

Test-loop Design of the Supercritical CO₂ Power Cycle with an Axial Turbine

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Description of Poster

The supercritical CO₂ power cycle has recently gained much attention for one of the alternative power conversion systems with heat sources like fossil fuel energy. The advantages of the supercritical CO₂ power cycle are higher efficiency, and smaller size of turbomachinery than for the conventional steam power cycles. Therefore, the supercritical CO₂ power cycle could be applied to the conventional power plants for the retrofit of the power plant in the near future. In this poster the design results of test-loop for the supercritical CO₂ cycle with a MW-scale axial turbine are introduced. Basic design of the test-loop was conducted for design basis, process description, process flow diagram, material selection diagram, P&ID, and major equipment list of the supercritical CO₂ test cycle. Then detailed design was conducted for equipment process data, instrument list, valve list, plot plan, hazardous area classification drawing, electrical load list, and electric/control drawings.

Simplified process flow diagram for the supercritical CO₂ power cycle test-loop is presented in Fig. 1. The major components of the test-loop are one internal heat exchanger as a heat source, one CO₂ axial turbine, one recuperator, five CO₂ pumps, and one cooler as a heat sink. A few examples of P&IDs and material selection diagram are in Fig. 2 and Fig. 3, and the process layout of the test-loop can be seen in Fig. 4.

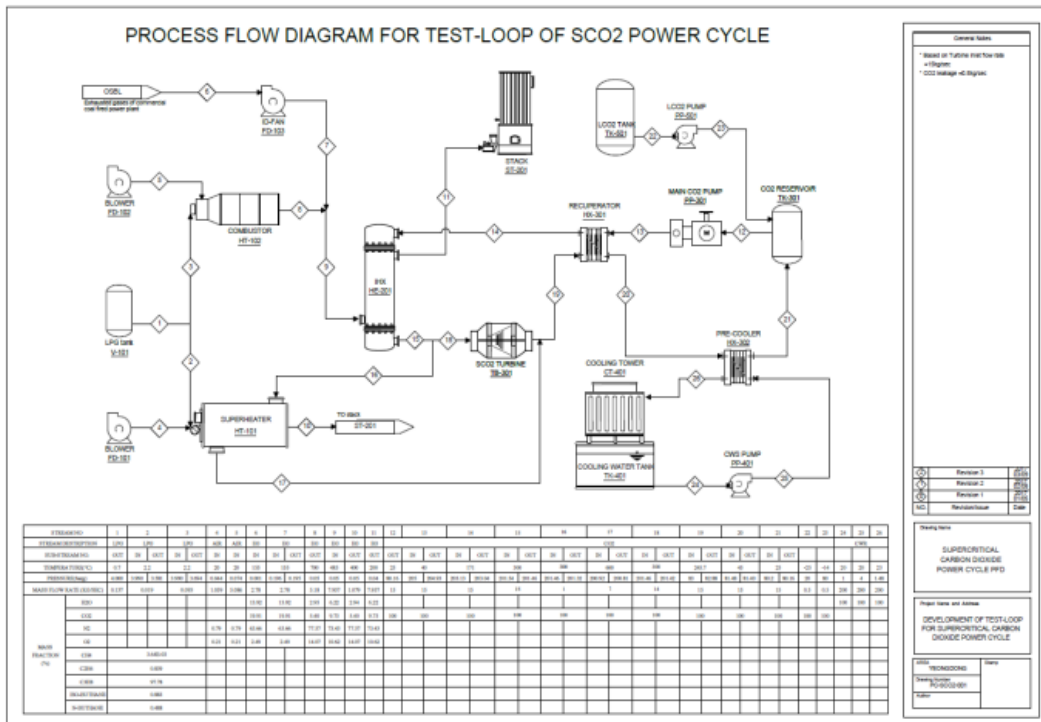


Fig.1. Process flow diagram of the supercritical CO₂ cycle test-loop

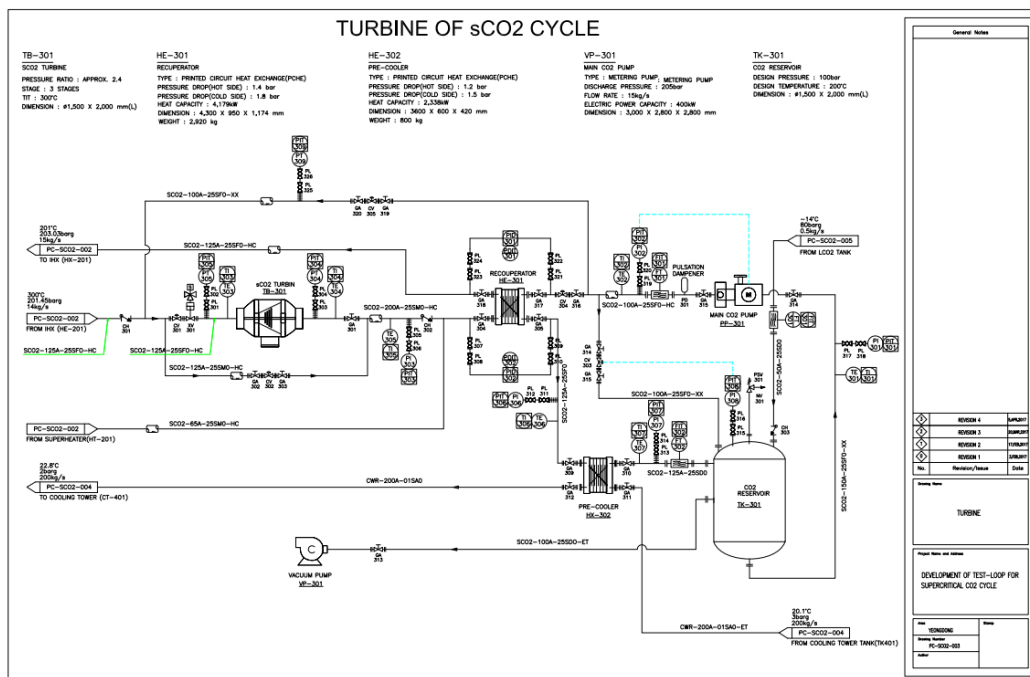


Fig.2. P&ID of the supercritical CO₂ cycle test-loop

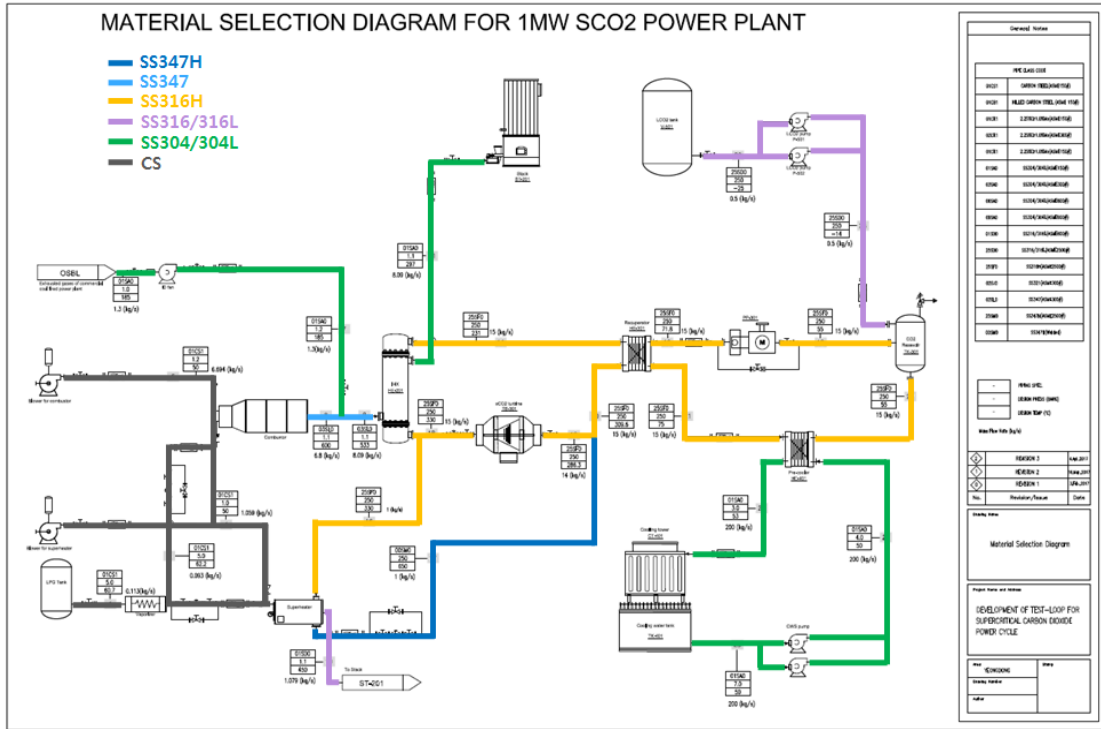


Fig.3. Material selection diagram of the supercritical CO₂ cycle test-loop

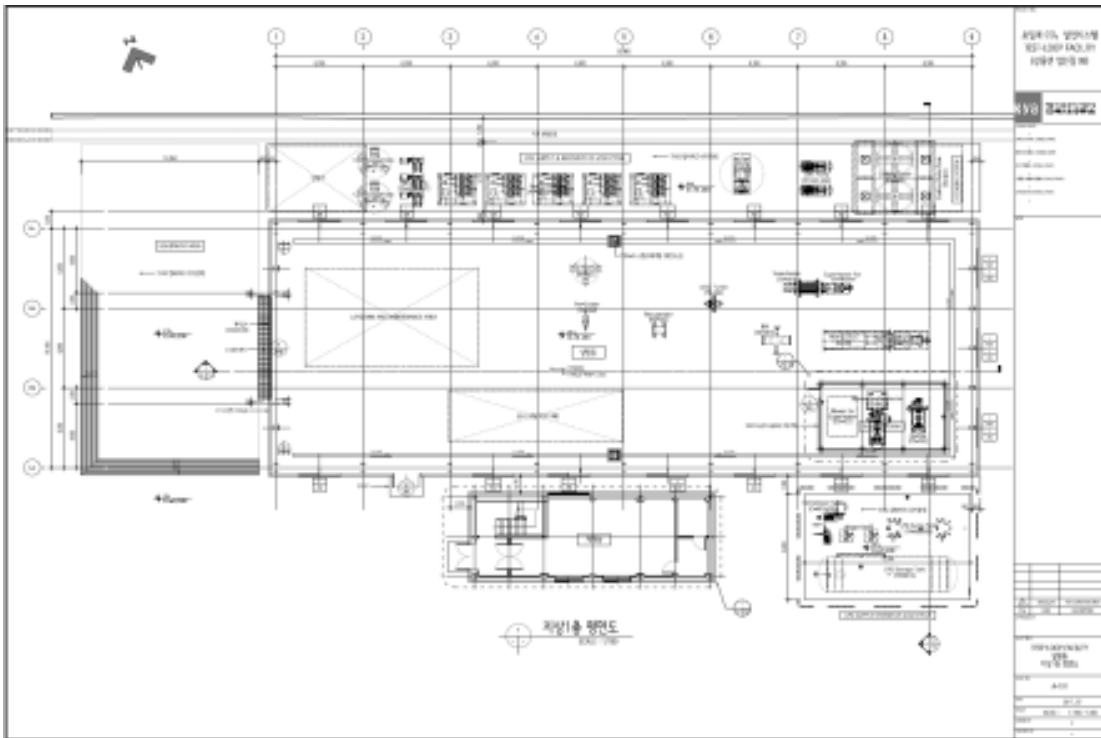


Fig.4. Process layout of the supercritical CO₂ cycle test-loop