

P3212

## PARALLEL FLOW HEAT EXCHANGER

### FEATURES

- ◆ Clear acrylic unit affording a visual appreciation of the experiment
- ◆ Sized to minimise temperature rise of air flowing in the tube

### PRINCIPLE EXPERIMENTS

- ◆ Determine the relationship between Nusselt's and Reynold's numbers for a stream of air flowing around and parallel to a heated tube (annular flow).
- ◆ Determine the relationship between Nusselt's and Reynold's numbers for a stream of air flowing through a tube with heated inner section.

### INTRODUCTION

Cussons P3212 Parallel Flow Heat Exchanger is provided as an additional experiment for use with P3210 Heat Transfer Bench, interchangeable with P3219 Cross Flow Exchanger and utilising a common power supply and temperature read-out facility.

The unit has been designed to demonstrate the correlation between flow rate and heat transfer coefficient, wall to air, as stated above.

### DESCRIPTION

The apparatus comprises a clear acrylic 60mm dia tube mounted centrally on a small stand, with a conical, inlet flow measuring device at one end and a small section of ducting at the other end which connects to the fan inlet by quick release toggles.

A cartridge type heater located centrally along the axis of the tube and a circumferential element are mounted in turn within the tube. Both heaters have been sized so as to minimise the temperature rise of the air flowing into the tube. The convective heat transfer coefficient is thus determined utilising the readings of power input and surface temperature along with the value of the heated surface area. The rate of heat transfer for each heater can then be found giving values of heat transfer coefficient for both internal and external surfaces.

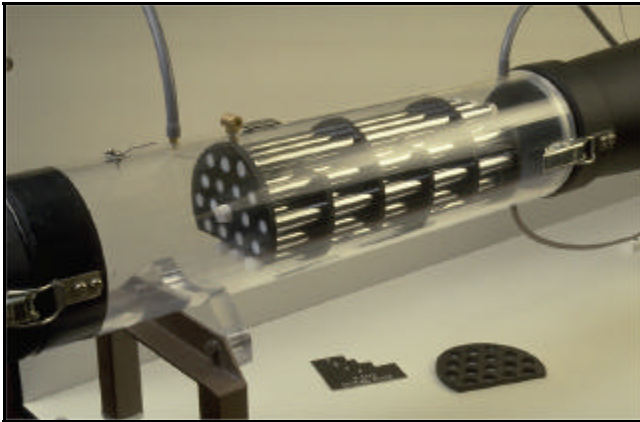
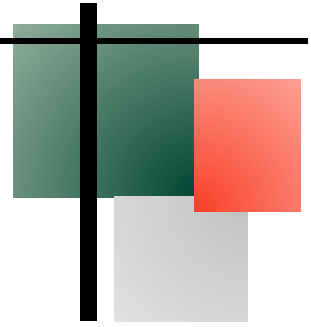
Air flow rate in all cases is measured by the conical, inlet flow measuring device connected to the sloping manometer.

### TENDER SPECIFICATION

The unit should consist of a conical inlet flow measuring device, followed by a flow tube having a short heated section, which is then followed by an annular section comprising a heated inner tube.

The two heated sections, outer tube and inner tube, are to be sized as to minimise the temperature rise of the air flowing in the tube. The convection heat transfer coefficient is thus determined utilising the readings of power input and surface temperature along with the value of heated surface area. The heat transfer rate for each heater can then be determined giving values of heat transfer coefficient for both inside and outside of the tubes.

The unit should be made from clear acrylic, thus affording a visual appreciation of the experiment.



## P3213

### MIXED FLOW HEAT EXCHANGER

#### FEATURES

- ◆ Bulk air temperature remains substantially constant
- ◆ Easily interchanged for other experiments

#### PRINCIPLE EXPERIMENTS

- ◆ To determine the heat transfer coefficient from tube wall to shell side within a tube bundle
- ◆ To determine the relationship between Nusselt's and Reynold's numbers by varying the flow rate of air

#### INTRODUCTION

Cussons P3213 Mixed Flow Heat Exchanger is provided as an additional experiment for use with P3210 Heat Transfer Bench, interchangeable with P3219 Cross Flow Heat Exchanger and utilising a common power supply and temperature read-out facility to demonstrate the use of flow baffles within a tube bundle in order to increase the heat transfer capability of the exchanger. The baffles direct the air flow so that a mixture of cross flow and parallel flow conditions prevail. They are arranged so that the number of baffles and the spacing between them can be varied.

#### DESCRIPTION

The Apparatus consists of a clear acrylic tube of nominal bore 100mm which is the outer wall (shell side) of the exchanger and positioned at the inlet to the fan of the Heat Transfer Bench. Air flow through the heat exchanger is determined by 20mm and 50mm orifice plates mounted in ducting at the inlet, while pressure tappings into the tube allow the pressure drop across the tube bundle to be measured on the sloping manometers.

The tube bundle consists of a number of blank tubes and a single heated tube positioned centrally within the tube bundle. The heated tube incorporates a surface mounted type K thermocouple which is connected to the variable low voltage power source and read-out facility which is provided with the basic bench. The heater element is sized so that the bulk air temperature remains substantially constant, thus greatly simplifying the experimental technique.

#### TENDER SPECIFICATION

The outer wall (shell side) of the exchanger should consist of a clear acrylic tube of nominal bore 100mm, which is positioned at the inlet to the fan of the Heat Transfer Bench.

The flow of air is determined by the use of the conical inlet device to be supplied with the basic bench.

The tube bundle should consist of a number of blank tubes and a single heated tube, positioned in a series of baffle plates that are free to slide along the tubes, enabling the baffle pitch to be varied. The heated tube, positioned centrally in the tube bundle, is to contain a built in, wall mounted thermocouple.