

H-6173

Continuous/Fractional Distillation System

Purpose

The **Model H-6173** makes educational and industrial experimentation possible in a virtually limitless range—from simple steady-state binary separations to highly sophisticated process dynamics research including column hydraulics and packing materials. Even bench-scale pilot production runs are feasible with appropriate modifications.

Description

Major components of **Model H-6173** are:

- Ten-gallon feed reservoir
- Feed pump
- Feed preheater
- Liquid-level and overheat controlled boiler
- Plate-type and packed-type columns
- Glass-walled, water-cooled, shell-and-tube type condenser providing 1-1/2 ft of tube surface
- Glass-walled distillate reservoir
- Reflux pump
- Reflux preheater
- Coolant rotameter
- Boiler, feed & reflux preheater temperature controls
- Twelve Chromel-Alumel thermocouples with thermocouple selection switch
- Digital temperature display
- Pump heater & main power ON-OFF switches
- Digital Voltmeter and Ammeter
- 72-inch manometer
- Necessary valves
- Quick-couple flexible hoses
- Operating Manual with experiments
- Reflux Ratio Timing Controls with ON/OFF Switch

Application

Because of its compact size, relatively large capacity boiler, relatively large condensing tube surface and versatile rapidly-manipulable feed and measurement hardware, this system possesses considerably more flexibility than conventional laboratory distillation equipment. Changes in operating conditions are quickly effected and column response is rapid. Students, teachers and industrial researchers are able to collect more pertinent data in a shorter time than with conventional equipment and carry exploration into distillation phenomena and processes further and at a lower cost.

The effects of vaporization, condensation and liquid-vapor mixing—relative to the separation of volatile liquid systems by the application of heat—are observed and measured under the dynamic conditions of column operation.

The **Model H-6173** requires only water and electrical connections for operation. Because the unit has very rapid response and glass column walls, it is also used effectively in lecture demonstrations.

The unit is designed for closed-loop operation with feed and product streams cycled through a common reservoir tank. However, it can be arranged to effectively separate a feedstream with separate distillate and bottoms product. Both in appearance and in operation, the columns are faithful replications of commercial columns. The unit does provide means for



MODEL H-6173
Continuous/Fractional Distillation System
Dimensions: 91"H x 65"W x 34"D
Shipping Weight: 1200 lbs

experimental external manipulation of certain internals such as the heights of the weirs and downcomers used in the plate-type column. Means are also provided for introducing feed and reflux streams at any of several pertinent locations for: obtaining liquid and vapor samples at critical locations, picking up critical temperatures and pressures, and measuring feed and reflux flows and distillation rates. Feed and reflux streams are continuously variable from zero to total.



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All Hampden units are available for operation at any voltage or frequency

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Process Control Training Systems

Educational Training Equipment for the 21st Century

Experiment Capabilities

Model **H-6173** will accept a wide variety of liquid systems. The unit is physically versatile and readily modifiable for open loop or cascade type processes. These design qualities make experimental capabilities virtually limitless, even though it is not designed for cryogenic or high-pressure fractionations.

Basic Technology

Plate Column Separations, evaluations of:

Hydraulics
Pressure drops
Efficiencies
Effects of feed plate locations, boil-up rates, reflux ratios, plate geometry

Packed Column Separations, evaluations of:

Pressure Drop
Efficiency
Types of Packings
Effects of Boil-Up Rates, Reflux Ratios, Packing Geometries

Separations By Either Type Column,

determinations of:

Mass Balances
Thermal Energy Balances
Physical and Chemical Characteristics of Feeds, Reflux, Products

General Learning:

Calibration of Rotameters, Thermocouples
Operation of Liquid-Level and Temp Controls
Operation and Heat Transfer Efficiency of Shell and Tube Type Condensers

Advanced Distillation

With respect to either type column:

Continuous Multi-Component Distillation
Multi-Component Batch Differential Distillation
Multi-Phase Distillation
Steam Distillation
Heterogenous Azeotropic Distillation
Homogenous Azeotropic Distillation
Extractive Distillation
Transient Operation
Process Dynamics And Control

Distillation Process Fundamentals

With respect to either type column:

Continuous Binary Stripping
Continuous Binary Rectification
Continuous Binary Fractionation
Binary Batch Differential Distillations

Specifications

- Mounted on a base with leveling feet carrying the vertically-oriented main frame and panel, and one 10-gal feed reservoir with liquid-level sight glass, with sump and drainage valve, with gasketed, spring-closed, filler cap.
- Includes one main and one reflux feed subsystem, each having one totally-enclosed, stainless steel, 220V AC centrifugal-type chemical pump with drain cock, one shut-off valve, one by-pass line which includes inlet and outlet shut-off valves and a rotameter, one preheater which includes a thermocouple fitting, a relief valve, and temperature controllability and is equipped with a silicone-insulated, stainless steel-enclosed, wrap-around type heating element, and, on panel face, one quick-couple outlet port.
- Has one insulated stainless-steel boiler with quick-couple inlet and pressure-measurement port, with stainless-steel-sheathed, variable-controlled, bayonet-type heating element, with explosion-proof, manual-reset pilot lighted, thermal overload power shut-off control, with float-type, liquid level control actuating a solenoid-operated valve for recycling excess liquid from tank sump to feed reservoir, with drainage stopcock, with sight glass, with 0-250°F dial-type temperature gauge.
- Incorporates a stacked sieve-plate column having six gasketed 3-inch nominal ID, Pyrex-glass-throat and stainless-steel plate sections and one bellows section joined by bolted collars, each plate section to be fitted with an externally adjustable weir and downcomer and to contain; (A) a thermocouple port, (B) a quick-couple, pressure-measurement (or feed inlet) port, (C) a vapor and/or liquid sample-extraction septum.
- Incorporates a 3 inch nominal ID packed column consisting of a single long, Pyrex glass section, a single sieve-plate and throat top section similar in all respects to plate sections described in (4) above.
- Includes suitable, bolted-collar-joined, line sections sufficient to carry the stream from column to condenser.
- Has a shell-and-tube-type condenser containing at least 1.5 square feet of heat exchange surface and equipped with; (A) thermocouple ports at cooling water inlet and outlet, (B) water shut-off valve, (C) spring-loaded relief valve.
- Has connected to the shell side of the condenser a distillate reservoir with; (A) spring-loaded relief valve, (B) thermocouple port, (C) an overflow standpipe return to main reservoir by a line containing a quick-couple connector "T" fitting and a shut-off valve, (D) a direct (bottom located) line containing a quick-couple connector "T" fitting and a shut-off valve to reflux pump inlet, (E) a calibrated volume scale.

- Has six removable sieve-tray and two removable, condenser-tube thermocouples two preheater, one still boiler and one condensate-tank-inlet thermocouples (all of the chromel-alumel type) remotely connected to a 12-position thermocouple selector switch with digital readout.
- Incorporates continuously variable boiler and preheater temperature controllers.
- Incorporates a lockable, 220V AC, 25 Ampere main power circuit breaker, ON-OFF switch and indicator light along with feed pump, feed preheater, reflux and pump and reflux preheater ON-OFF toggle switches and indicator lights.
- Incorporates in the main power circuit a suitable voltmeter and ammeter
- Incorporates a quick-couple 72-inch manometer
- Incorporates a vertical hydrometer holder
- Has all electricals grounded
- Reflux ratio timing controls with ON/OFF switch

Standard unit includes one plate and one packed (packing not included) type of column for interchangeable use. Packing may be obtained through regular commercial channels.

Optional Computer System

The **Model H-6173-CS** Computer System

Computer Data Logging

This feature adds differential pressure transducers, and one rotary transducer into the system. One National Instruments interface package is provided for interfacing into a PC compatible computer through the USB port.

Computer is included. I/O programming and Data Acquisition Software is included, (LaVIEW) templates included.

Specify **MODEL H-6173-CDL**

Computer Data Logging and Control

This feature adds the CDL option plus the ability to control the flow and temperatures

Specify **MODEL H-6173-CDLC**

Available as:

- Sieve Plate Column only - **H-6173-SP**
- Bubble Cap Column only - **H-6173-BC**
- Packed Bed Column only - **H-6173-PC**

All Hampden units are available for operation at any voltage or frequency

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