

PERFORMANCE ANALYSIS OF AIR CONDITIONING (AC) COOLING MACHINE USING ENVIRONMENTALLY FRIENDLY REFRIGERANT

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ABSTRACT

R32 refrigerant is still widely used in Air Conditioning (AC) systems despite its relatively high Global Warming Potential (GWP), thus requiring a more environmentally friendly refrigerant alternative such as R290. This study aims to compare the performance of an AC system using R32 and R290 refrigerants, evaluated in terms of system working pressure and temperature, cooling capacity, *Coefficient of Performance* (COP), electrical power consumption, and system efficiency. The experiment was conducted on the same AC unit, operating both refrigerants alternately for 60 minutes, with data recorded at 10-minute intervals. The measured data included low- and high-side pressure, evaporator temperature, condenser temperature, air flow velocity, and electrical parameters. Cooling capacity was calculated using the air-side approach, while COP and system efficiency were determined based on the ratio of cooling capacity to the electrical power consumed by the compressor. The results show that R290 operated at a lower system pressure compared to R32, producing an average cooling capacity of 0.710 kW compared to 0.678 kW for R32, with a lower average power consumption of 866.0 Watts compared to 963.3 Watts for R32. The average COP of R290 was 0.811 with a system efficiency of 81.04%, both higher than R32, which recorded 0.698 and 69.84%, respectively. Based on these results, it can be concluded that R290 refrigerant exhibits better performance than R32, making it a viable alternative to conventional refrigerants for AC systems.

Keywords: refrigerant, R32, R290, cooling capacity, COP, system efficiency