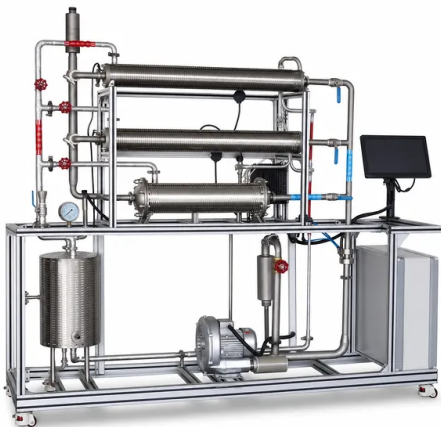


# Comprehensive Heat Transfer Coefficient Determination Educational Unit Operations Pilot Plant

Item Number: LPK-BHTC



## Introduction

Advanced industrial-grade educational pilot plant for comprehensive heat transfer coefficient determination. Enables quantitative convective heat transfer analysis, evaluates double-pipe and shell-and-tube exchanger configurations, and includes digital data acquisition. Customizable for engineering curriculum. Ideal for engineering unit operations labs.

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| Specification Parameter  | Detail Description                                                                                                     |
|--------------------------|------------------------------------------------------------------------------------------------------------------------|
| Structure Frame          | High-grade aluminum alloy framework with locking industrial casters for mobility and stability.                        |
| Footprint Dimensions     | 2200 mm (L) × 580 mm (W) × 1800 mm (H).                                                                                |
| Smooth Tube Exchanger    | Stainless steel outer shell with a high-conductivity smooth red copper inner tube.                                     |
| Threaded Tube Exchanger  | Stainless steel outer shell with an internally threaded red copper inner tube for turbulent boundary layer disruption. |
| Shell-and-Tube Exchanger | Industrial-geometry multi-pass shell-and-tube configuration with a stainless steel shell.                              |
| Steam Generation Unit    | Automated electric steam boiler equipped with pressure sensors, safety liquid seal, and automatic pressure release.    |
| Data Acquisition         | Digital temperature transmitters, turbine flowmeters, and pressure sensors linked to a centralized control panel.      |

| Experimental Module                  | Targeted Engineering Fields                    | Core Concepts & Classic Textbook Alignment                                                                                                                                                                                                       |
|--------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Convective Heat Transfer Correlation | Chemical Engineering, Mechanical Engineering   | Determination of $Nu = A \cdot Re^m \cdot Pr^{0.4}$ correlation parameters; evaluation of Reynolds number ( $Re$ ) and Prandtl number ( $Pr$ ) effects on Nusselt number ( $Nu$ ) as covered in <b>Unit Operations of Chemical Engineering</b> . |
| Enhanced Heat Transfer Evaluation    | Chemical Engineering, Food Engineering         | Comparative study of heat transfer coefficients ( $\alpha_i$ ) in smooth versus threaded tubes; boundary layer interruption and pressure drop trade-offs as discussed in <b>Transport Processes and Unit Operations</b> .                        |
| Steam Condensation Analysis          | Environmental Engineering, Thermal Engineering | Measurement of external steam condensation film-heat transfer coefficients ( $\alpha_o$ ) and overall thermal resistance, directly referencing heat transfer topics in <b>Unit Operations of Chemical Engineering</b> .                          |
| Shell-and-Tube Performance Testing   | Chemical Engineering, Process Design           | Calculation of overall heat transfer coefficient ( $K_o$ ) and Logarithmic Mean Temperature Difference (LMTD) correction factors; practical evaluation of industrial exchanger geometries as outlined in <b>Chemical Engineering Design</b> .    |