rendah hambatan termal total sistem. Hasil ini dapat menjadi referensi ilmiah serta mendukung pengembangan *cooling system trainer* sebagai media pembelajaran praktikum sistem pendingin mesin alat berat pada Program Studi Perawatan Alat Berat di Politeknik Negeri Sriwijaya.

Kata kunci: *coolant*, debit aliran udara, radiator, efektivitas, *cooling system trainer*

ABSTRACT

ANALYSIS OF THE EFFECT OF COOLANT TYPE AND AIR FLOW RATE ON RADIATOR PERFORMANCE IN A TRAINER COOLING SYSTEM

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The cooling system is a vital component in heavy equipment engines, functioning to maintain the engine's working temperature at an optimal level. The radiator, as the main component of the cooling system, is significantly influenced by the type of coolant and the air flow rate of the cooling fan in dissipating heat. This study aims to analyze the effect of coolant type and air flow rate on radiator performance in a Cooling system trainer. This is a quantitative experimental study with independent variables consisting of three types of coolant—propylene glycol (PG)-based coolant, ethylene glycol (EG)-based coolant, and demineralized water—and three variations of fan air flow rate (40%, 60%, and 100% dimmer capacity). The parameters analyzed include radiator inlet and outlet temperature, temperature difference (ΔT), radiator effectiveness, heat transfer rate, and thermal resistance, with statistical analysis using a Two-Factor ANOVA with Replication. The results show that coolant type and air flow rate have a significant effect on radiator performance ($P\text{-value} < 0.05$). Propylene glycol-based coolant produced the best cooling performance compared to ethylene glycol-based coolant and demineralized water. The highest ΔT and radiator effectiveness were obtained with the combination of propylene glycol coolant and 100% air flow rate, namely a ΔT of 18.43°C and an effectiveness of 0.39. The greater the air flow rate, the higher the radiator's heat dissipation capability and the lower the system's total thermal resistance. These findings can serve as a scientific reference and support the development of the Cooling system trainer as a learning medium for heavy equipment cooling system practicums in the Heavy Equipment Maintenance Study Program at Politeknik Negeri Sriwijaya.

Keywords: *coolant, air flow rate, radiator, effectiveness, cooling system trainer*