Exergy Analysis for A Two-Stage Turbine

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Abstract

Exergy can be defined as the maximum theoretical work that can be acquired when a system is brought to equilibrium with a reference state, typically: the environment or the surroundings. In this work, exergy analysis for a two-stage turbine is studied and presented. Steam enters the first stage of the turbine at 8 MPa and 500 °C; then, it leaves this stage at 2 MPa and 350 °C. Heat is added to the steam between the stages at a constant pressure so that it enters the second stage of the turbine at 2 MPa and 500 °C. Steam leaves the second stage of the turbine at 30 kPa and a quality of 97%. Results showed that by increasing the turbine's inlet pressure, the rate of exergy destruction within the turbine increased. Hence, the second law efficiency of the turbine decreased. In fact, a second law efficiency was found to be 91.62 % when the inlet pressure for the turbine was 8 MPa; however, the second law efficiency decreased to 86.36 % when turbine's inlet pressure increased to 12 MPa. This demonstrates that by increasing the inlet pressure for the first stage, the reversible power output increases within the turbine.

Keywords

Exergy, Turbine, Second Law Efficiency, Reversible Power Output.