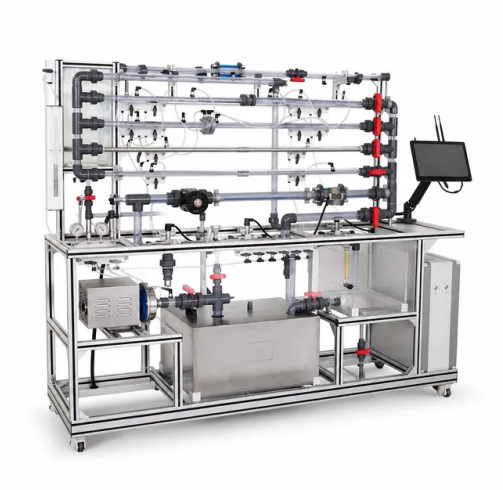
Comprehensive Fluid Mechanics Educational Unit Operations Pilot Plant

Item Number: LPK-BFMC-C



Introduction

Hands-on fluid mechanics pilot plant for engineering education covering over 13 principles including pipe flow, minor losses, flowmeter calibration, and pump performance with industrial-grade components, smooth and rough piping, venturi and orifice flowmeters, and centrifugal pump testing and analysis.

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Module / System Component	Description & Target Measurements
Physical Dimensions	Maximum footprint: 2200 mm × 580 mm × 1800 mm (L × W × H)
Frame & Structural Support	High-quality, industrial-grade aluminum alloy profile with heavy-duty swivel casters
Pipe Flow Evaluation	- Smooth and rough piping sections (thin and thick) - Laminar and turbulent flow regimes - Straight pipe resistance coefficient (λ) vs. Reynolds number (Re)
Local Resistance Analysis	- Minor losses in abrupt contraction pipelines - Local resistance coefficient (ζ) of standard process valves
Flow Metering Stations	- Orifice plate flowmeter & Venturi flowmeter calibration - Flow coefficients (C_o, C_v) vs. Reynolds number (Re) - Evaluation of permanent pressure drop across metering devices
Pumping Operations	- Centrifugal pump characteristic curves (Head, Power, and Efficiency vs. Flow Rate) - Pipeline system curve plotting and operating point determination
Calibration & Static Measurement	High-level water tank, inverted U-tube manometer, and volumetric calibration vessel

Experimental Module	Core Knowledge Points	Directly Correlated Textbook Terminology
Pipe Friction Losses	Fluid friction in conduits, laminar flow development, boundary layer effects, Colebrook equation, Moody chart.	*Unit Operations of Chemical Engineering* *Transport Processes and Unit Operations*
Minor Fittings Losses	Form friction, local resistance coefficients, expansion/contraction energy losses, equivalent length method.	*Unit Operations of Chemical Engineering* *Chemical Engineering Design*
Flow Meter Calibration	Conservation of mass and energy, Bernoulli’s equation, discharge coefficients, restriction flowmeters, pressure recovery.	*Transport Processes and Unit Operations* *Unit Operations of Chemical Engineering*
Pumping Performance	Fluid machinery, net positive suction head (NPSH), system curve matching, pump efficiency, brake horsepower.	*Chemical Engineering Design* *Transport Processes and Unit Operations*