ABSTRACT

A boiler is one of the main components in the Rankine cycle, along with the pump, turbine, and condenser. The boiler is a closed vessel used to convert water under pressure into steam by applying heat. The main background for the design of this equipment is the lack of educational tools for practical training to enhance the learning of the Rankine cycle in the Bachelor's program of Physics Engineering at Telkom University. The design of this boiler is sustainable and aims to create a complete Rankine cycle system as an educational tool.

The boiler design is small-scale, with a design pressure of 5 bar, a capacity of less than 10 kg/hour, and an output of superheated steam with a minimum temperature of 200°C. The thickness of the boiler is calculated using ASME Section IV. The selected type of boiler is a firetube design based on a conventional LPG stove for ease of operation in the educational process. The boiler is also equipped with a water fill control system and instrumentation to measure the inlet and outlet temperatures.

Based on the results obtained from the design process of this vertical firetube boiler, the efficiency is found to be 55.48%, with an outlet steam temperature of 582.4°C and a boiler capacity of 3.61 kg/hour, with the optimal gas opening at a medium gas opening of 25°. This boiler has a maximum operating pressure of 1.69 bar. The use of the designed superheater does not significantly affect the efficiency value but drastically impacts the outlet temperature of the boiler.

Keywords: Rankine cycle, Boiler, Superheater, Temperature.