Abstract

About 20-50% of industrial processes energy is lost as waste heat in their operations. The thermal hydraulic engine relies on the thermodynamic properties of supercritical carbon dioxide (CO2) to efficiently perform work. Carbon dioxide possesses great properties that makes it a safe working fluid for the engine’s applications. This research aims to preliminarily investigate the actual efficiency which can be obtained through experimental data and compare that to the Carnot or theoretical maximum efficiency. The actual efficiency is investigated through three approaches. However, only the efficiency results from the second method are validated since the other approaches are based on a complete actual cycle which was not achieved for the engine. The efficiency of the thermal hydraulic engine is found to be in the range of 0.5% to 2.2% based on the second method which relies on the boundary work by the piston. The heating and cooling phases of the engine’s operation are viewed on both the T-s (temperature-entropy) and p-v (pressure-volume) diagrams. The Carnot efficiency is also found to be 13.7% from a temperature difference of 46.2 degree Celsius based on the measured experimental data. It is recommended that the thermodynamic cycle and efficiency investigation be repeated using an improved heat exchanger design to reduce energy losses and gains during both the heating and cooling phases. The temperature of CO2 can be measured through direct contact with the thermocouple and pressure measurements can be improved using a digital pressure transducer for the thermodynamic cycle investigation.