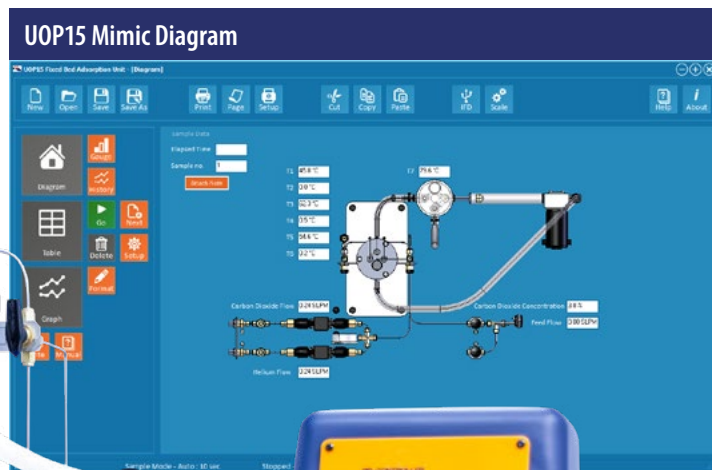
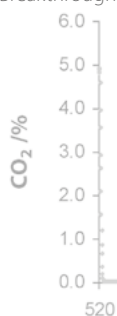


## Fixed Bed Adsorption Unit – UOP15

UOP15 demonstrates the adsorption of a solute, carbon dioxide, from a binary gas mixture onto the surface of a solid adsorbent, activated carbon. The process takes place in a fixed bed adsorption column.

The adsorption and desorption/regeneration processes are monitored using temperature sensors sited at intervals along the column and also by carbon dioxide measurement of the exit gas using an infra red (IR) detector.

Breakthrough curve of CO<sub>2</sub> in adsorption and desorption processes



### Detailed Capabilities

- ▶ Teaching exercises are included to familiarise students with the following principles:
- ▶ Study of the adsorption/desorption processes under different operational conditions: temperature, flow rate, molar fraction and pressure
- ▶ Study of the breakthrough curves of temperature profiles during the adsorption/desorption process
- ▶ Study of the quasi-isothermal regime at low concentrations and pressures
- ▶ Study of the solute movement theory model, which describes the adsorption/desorption process
- ▶ Familiarisation with the formation of the compressive and dispersive fronts in adsorption processes
- ▶ Analysis of the breakthrough curves of CO<sub>2</sub> during the adsorption and desorption/regeneration processes
- ▶ Obtain the adsorption equilibrium isotherm of CO<sub>2</sub> from the desorption curve (dispersive wave)

## Description

The UOP15 introduces students to the fundamentals of adsorption and desorption processes using a packed bed reactor. The unit is fitted with a stainless steel reactor column in which the adsorbent, activated carbon, is packed.

There are six thermocouples (T1 - T6) sited along the length of the column, which enable the adsorption/desorption fronts to be followed (adsorption/desorption of CO<sub>2</sub> leads to changes in temperature).

A hot water circulation system, also containing a thermocouple (T7), is connected to the jacket of the column to enable accurate temperature control via a PID temperature controller. This way the desired processing temperature is accurately maintained.

The system is equipped with all the valves required for flow direction control, flow rate control and pressure relief for safety.

Electronic flow meters monitor the flow rate of both the carrier gas, helium, and the absorbate, carbon dioxide. These combined with the column temperature sensors and the IR detector, for measuring CO<sub>2</sub> concentration, enable the processes to be followed closely and a wide range of operating variables to be examined.

There is a divert path around the column, which is used for calibration of the IR detector and also setting up of process conditions prior to beginning an experiment.

The recommended operation variables are flow rates of 0 - 5 SLPM and pressures of 0 - 0.3 bar. Such operating pressures suit safe operation and provide ideal conditions for the adsorption/desorption processes.

The UOP15 column is easily loaded with the activated carbon supplied or the operator could use their own variety thus enabling performance comparison of different adsorbents.

All important sensors used on the unit are electronic and provide outputs for data logging and analysis. The data logger, provided with the unit, interfaces between the UOP15 unit and the user's computer using a USB port.

The associated software enables graph plotting and provides full instructions on setting up the equipment and performing the experiments.

## Educational Content

To study the absorption of the CO<sub>2</sub> in a packed column containing activated carbon



## Overall dimensions

Length	1.00m
Width	0.50m
Height	0.60m

## Packed and crated shipping specifications

Volume	0.44m <sup>3</sup>
Gross weight	45Kg

## Requirements

## Scale



### Electrical supply:

UOP15-A:	220/240V/1ph/50 Hz,10A
UOP15-B:	120V/1ph/60 Hz,15A
UOP15-G:	220V/1ph/60 Hz,10A

### Gases:

CO <sub>2</sub>	5 SLPM,1 bar max
Helium	1 SLPM,1 bar max

► **NOTE:** The equipment should be run in a ventilated room.

► Software requires a computer running Windows 7 or above with a USB port.

## Ordering specification

- A bench top unit comprising a vacuum formed ABS plastic plinth with integral electrical console onto which is mounted the stainless steel, packed fixed bed adsorption column, hot water circulation system and infrared detector
- The hot water circulation system connected to the column jacket enables automatic control of temperature adsorption to a setpoint value
- Gas feed flow rate can be controlled between 0 and 5 l/min
- The bed adsorption column has the following specifications:
  - Height 325 mm, diameter 58 mm
  - Stainless steel jacket for temperature control
  - Gas distribution plate at entry to column
  - Bed of glass beads for good gas distribution and maintenance of steady state temperature
  - Six thermocouples spaced evenly along the length of the column
- All electrical circuits are protected by appropriate safety devices
- The control console incorporates an electronic display: PID controller display, including the setpoint temperature
- USB interface and sophisticated data logging software are included

## Technical specifications

Operation pressure	0-0.5 bars
Gas flow rates	0 < 5 SLPM (He) 0 < 1 SLPM (CO <sub>2</sub> )
Column capacity	480 cm <sup>3</sup>
Gases	CO <sub>2</sub> , He
Relief valve pressure	20 psi
Column operating temperature	25 - 45°C

## Ordering codes

- UOP15-A: 220-240V / 1ph / 50Hz, 10A
- UOP15-B: 120V / 1ph / 60Hz, 15A
- UOP15-G: 220V / 1ph / 60Hz, 10A

**Armfield standard warranty applies with this product**

## Knowledge base

- > 28 years' expertise in research & development technology
- > 50 years' providing engaging engineering teaching equipment

Benefit from our experience, just call or email to discuss your laboratory needs, latest project or application.

An ISO 9001:2015 Company



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