H-6260

Chemical Liquid Tubular Reactor Demonstrator

Purpose

Reactor vessel kinetics is of great importance in the area of chemical engineering. The tubular flow (also known as plug flow) reactor is one of the two classic reactor types in the field of chemical engineering. In the tubular flow reactor, the reagent streams are combined and react while they flow through the tube. The fluid which enters the reactor at any given time does not react with fluid which enters at a different time. Thus, the fluid can be considered as traveling in discrete fluid 'packets'.

Model H-6260-CDL
Chemical Liquid Tubular Reactor Demonstrator with CDL option

Dimensions: 64"H x 56"W x 30"D
Shipping Weight: 738 lbs.

Specifications

The **Model H-6260** Chemical Liquid Tubular Reactor Demonstrator is designed to permit the investigation of the characteristics of the tubular flow reactor. Two reagent streams are introduced to a long tube (the reactor) on a continuous basis. The tubular reactor is arranged such that the combined fluid stream has the characteristics of "plug" type flow. The reaction is contained in a water jacket to allow the reaction to occur under isothermal conditions. The principal reaction that this unit is designed for is the second order reaction between dilute caustic soda and ethyl acetate. However, the unit can be used to demonstrate other reactions.

With this unit, the student is capable of determining the following:

A. Chemical Kinetics

Continuous tubular flow reactor:

Compare the actual yield with the theoretical yield.

Temperature effects:

Determine the effect of temperature on the reaction rate including preheating of the reagents. The reactor can be controlled from ambient to 80°C.

Flow rate effects:

Determine the effects of flow velocity on the rate of reaction. The residence time can also be calculated. The flow rate can be optimized for the reaction, i.e. the flow rate where the product yield is optimized considering any pertinent operating conditions.

Mathematical analysis:

The validity of the mathematical models of the reactor system can be checked. The strengths and weaknesses of a given model will become evident.

B. Chemical Analysis

The student will gain experience in taking product samples and performing the appropriate analytical procedures to determine the contents of the sample.

The student will verify the different reactions occurring in the reactor (from above) and thus the model of the reactor system.

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

Hampden® ENGINEERING CORPORATION

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Chemical Engineering Systems

Educational Training Equipment for the 21st Century

Equipment Specification

- Reactor vessel - the reactor is a 5 millimeter polyethylene tube which is 20 meters long. This tube is wrapped around a cylindrical water jacket. The total reactor volume is approximately 400 cubic centimeters. The design of the reactor best approximates "plug" flow conditions. The water jacket temperature is controlled by a microprocessor controller with a Thermocouple Type T input. The reactor vessel shall be fitted with a Type T probe, a mixer, a reagent mixing valve, a product outlet and a sampling valve at the reactor outlet.
- Temperature controller - a microprocessor based PID controller which accepts a Type T Thermocouple input (other inputs available on request). The unit comes equipped with a Type T Thermocouple probe. An optional communication interface (USB) is also available to allow computer monitoring or control of the process.
- Feed pumps - two electronic chemical pumps constructed out of non-corroding materials. The flow rate can be varied from 10 to 300 ml/min. 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 computer.
- Reagent flowmeter calibration - an outlet port that allows the calibration of the metering pumps to be checked.
- Reagent tanks - a pair of tanks, each with a capacity of 22 liters, constructed out of corrosion resistant materials. These reservoirs, which are covered, hold the chemicals used in the reactor vessel.
- Product tank - a 75 liter tank constructed out of corrosion resistant materials. The reservoir, which is covered, holds the output of the reactor vessel. The products can be neutralized (if necessary) before being discharged to the laboratory drain.
- Reagent pre-heating coil - each reagent shall be capable of being pre-heated to any temperature from ambient to 45°C. The temperature of the reagents are thermostatically controlled.
- The unit has a self supporting frame constructed out of mechanical square tubing. The instrument panel is constructed out of code gauge steel and be 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 is also supplied with an experimental manual.
- The unit comes complete with all of the necessary instrumentation with the following exceptions noted. These are the analytical instrumentation to measure and analyze the reagents and products (titration glassware, chemical reagents, etc.), and the reagents used in the experiments.

Services Required

Electrical - 120V AC-1ϕ-60Hz

Options

The **Model H-6260** is also available in a bench top configuration. Specify **Model H-6260-BT** for this option.

The overall dimensions are 44" high, 39" wide, by 28" deep.

Computer Data Logging

This feature adds temperature controller, water jacket temperature, flow rate, and reagent pre-heat temperature into the system. One interface package consisting of National Instruments I/O modules is provided for interfacing into a PC computer through the USB port. Templates for LabVIEW® control software are included.

LabVIEW® control software and PC computer are included.

Specify **Model H-6260-CDL** ♦

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