



University of North Alabama
Office of Procurement
UNA Box 5025
Florence, AL 35632
Phone: (256)765-4206
Fax: (256)765-4329

Bid No. 2018-12 For: Engineering Instructional Equipment

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INVITATION FOR BIDS:

Sealed Proposals for furnishing materials, equipment or services as described herein will be received at the Purchasing Department, Bibb Graves Hall, Room 126, University of North Alabama, Florence, Alabama, until 2:00 p.m. local time on January 30, 2018.

It is understood that the owner may accept any or all items at the prices listed in this proposal within a noted timeframes on the specification page. Time is of the essence to this bid and if delivery is not made within the time specified, the University reserves the right to cancel any order placed as a result of this bid. This bid may be withdrawn at any time prior to the scheduled time for the opening of bids, or any authorized postponement thereof.

DIRECTIONS FOR MAILING BIDS:

Do not place more than one bid in an envelope. Envelopes containing more than one bid may not be opened in time for a bid to be considered.

Envelopes containing bids must be sealed, marked and addressed as follows:

ADDRESSED TO:	(If via any postal service University of North Alabama Purchasing Department - Bid 2018-12 UNA M/S 5025 One Harrison Plaza Florence, AL 35632-0001	(If hand carry) University of North Alabama Purchasing Department - Bid 2018-12 Bibb Graves Hall, Room 126 One Harrison Plaza Florence, AL 35632-0001
BID FOR:	Eng. Instructional Equipment Bid No. 2018-12	

CAUTION – The above mailing address line, UNA Box 5025, is the address for the University of North Alabama Central Mail Room and is not part of the physical address for the University of North Alabama Purchasing Department. Envelopes or packages addressed to this box number may not be received in the Purchasing Department by the specified bid due date and time. It is the bidder's responsibility to ensure that the bid is received in the Purchasing Department by the date and time specified; no assumptions should be made in regard to an extension due to unforeseen circumstances of any kind, no due date or time will change without advance written notice from the Procurement Office.

Bidders are strongly cautioned to mail or ship bids to allow ample time for receipt in the Purchasing Department, not the Central Mail Room nor Central Receiving. Overnight or next day delivery services may not be adequate. Since bids must be received in a sealed envelope, faxed or emailed bid copies cannot be accepted.

Bids received in the Purchasing Department after the specified date and time set forth above will not be considered

Bids will be opened in Bibb Graves Hall, Room 126 at 2:00 p.m. local time on January 30, 2018

Revised 1/30/08

_____ initial
I have read and understand the contents of this page



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INSTRUCTIONS TO BIDDERS

1. All bidders are to submit bids on proposal forms furnished by the Assistant Vice President of Business Services, University of North Alabama (forms enclosed). All bid forms are to be signed in all designated spaces by an authorized officer or employee of the bidder. Telephone bids will not be accepted. Bids submitted by "fax" machine will not be accepted. All bids are to be mailed or delivered in a sealed envelope.
2. All bidders shall base their proposals on the exact schedule of equipment, material or service specifications herein.
3. Pictures, descriptions, and specifications should accompany all bids when required or desirable. Samples may be required and, if so, shall be furnished free of cost to the Owner.
4. Reference to manufacturers, suppliers, catalog numbers, etc., is intended to set quality standards and does not preclude bids from others as long as quality standards are met. Offers of equal items shall state the brand and number or level of quality. Alternates will not be considered unless they conform to the specifications.
5. All bidders are required to submit unit prices and extended prices, where applicable, for each item bid. Where the unit price and the extended total price do not agree, the unit price shall prevail.
6. The Owner reserves the right to accept any or all items on any bidder's proposal at the unit price submitted. The Owner reserves the right to reject any and all bids and to waive informalities.
7. All prices submitted on the proposal are to be delivered prices to the University of North Alabama and shall not include any state or local sales tax.
8. Bidders should sign & return all pages of the complete bid to imply complete understanding and compliance with all bid requirements.
9. All questions should be directed to the Purchasing Office, University of North Alabama, UNA Box 5025, Florence, AL 35632-0001, phone 256/765-4206.
10. Should a bidder find discrepancies in, or omissions from the bid documents or should he be in doubt as to their meaning, he should at once notify the Owner who will send written instructions to all bidders.
11. Bids received after the bid opening date and time, or any authorized postponement thereof, will not be considered.
12. **If required, a bond may be requested and must be supplied within forty-eight (48) hours after request to protect the University from any risk of loss.**
13. **EQUAL EMPLOYMENT OPPORTUNITY/U.S. FAIR LABOR STANDARDS ACT:** By signing this proposal, bidder certifies that bidder is in compliance with the nondiscrimination clause contained in Section 202, Executive Order 11246, as amended by Executive Order 11375, relative to Equal Employment Opportunity for all persons without regard to race, color, religion, sex, or national origin, and the rules and regulations prescribed by the Secretary of Labor, Veteran's Act 38USC4212, Section 503 - Rehabilitation act of 1973 Title I of the Americans with Disabilities Act of 1990 42USC12101, and that any and all goods were produced in compliance with all applicable requirements of Sections 6, 7, and 12 of the Fair Labor Standards Act, as amended, and of regulations and orders of the United States Department of Labor issued under Section 14 thereof.
14. Verbal communication before or while Bid is open shall have no force or affect whatsoever toward this bid as written, or the entire agreement. All parties represent that no promises, representations, or inducements have been made with respect to the subject matter of the bid nor a contract, except as specifically set forth herein. The bid or final contract, agreement, or order, can only be changed, altered, modified or amended by written agreement from both parties.

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PROPOSAL FORM

In compliance with the University of North Alabama **INVITATION FOR BIDS** and **INSTRUCTIONS TO BIDDERS**, the undersigned hereby proposes to furnish and supply items to the University of North Alabama, Florence, Alabama, in strict accordance with the **SCHEDULE** and **SPECIFICATIONS**.

The undersigned bidder/proposer hereby certifies that it, its officers, partners, owners, providers, representatives, employees, and parties in interest, including the affiant, has not in any way colluded, conspired, connived or agreed, directly or indirectly, with any other bidder/proposer, potential bidder/proposer, firm or person, in connection with this solicitation, to submit a collusive or sham bid/proposal, to refrain from bidding/proposing, to manipulate or ascertain the price(s) of other bidders/proposers or potential bidders/proposers, or to secure through any unlawful act an advantage over other bidders/proposers or the university.

The prices submitted herein have been arrived at in an entirely independent and lawful manner by the bidder/proposer without consultation with other bidders/proposers or potential bidders/proposers or foreknowledge of the prices to be submitted in response to this solicitation by other bidders/proposers or potential bidders/proposers on the part of the bidder/proposer, its officers, partners, owners, providers, representatives, employees, or parties in interest, including the affiant.

DATED: _____

COMPANY NAME: _____

BY: _____

(Signature)

(Typed or Printed Name)

(Title)

BUSINESS ADDRESS: _____

TELEPHONE: _____

Email Address: _____

This address will be used to publish the bid tabulation & any other communication regarding bid results

If Bidder is a Corporation, write the State of Incorporation, and if a Partnership, give full name of partners, using space below.

_____ **initial**
I have read and understand the contents of this page



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**UNIVERSITY OF NORTH ALABAMA
VENDOR CERTIFICATION
PURSUANT TO ACT NO 2012-491 & ACT2014-044**

ALABAMA LAW (SECTION 31-13-9 , CODE OF ALABAMA 1975: By signing a contract resulting from this proposal, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the state of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom.

ALABAMA LAW SECTION 16-25-26C , CODE OF ALABAMA 1975; Legislation requiring the University of North Alabama to report to Retirement Systems of Alabama individuals paid for personal services who are currently receiving benefits from TRSA or ESA became effective October 1, 2013. No minimum level of compensation was defined. **Any individual receiving direct or indirect compensation from this contract who is a retiree receiving benefits from the State of Alabama Retirement System MUST NOTIFY UNA of this status along with Bid/RFP Submission.**

Bidder hereby certifies full compliance with Act No. 2012-491 & Act No. 2014-044:

Date: _____

Company: _____

Authorizing Signature: _____

Printed Name: _____

Title: _____

State of _____ County of _____

CERTIFICATE OF COMPLIANCE WITH THE BEASON-HAMMON ALABAMA TAXPAYER AND CITIZEN

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PROTECTION ACT (ACT 2011-535, as amended by Act 2012-491)

DATE: _____ **RE: Contract/Grant/ Incentive (*describe by number or subject*):**

BID/RFP _____ **by and between**

_____ (Contractor/Grantee) and

_____ (State Agency, Department or Public Entity)

The undersigned hereby certifies to the State of Alabama as follows:

1. The undersigned holds the position of with the Contractor/Grantee named above, and is authorized to provide representations set out in this Certificate as the official and binding act of that entity, and has knowledge of the provisions of THE BEASON-HAMMON ALABAMA TAXPAYER AND CITIZEN PROTECTION ACT (ACT 201 1-535 of the Alabama Legislature, as amended by Act 2012-491) which is described herein as "the Act".
2. Using the following definitions from Section 3 of the Act, select and initial either (a) or (b), below, to describe the Contractor/Grantee's business structure. **BUSINESS ENTITY.** Any person or group of persons employing one or more persons performing or engaging in any activity, enterprise, profession, or occupation for gain, benefit, advantage, or livelihood, whether for profit or not for profit. "Business entity" shall include, but not be limited to the following:
 - a) Self-employed individuals, business entities filing articles of incorporation, partnerships, limited partnerships, limited liability companies, foreign corporations, foreign limited partnerships, foreign limited liability companies authorized to transact business in this state, business trusts, and any business entity that registers with the Secretary of State.
 - b) Any business entity that possesses a business license, permit, certificate, approval, registration, charter, or similar form of authorization issued by the state, any business entity that is exempt by law from obtaining such a business license, and any business entity that is operating unlawfully without a business license.

EMPLOYER.: Any person, firm, corporation, partnership, joint stock association, agent, manager, representative, foreman, or other person having control or custody of any employment, place of employment, or of any employee, including any person or entity employing any person for hire within the State of Alabama, including a public employer.

This term shall not include the occupant of a household contracting with another person to perform casual domestic labor within the household.

_____(a) The Contractor/Grantee is a business entity or employer as those terms are defined in Section 3 of the Act.

_____(b) The Contractor/Grantee is not a business entity or employer as those terms are defined in Section 3 of the Act.

3. As of the date of this Certificate, Contractor/Grantee does not knowingly employ an unauthorized alien within the State of Alabama and hereafter it will not knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama;
4. Contractor/Grantee is enrolled in E-Verify unless it is not eligible to enroll because of the rules of that program or other factors beyond its control.

Certified this ____ day of _____ 20 ____.

Name of Contractor/Grantee/Recipient

By: _____

Its: _____

The above Certification was signed in my presence by the person whose name appears above, on this ____ day of _____ 20 ____.

WITNESS: _____ *Printed name of Witness:* _____

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State of Alabama
Disclosure Statement
(Required by Act 2001-955)

ENTITY COMPLETING FORM

Agreement Number

ADDRESS

CITY, STATE, ZIP

TELEPHONE NUMBER

()

STATE AGENCY/DEPARTMENT THAT WILL RECEIVE GOODS, SERVICES, OR IS RESPONSIBLE FOR GRANT AWARD

ADDRESS

CITY, STATE, ZIP

TELEPHONE NUMBER

()

This form is provided with:

☐ Contract

☐ Proposal

☐ Request for Proposal

☐ Invitation to Bid

☐ Grant Proposal

Have you or any of your partners, divisions, or any related business units previously performed work or provided goods to any State Agency/Department in the current or last fiscal year?

☐ Yes

☐ No

If yes, identify below the State Agency/Department that received the goods or services, the type(s) of good or services previously provided, and the amount received for the provision of such goods or services.

Have you or any of your partners, divisions, or any related business units previously applied and received any grants from any State Agency/Department in the current or last fiscal year?

☐ Yes

☐ No

If yes, identify the State Agency/Department that awarded the grant, the date such grant was awarded, and the amount of the grant.

1. List below the name(s) and address(es) of all public officials/public employees with whom you, members of your immediate family, or any of your employees have a family relationship and who may directly personally benefit financially from the proposed transaction. Identify the State Department/Agency for which the public officials/public employees work. (Attach additional sheets if necessary.)

2. List below the name(s) and address(es) of all family members of public officials/public employees with whom you, members of your immediate family, or any of your employees have a family relationship and who may directly personally benefit financially from

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the proposed transaction. Identify the public officials/public employees and State Department/Agency for which the public officials/public employees work. (Attach additional sheets if necessary.)

If you identified individuals in items one and/or two above, describe in detail below the direct financial benefit to be gained by the public officials, public employees, and/or their family members as the result of the contract, proposal, request for proposal, invitation to bid, or grant proposal. (Attach additional sheets if necessary.)

Describe in detail below any indirect financial benefits to be gained by any public official, public employee, and/or family members of the public official or public employee as the result of the contract, proposal, request for proposal, invitation to bid, or grant proposal. (Attach additional sheets if necessary.)

List below the name(s) and address(es) of all paid consultants and/or lobbyists utilized to obtain the contract, proposal, request for proposal, invitation to bid, or grant proposal:

By signing below, I certify under oath and penalty of perjury that all statements on or attached to this form are true and correct to the best of my knowledge. I further understand that a civil penalty of ten percent (10%) of the amount of the transaction, not to exceed \$10,000.00, is applied for knowingly providing incorrect or misleading information.

Signature

Date

Notary's Signature

Date

Date Notary Expires

Act 2001-995 requires the disclosure statement to be completed and filed with all proposals, bids, contracts, or grant proposals to the State of Alabama in excess of \$5,000.

____ initial
I have read and understand the contents of this page



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This form must be completed and returned before any contract(s) will be issued by the University of North Alabama

REQUIREMENTS/ SPECIFICATIONS

The University of North Alabama is seeking bids for the supply of instructional equipment supporting new engineering technology programs. It is the University's intent to purchase within 5 to 10 days of bid award; however no guarantee is made that any purchase will take place as a result of this bid. Only new units will be considered with appropriate warranty. The manufacturer noted is meant to establish quality standards and minimum functional requirements; any bidder proposing an alternate manufacturer is encouraged to do so, but must clearly identify equality or superior attributes along with sufficient documentation within the bid response to enable the University to determine if the item is acceptable for the purpose for which it is intended. UNA reserves the right to reject any item that UNA deems unsuitable for intended use.

Responsible bidders must provide a complete bid package and attach a formal company quote, full warranty and service details, and an explanation of delivery, installation and training process.

Award factors of this bid will be based upon the following parameters: Total Cost, Capabilities, and Serviceability. UNA reserves the right to choose the best option based on all award factors. We request the price quoted be firm for 60 days after the bid opening date to cover any unforeseen time needed to get funding positioned for an order. Each item may be considered independently, UNA may split award if it is found to be in the best interest of the University.

All bid submissions must include the following to be considered a Responsible Bidder:

- Complete Bid Document, all pages appropriately filled out and signed.
- Attach a formal quote, detailing any specifics not noted on the Bid Quote Sheet.
- Attach warranty details (for each unit if different)
- Note Any special requirements for delivery & installation
- Details of training provided
- Acknowledgement of 60 day price commitment on new unit quote

Bidders may quote one item, or every item.

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I have read and understand the contents of this page



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BID QUOTE SHEET

Item 1: Flow Systems Control Trainer – to study the control devices utilized in a flow system QTY: 1
Hampden H-FSCT (bulletin 131-105-1A)

Make / Model if different than Hampden: _____ Unit Price: \$ _____

Notes about Item 1: _____

Item 2: Continuous / Fractional Distillation System – industrial experimentation. QTY: 1
Hampden H-6173 (bulletin 617-3E)

Make / Model if different than Hampden: _____ Unit Price: \$ _____

Options:

CDL – Computer Data Logging Adder: P/N _____ Unit Price: \$ _____

CDLC – Computer Data Logging & Control (Lab View)
P/N _____ Unit Price: \$ _____

Notes about Item 2 or options: _____

Item 3: Liquid-to-Liquid Extraction Demonstrator – To permit student study of the fundamentals of a liquid to liquid extraction system. In addition to the hydrodynamics demonstrated it also must be able to provide mass transfer rates, heat transfer coefficients, extraction efficiency, and operating conditions at different liquid flow rates. Extraction process operable in continuous or semi-continuous mode.

Hampden H-6150 (bulletin 615E) QTY: 1

Make / Model if different than Hampden: _____ Unit Price: \$ _____

Options:

Distillation Column w/ Boiler & Overhead Condenser (H-6150-10)
P/N _____ Unit Price: \$ _____

Computer Data Logging Adder (CDL) P/N _____ Unit Price: \$ _____

Notes about Item 3 or options: _____

____ initial
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Item 4: Chemical Liquid Reactor Demonstrator – instruction of reactor vessel kinetics from stirred liquid phase
Hampden H-6250 (bulletin 625A) QTY: 1

Make / Model if different than Hampden: _____ Unit Price: \$ _____

Notes about Item 4: _____

Item 5: Process Control Trainer w/ Faults – to provide hands-on training for industrial process automation.
Hampden H-ICS-8189 (bulletin 132-102C) QTY: 1

Make / Model if different than Hampden: _____ Unit Price: \$ _____

Options:

Computer Workstation – H-ICS-8189-CC P/N _____ Unit Price: \$ _____

Computer Control System – H-ICS-8189-CCS P/N _____ Unit Price: \$ _____

Printer – H-ICS-8189-PO P/N _____ Unit Price: \$ _____

Temperature Package – H-ICS-8189T P/N _____ Unit Price: \$ _____

Notes about Item 5 or options: _____

Item 6: Temperature Process Control Trainer w/ Faults, Table Top - to provide experience in setting up, tuning, operating, and troubleshooting actual instrument and control systems used in the power & process industries. Specifically Temperature Process Loop
Hampden H-ICS-TT-TT (bulletin 133E) QTY: 1

Make / Model if different than Hampden: _____ Unit Price: \$ _____

Notes about Item 6: _____

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Item 7: Temperature System Trainer – simulation of temperature loop consisting of a reservoir with heating coil, pump, heat exchanger, and solenoid operated three-way valve.

Hampden H-ICS-TX (bulletin 131G/-004B)

QTY: 1

Make / Model if different than Hampden: _____ Unit Price: \$ _____

Options:

Fault Program – H-ICS-200 P/N _____ Unit Price: \$ _____

Notes about Item 7 or option: _____

Bulletins / spec sheets within following pages

Payment Terms: _____

Delivery commitment after receipt of order: _____

Quote Valid : _____ **Days**

FOB UNIVERSITY OF NORTH ALABAMA, FLORENCE, AL 35632-0001

For any questions regarding use or needed performance of this equipment

Contact Dr. Peter Rim (256)765-4430; email prim@una.edu

For questions regarding bid submission

Contact the Office of Procurement, (256)765-4206; chconlon@una.edu

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I have read and understand the contents of this page

Item 1

H-FSCT

Flow System Controls Trainer

Purpose

The Hampden **Model H-FSCT** Flow System Controls Trainer has been developed to permit students to study the control devices utilized in a flow system. The interaction of the control mechanisms; namely liquid level switches; with one another and the valves and actuators utilized are flange fitted for easy removal from the unit so that the students can learn how to service them.

Description

The **Model H-FSCT** Flow System Controls Trainer consists of the following:

Rotary Gear Pumps (2):

3/4HP @1725 RPM 90V DC PM. Motor complete with motor starter and auxiliary N.O./N.C. contacts. Nominal output at 1200 RPM is 16.4 GPM @ 20 PSI.

Motor Speed Controllers (2):

Full wave, solid state DC motor controller with a 1% load regulator and 1/2% line voltage regulator.

Circulating Pump:

1/12 HP @ 1725 RPM 115V AC motor with nominal output of 8 GPM @ 8 feet of head.

Motorized Valve Actuator:

Limitorque Model L120

Rotork Model 7A

Valves:

Globe (2), 1"
Diverting, 3-way, 1"
Solenoid, N.C., 1"

Switches:

Pressure, with an adjustable range of 1-30 PSI and a SPST relay, N.O. configuration.
Differential Pressure, with an adjustable range of 0-80" WCD and a SPST relay, N.O. configuration.
Flow, with a flow of 1.5 GPM necessary to activate it and 1.0 GPM to deactivate the switch. An SPDT relay, N.O. configuration.

Pressure Gauges (2):

0-30 PSI range and a full scale accuracy of 4%.

Differential Pressure Gauge:

0-100" WC range and a full scale accuracy of 4%.

Flowmeters (2):

One with a range 0.6-10.4 GPM and the other with a range of 1.5-21 GPM, both having a full scale accuracy of 2.5%.

CMC Control Switch

This trainer also comes complete with all of the system components necessary to realize a working system. These include the following:

- Main water reservoir (23 gal. capacity) with a sight glass and breather
- Clear water holding tanks (2) with a vertical scale
- Pressure relief valves (3), 1"
- Check valves (3), 1"
- Filters (3), 1"
- Shut-off valves, 1"
- Time relays (4)
- Control transformer
- On/Off switch
- Fuse
- Indicators lights
- DPDT switches
- AC main
- Legend plates
- All of the necessary 1" copper tubing, elbows, tees, etc.

All of the components of this trainer are assembled and wired.

The trainer is permanently mounted on a panel and base constructed out of 11 gauge sheet metal. The panel is finished in white enamel and the base is instrument tan texture. The front of the panel is silkscreened with a schematic of the flow system. The unit is 78"H x 102"W x 32"D, and comes with an instruction manual.

Services Required

Input Power: 208V AC-3 ϕ -60Hz

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

Hampden
ENGINEERING CORPORATION

H-6173

Continuous/Fractional Distillation System

Item 2

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.



032717

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

Hampden®
ENGINEERING CORPORATION

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**

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

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Item 3

Purpose

The Hampden **Model H-6150** Liquid-To-Liquid Extraction Demonstrator has been developed to permit student study of the fundamentals of a liquid-to-liquid extraction system. In addition to demonstrating the hydrodynamics of liquid-to-liquid extraction systems and interface control techniques, this unit can also be used to determine the mass transfer rates, heat transfer coefficients, extraction efficiency, and operating conditions at different liquid flow rates. The extraction process can be operated in a continuous or semi-continuous mode. The unit comes fully equipped with all of the instrumentation and accessories necessary to function as a stand-alone device. It is completely factory wired and plumbed.

Description

The feed, solvent, extract, and raffinate solutions are contained in corrosion resistant 316 stainless steel tanks. These tanks are polished inside for quick, easy cleaning and added sanitation. The extract and raffinate solutions can be fed into an optional distillation column or into the laboratory sump tank.

The unit can be supplied with an optional distillation column, specify **Model H-6150-10**. The distillation column comes complete with an electrically heated boiler and water cooled condenser. The distillation column can be used to recover the solvent from the raffinate for reuse in the extraction process or to concentrate the product in the extract solution.

The unit is supplied with a comprehensive instruction manual, Bulletin 615-01, which includes:

- (1) operating instructions;
- (2) equipment data;
- (3) theoretical background of the process kinetics.

An experiment manual is also provided.



110716

H-6150 Liquid-Liquid Extraction Demonstrator



Model H-6150 Liquid-Liquid Extraction Demonstrator
(Shown with H-6150-10 Distillation Column Option)
Dimensions: 102"H x 57-1/4"W x 29"D, Weight: 800 lbs.

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

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Chemical Engineering Systems

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Technical Specifications

Extraction Column

working length of 1200 mm with a column diameter of 50 mm. The column comes complete with all of the necessary sampling ports, pressure ports, temperature ports and fluid inlet and outlet ports.

Feed Solution Pump

a variable speed pump constructed out of corrosion resistant materials. The pump has an output range of 0 to 800 ml/min.

Solvent Solution Pump

a variable speed pump constructed out of corrosion resistant materials. This pump has an output range of 0 to 300 ml/min.

Chemical Solution Storage Tanks

four corrosion resistant storage tanks constructed out of 316 stainless steel. These tanks have the following capacities:

- a. feed tank - 30 liters
- b. solution tank - 15 liters
- c. extract tank - 10 liters
- d. raffinate tank - 15 liters

H-6150-10 Distillation Column Option

Distillation Column

has a working length of 500 mm and a diameter of 50 mm.

Distillation Boiler

a steam boiler with a capacity of 5 liters and a variable heater element rated at 1000 watts.

Shop view of multiple **Model H-6150**
Liquid-Liquid Extraction Demonstrators and
Model H-6160 Solid-Liquid Extraction Trainer

Equipment Specification

All components are mounted on a steel frame constructed out of square mechanical tubing.

All steel surfaces are finished with oven-baked enamel.

The control instrumentation is located on a control panel which is surface-mounted to the steel frame.

The control panel is finished in white, oven-baked enamel.

All control instruments are clearly identified by means of a silkscreened legend. The entire unit is completely factory-assembled and tested.

The unit is self-contained, requiring only the listed services.

Services Required

- Cold water supply (tap)
- Electrical supply: 120/220V.AC-1Ø-60Hz
- Air ventilation system.

Computer Data Logging

This feature adds two dual thermocouples, two flow transducers, and two pump inputs into the system. One interface package consisting of National Instruments I/O modules and LabVIEW® templates are provided for interfacing into a PC computer through the USB port. Computer and National Instruments LabVIEW® are included.

Specify **Model H-6150-CDL** ♦



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

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Item 4

H-6250 Chemical Liquid Reactor Demonstrator

Purpose

The reactor vessel constitutes a critical part of any chemical process plant. Reactor vessel kinetics is of great importance in the area of chemical engineering. One of the major types of reactors is the stirred liquid phase reactor. In order for the process engineer to optimize the product yield, a detailed understanding of the process is necessary.

Equipment Overview

The fundamental device is the reactor vessel. This vessel has a usable process volume of 1 to 2 liters (adjustable) and is equipped with a variable speed stirrer, reagent feed ports, product outlet port, product sampling port, and temperature measurement port.

The reagents are stored in a pair of corrosion-resistant tanks, each matched with a chemical metering pump and flow calibration port. The metering pumps are equipped with an external control feature. A product collection tank (constructed out of corrosion-resistant material) is also provided. All of the tanks are covered and are provided with drain valves.

The measurement and control of temperature are accomplished with a microprocessor based PID controller and a platinum RTD probe. The controller operates an electric heating element. In addition, a cooling/heating coil is provided to carry out heat transfer studies.

The variable speed mixer, used in conjunction with removable and adjustable baffles, allows experiments to be performed studying the effects of reagent mixing.

Model H-6250-CDL
Chemical Liquid Reactor Demonstrator
with CDL option

Dimensions: 60"H x 60"W x 30"D
Shipping Weight: 550 lbs.



The unit has provisions for gas/liquid reactions. A gas flowmeter, connected to the reactor vessel is provided. The gas tank, pressure sensor and pressure controller are not included. A port for the pressure sensor is available. This port can also be utilized to maintain an inert gas atmosphere in the reactor vessel.

Specifications

The Hampden **Model H-6250** Chemical Liquid Reactor Demonstrator is designed to permit the investigation of the characteristics of the stirred liquid phase reactor. The unit comes equipped with all of the necessary instrumentation to study the reactor characteristics except for the analytical measurement instrumentation used to determine the feed and product mixture compositions.

With the unit, the student can determine the following:

A. Chemical Kinetics

Batch reactor:

As a batch reactor, the reaction rate (and thus the kinetic constant) can be determined with respect to temperature, residence time and mixing effects.

Continuous operation:

As a continuous reaction, the actual yield can be compared to the theoretical yield based upon the factors determined above.

Temperature control:

The effect of temperature on the reaction rate can be studied. The batch reactor can be operated at a constant temperature or with a variable temperature (e.g. a ramp temperature input). The reactor can be controlled from ambient to 80°C.

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

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B. Heat Transfer

Heat transfer coefficients:

The heat transfer coefficients between the reactants and the heating or cooling coil can be determined. This will enable the use of mass and enthalpy balances which will introduce the student to yield optimization.

C. Mixing effects:

The effect of mixing on the reaction may be carried out. In general, theoretical results are based on a well-mixed model of a given process. By using baffles and the variable-speed stirrer, various mixing conditions can be simulated and the mixing speed optimized.

Equipment Specification

Reactor Vessel

The reactor vessel consists of a transparent sided member with a maximum capacity of 2.5 liters. It is fitted with a RTD probe, a variable speed stirrer, a heating/cooling coil (stainless steel construction), a pair of reagent inlet lines, a product outlet line with an adjustable overflow, and a removable lid which will only allow carbon-dioxide free air into the reactor vessel.

Temperature Controller

A microprocessor based PID controller which accepts a RTD input (other inputs available on request). The unit features a programmable ramp and soak function to allow the optimization of the product yield by controlling the temperature in the reactor at different values during the reaction. The unit comes equipped with a RTD probe. An optional communication interface (RS-232 or RS-422) is also available to allow computer monitoring or control of the process.

Feed Pumps

Two electronic chemical metering pumps constructed out of non-corroding materials. The flow rate can be varied from 10 to 300 ml/min and is accurate within $\pm 1\%$ over the operating range. The flow rate can be controlled manually or by an external 4-20mA signal. The external remote signal can come from the remote station (which allows computer monitoring of the flow rate) or from a host computer.

Reagent Calibration Ports

A pair of outlet ports that allow the calibration of the metering pumps to be checked. However, since these are precision devices, the volumetric flow rate shall not vary significantly with time.

Gas Flowmeter

A precision rotameter which has a fullscale accuracy of $\pm 2\%$ and a $\pm 2\%$ repeatability. This unit also features a polycarbonate shield for use in pressurized systems.

Reagent Tanks

A pair of tanks, each with a capacity of 22 liters, and constructed out of corrosion resistant materials. These reservoirs include covers and store the chemicals utilized in the reactor vessel.

Product Tank

A 75 liter tank constructed out of corrosion resistant materials. The reservoir includes a cover and stores the output of the reactor vessel.

Stirrer

A variable speed (0-1000RPM) stirrer constructed out of stainless steel. An optional tachometer is available to allow a host computer to monitor the stirrer speed.

The unit has a self supporting frame constructed out of mechanical square tubing. The instrument panel is constructed out of code gauge steel and is mounted on a formica top. The frame is finished in instrument tan texture and the instrument panel is finished in gloss white enamel. The overall dimensions are 60" high by 60" wide by 30" deep.

The unit comes complete with all of the necessary instrumentation with the above exceptions noted. These are the analytical instrumentation to measure, and analyze the reagents and products (titration glassware, chemical reagents, etc.), the reagents used in the experiments, the gas tank, pressure sensor, and pressure controller.

Services Required

Electrical: 120V-1 ϕ -60Hz

Water: supply of deionized or distilled water
supply of water for cooling (2 liter/min)

Computer Data Logging

In order to enhance the experiment capabilities of the equipment, a computer interface option is available. This will allow a host computer either to monitor (data logging) or control the process. The chemical feed pumps, stirrer RPM, the RTD probe and temperature controller are all capable of being monitored and/or controlled by a host computer. The bench can be configured to operate with either RS-232 or RS-422 serial communications.

Specify the Model H-6250-CDL. ♦

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

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Item 5

H-ICS-8189 Process Control Trainer

Purpose

The **Model H-ICS-8189** Process Control Trainer was developed to provide hands-on training for industrial process automation.

Description

This trainer provides measurement and/or control of flow, level and pressure utilizing micro-processor based controls.

The system consists of a clear process level tank, reservoir tank, pump and other instrumentation mounted on or in a mobile bench.

Specifications

Plumbing:

All piping is clear PVC. Fittings are PVC.

Instrumentation:

- Rosemount single- station controllers (2 req'd) with RS-485 (USB optional)
- Monarch paperless recorder with 6 input channels
- IDP10 Intelligent d/p cell transmitters (2 req'd), level/flow
- IGP10 Intelligent Electronic Gauge Pressure Transmitter
- Bauman Globe style control valve, A-O, with I/P valve positioner

Components:

- Main circuit breaker with ground fault interrupter protection
- Pump control switch
- Oil-less air compressor switch
- Oil-less air compressor rated 1.9 CFM at 100 psi complete with three gallon tank and regulator with gauges.
- Reservoir tank, 11 gallon with fill and drain ball valve with hose fitting
- Clear process tank, 5 gallon with fittings for overflow, manual load needle valve and level transmitter
- Pump, submersible rated 210 gph at 20' Head
- Three-way Valve with 50' dead time flow circuit



MODEL H-ICS-8189 Process Control Trainer

Dimensions: 75"W x 62"H x 30"D - Shipping Weight: 900 lbs

- Orifice plate assembly with flexible tube interface and quick-connect fittings
- Power cord, 8ft.
- Cord storage rack

Construction:

Mobile bench with doors and control panel. The bench is finished in instrument tan enamel and the control panel in instrument white enamel.

Casters:

Two stationary and two swivel with locks

Bench Top:

75" x 30" x 1 1/16". Unit consists of a 1/16" thick plastic laminate fastened to 1" thick medite.

Nomenclature:

- silkscreen with black KEM enamel

Fault Package:

- Fault Package providing 12 instructor controlled programmable faults with switches located in a locked compartment.

Services Required

Electrical: 120V AC 1Ø 60Hz

Water: Cold - normal cold water service

Drain: Floor

Options

MODEL H-ICS-8189-CC

Computer Workstation

MODEL H-ICS-8189-PO

Printer

MODEL H-ICS-8189T

Temperature Package complete with additional Rosemount controller, electronic control valve, constant speed pump, heat exchanger, RTD thermocouple, electric heater with controls and accessory package.

MODEL H-ICS-8189-PLC

Programmable Logic Control consists of:

- H-ML-1100 Programmable Controller
- H-PLC-RS-LOGIC Programming and Documentation Software

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

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Item 6

Purpose

The Hampden **H-ICS "T" Series** Trainers provide experience in setting up, tuning, operating, and troubleshooting actual instrument and control systems of the type used in the power and process industries. Each panel, by simulating a different process loop, provides instruction in the measuring and transducing of such physical variables as pressure, temperature, flow and level. Student trainees learn instrumentation and control techniques of standard Fisher-Rosemount equipment. Covered are open-loop control as well as the various types of closed-loop control: on/off, proportional, proportional plus integral, and proportional plus derivative, as well as a variety of final control devices, including electric, pneumatic and electronic.

Description

The Hampden Instrumentation and Process Control Training System is comprised of seven mobile panels, each containing a single process loop. These panels may be interconnected to form more complex control configurations. Each panel contains, in addition to the principal measuring and transducing device, an independent indication of the value of the physical variable being controlled. Microprocessor-based controllers provide maximum flexibility in setting control parameters, besides providing the computer interface for distributed control. Each panel contains a means of creating a process disturbance, and a recorder for charting the controller's response to changes in setpoint or load.

The Hampden **ICS "T" Series** Trainers are equipped with six instructor-insertable faults covering both mechanical and electrical failures. The fault switches are located in a locked compartment located on the side of the units.

H-ICS-FT

Flow Process Loop

The Flow Process Loop consists of the following components:

- Single System Microcontroller (PID) with communications port RJ45
- Electronic Indicating Recorder
- Transmitter, electronic d/p cell - pressure
- Venturi Tube Assembly
- Power Supply, 24V DC
- Air Regulator
- Centrifugal Pump with 1/2HP motor and variable frequency drive
- Storage Tank, 20 gallon
- Flowmeter, water
- Alarm Indicating Lights (2)
- Three-way Manifold
- Receptacle
- Electromagnetic Circuit Protector Power Switch with pilot light
- Removable header assembly
- Control Panel and mobile stand
- Patch Cords (20)
- Air Hoses (2)
- Ground Fault Interrupter
- Fault Program (6)
- Storage compartment for patch cords and air hoses
- Power Supply (12VDC, 24VDC)



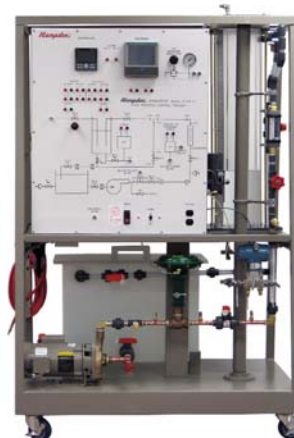
MODEL H-ICS-FT Flow Process Control Trainer

H-ICS-LT

Level Process Loop

The Level Process Loop consists of the following components:

- Single System Microcontroller (PID) with communications port RJ45
- Electronic Indicating Recorder
- Transmitter, electronic d/p cell - level
- Current to Pressure (I/P) Converter
- Control Valve, air actuated
- Power Supply, 24V DC
- Air regulators (2)
- Centrifugal Pump with 1/2HP motor
- Storage Tank, 22 gallon
- Flowmeter, water
- Alarm Indicating Lights (2)
- Bubble pipe
- Pump Circuit Breaker
- Level Tank (for opened and closed level measurement)
- Electromagnetic Circuit Protector Power Switch with pilot light
- Pressure Monitor Taps - Piping
- Control Panel and mobile stand
- Patch Cords (20)
- Air Hoses (4)
- Ground Fault Interrupter
- Fault Program (6)
- Storage compartment for patch cords and air hoses
- Power Supply (12VDC, 24VDC)



MODEL H-ICS-LT Level Process Control Trainer

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

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Instrumentation and Control Trainers

Educational Training Equipment for the 21st Century

H-ICS-PT

Pressure Process Loop

The Pressure Process Loop consists of the following components:

- Single System Microcontroller (PID) with communications port RJ45
- Electronic Indicating Recorder
- Transmitter, electronic - pressure
- Current to Pressure (I/P) Converter
- Control Valve, air actuated
- Power Supply, 24V DC
- Air Regulators (2)
- Pressure Process Tanks (2)
- Pressure Gauge (100 psi)
- Flowmeter, air
- Alarm Indicating Lights (2)
- Orifice Plate
- Receptacle
- Electromagnetic Circuit Protector Power Switch with pilot light
- Air load system
- Air muffler
- Fault Program (6)
- Control Panel and mobile stand
- Patch Cords (20)
- Air Hoses (16)
- Ground Fault Interrupter
- Storage compartment for patch cords and air hoses
- Power Supply (12VDC, 24VDC)



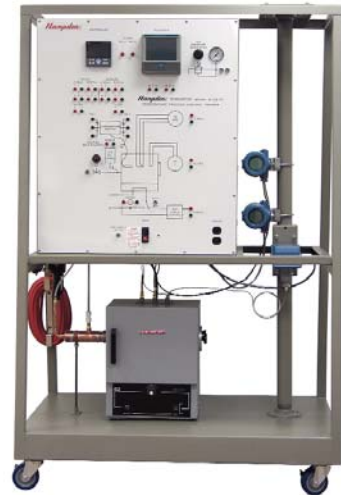
MODEL H-ICS-PT Pressure Process Trainer

H-ICS-TT

Temperature Process Loop

The Temperature Process Loop consists of the following components:

- Single System Microcontroller (PID) with communications port RJ45
- Electronic Indicating Recorder
- Air Velocity Transmitter
- SCR Power Controller
- Power Supply, 24V DC
- Air Regulators (2)
- Alarm Indicating Lights (2)
- Temperature Transmitter (for Type T element)
- Temperature Transmitter (for RTD element)
- Power Supply (12VDC, 24VDC)
- Thermocouple, Type T
- RTD Element
- Laboratory Oven (modified with an air cooling injector and exhaust damper)
- Thermostat Temperature Control (bulb type)
- Receptacle
- Electromagnetic Circuit Protector Power Switch with pilot light
- Fault Program (6)
- Control Panel with mobile stand
- Patch Cords (24)
- Air Hoses (2)
- Ground Fault Interrupter
- Storage compartment for patch cords and air hoses



MODEL H-ICS-TT Temperature Process Trainer

Optional Computer Control

The Hampden H-ICS "T" Series Trainers are equipped with an RS-485 port so the process may be supervised by a host computer as part of a distributed control scheme.

A computer program and interface is available from Hampden, Model H-ICS-X. Together with the interfacing hardware supplied, this system allows for the operator to control the process from any compatible PC system.

PLC Option

- PLC Control to include (1) Allen Bradley Micrologix ML-1200 PLC with H-LTCS Laptop Control System and Software. Designate Model H-ICS-_T-PLC.

H-6485

Instrumentation and Calibration Console

The Hampden Model H-6485 Instrumentation and Calibration Console enables demonstration of the principles of calibration and measurement of process instrumentation. After calibrating an instrument, it can be installed on a trainer and utilized in a real application.



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

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Item 7

Purpose

The Hampden ICS Trainers provide experience in setting up, tuning, operating, and troubleshooting actual instrument and control systems of the type used in the power and process industries. Each panel, by simulating a different process loop, provides instruction in the measuring and transducing of such physical variables as pressure, temperature, flow and level. Students and trainees learn instrumentation and control techniques of standard commercial manufacturers, such as Yokogawa and Rosemount. Covered are open-loop control: on/off, proportional, proportional plus integral, and proportional plus integral plus derivative, as well as a variety of final control devices, including electric, pneumatic and electronic.

Description

The Hampden Instrumentation and Controls Training System is comprised of four mobile panels, each containing a single process loop. One controls Pressure; one Temperature; one Flow; and one Level. These panels may be interconnected to form more complex control configurations. Each panel contains, in addition to the principal measuring and transducing device, an independent indication of the value of the physical variable being controlled. Microprocessor-based controllers provide maximum flexibility in setting control parameters, besides providing the computer interface to distributed control. Each panel contains a means of creating a process disturbance, and recorder for charting the controller's response to changes in setpoint or load. When specified, the Hampden ICS Trainers may be equipped with instructor-inserted faults. (Please specify **Model H-ICS-200**.)

A complete computer control system, **MODEL H-ICS-X**, is available, allowing full access to all functions of the trainers. Each trainer is furnished complete with electrical patch cords, interconnecting hoses, and a text/manual that includes experimentation.

PLC Option

- PLC Control to include (1) Allen Bradley Micrologix **ML-1200** PLC with **H-LTCS** Laptop Control System and Software. Designate **Model H-ICS-X-PLC**.



MODEL H-ICS-TX – The temperature loop consists of a reservoir with heating coil, pump, heat exchanger, and solenoid-operated three-way valve. Heated water is circulated through a pipe where its temperature is sensed by a thermocouple. Water temperature is controlled by: (1) the voltage applied to the heater coil through the power controller; and (2) whether the water is made to flow through the heat exchanger. A thermocouple drives the controller input. The 4-20 mA output loop includes the controller, recorder, and power controller. An additional contact-closure output operates the three-way valve, or the valve may be manually switched to provide the process disturbance. A gas-filled thermometer provides an independent indication of temperature.



MODEL H-ICS-PX – The pressure loop consists of a reservoir, variable-speed pump, pressure vessel, and manually-operated bypass valve. Water is pumped into a tank, creating an air pressure whose value depends on pump speed and bypass valve setting. The 4-20 mA output loop contains the controller, recorder and a motor speed controller to control pump speed. A bourdon tube gauge provides an independent indication of pressure.



MODEL H-ICS-FX – The flow loop consists of a reservoir, pump, and pneumatically-operated control valve. Water is pumped at a rate determined by the position of the control valve and of a hand-operated stop valve. Flow is sensed by a differential pressure transmitter. The 4-20 mA output loop contains the controller, recorder, and a current-to-pneumatic converter positioner to control the position of the valve. A rotameter provides an independent indication of flow rate.



MODEL H-ICS-LX – The level loop consists of a reservoir, pump, electronically controlled control valve, delay loop, and level tank. Water is pumped through the delay loop to the level tank. The water level in the level tank is controlled by changes in the control valve. The 4-20 mA input loop consists of a level transmitter, recorder, and controller. The output signal is a 4-20 mA control signal, driving the valve toward either the open or closed position. A gauge glass provides an independent indication of level. A rotometer indicates the flow upstream of the control valve.

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

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H-IPPT-3

Industrial Process Plant Trainer

Purpose

The Hampden **Model H-IPPT-3** Industrial Process Plant is a pilot plant unit designed for training engineers, technicians, repairmen, and operators in the following ways:

- Enables students to familiarize themselves with actual industrial process systems. It is designed to expose them to the different kinds of industrial equipment used in measurement and control.
- Has all the operating characteristics of a full-sized industrial plant without the psychological pressures and dangers inherent in an actual process plant. This permits students to make and experience the results of errors in system operation with no danger to the process or operator.
- It is designed to allow student development in the areas of system start-up, tuning, and troubleshooting, all of which are of critical importance to the instrument technician.

Description

The Hampden **Model H-IPPT-3** is comprised of two sections. The Control Section contains all control equipment, remote control interface and a complete tri-colored graphic representation of the pilot plant.

The Process Plant incorporates transparent level towers that make it possible for the students to actually see the process in action. The two liquids used in the Process Plant have different specific gravities, different colors, and are immiscible. These liquids are non-corrosive to brass and copper alloys, non-toxic, and non-flammable.



Control Section (left) and Process Plant (right)
Shipping Weight: 3000 lbs

The Process Plant is factory assembled and is supplied with a pair of transparent towers, two storage tanks, circulating pumps, four heat exchangers, a low-pressure steam generating boiler and all necessary hand valves together with its copper and applicable transparent piping. It comes completely equipped with the instrumentation necessary to allow instruction in operation, measurement, control, and control system tuning adjustment of the process and control system variables.

Equipment Supplied

- Electric boiler
- Steam heat exchangers
- Air heat exchangers
- Microprocessor-based controllers
- Recorders
- Temperature transmitters
- Differential pressure transmitters
- Pressure transmitter
- Level transmitters
- Control valves
- Auto/manual stations
- Interconnecting cords

Optional Equipment

MODEL H-ICS-X - Computer Control Software/Interface

MODEL H-ICS-CS - Computer System

MODEL H-IPPT-3-FP - Fault Program

MODEL H-IPPT-PLC-5
Programmable Logic Controller

MODEL H-ICS-CC - Computer Workstation

Services Required

Electrical—

208/120V. AC-3Ø-60Hz-100A for electric steam boiler and water chiller

Air—

1/4" line, clean dry instrument air, 60-100 psig

Water—

1/2" line - drain (customer connection),
1/2" line - boiler make-up

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

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