

Dual Mode Heat Transfer Pilot Plant For Unit Operations Training

Item Number: LPK-SMTCR



Introduction

Engineering-scale dual-mode heat transfer pilot plant for hands-on unit operations training in chemical engineering. Features real and simulated modes, multiple heat exchanger types, comprehensive coefficient determination, and advanced process control with data acquisition for engineering students and researchers.

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Specification	Details
System Footprint	Approx. 3930 mm × 2560 mm × 3900 mm (L × W × H) (Customizable to site requirements)
Structural Framework	Two-tier steel structure with powder-coated finish; 1.2 m safety handrails on Level 2; 3 mm checkered plate flooring; integrated safety inclined ladder
Exchanger Types	Tubular/Shell-and-Tube heat exchangers, Plate heat exchangers, and other partition wall types (4 types total)
Operation Modes	Real-Material Mode: Real-time sensor data acquisition and direct physical control of pumps and electric heaters. Simulated-Material Mode: Uses safe media (water/air) coupled with mathematical models to simulate process dynamics based on physical valve positions.
Control Interface	Industrial computer with SCADA/configuration software for real-time monitoring and process control
Customizability	Fully customizable hardware (piping, sensors, dimensions) and software (interfaces, simulation algorithms)

Experimental Module	Key Unit Operation / Knowledge Point	Corresponding Academic Concepts in Classic Textbooks
Heat Exchanger Characterization	Conduction and Convection in Pipes	Steady-state heat transfer through multi-layered walls, individual and overall heat transfer coefficients, fouling factors.
Co-current vs. Counter-current Operation	Logarithmic Mean Temperature Difference (LMTD)	LMTD correction factors, thermal efficiency comparison, heat exchanger effectiveness (ϵ -NTU method).
Multi-Media Heat Switching	Process Design & Thermal Utilities	Energy balances, utility consumption calculations, switching mechanisms between different heating and cooling media.
Dual-Mode Process Control	Process Dynamics and Modeling	Sensor calibration, data acquisition, valve flow characteristics, transition from physical process behavior to simulated dynamic models.