

Fixed and Fluidised Bed Apparatus – CEL-MKII

MKII VERSION INCLUDES THREE COLUMNS AND DATA LOGGER

The CEL-MKII is designed to facilitate the study of flow through fixed and fluidised beds of solid particles.

This new improved MKII version has three columns, one for use with water and two for use with air.

The separate air and water columns enable the difference between 'aggregative' and 'particulate' fluidised bed characteristics to be demonstrated.

The two air columns enable the effect of different packing material sizes to be demonstrated without having to remove, empty and repack a column.

The MKII version also benefits from full electronic instrumentation and powerful armSOFT data logging software.

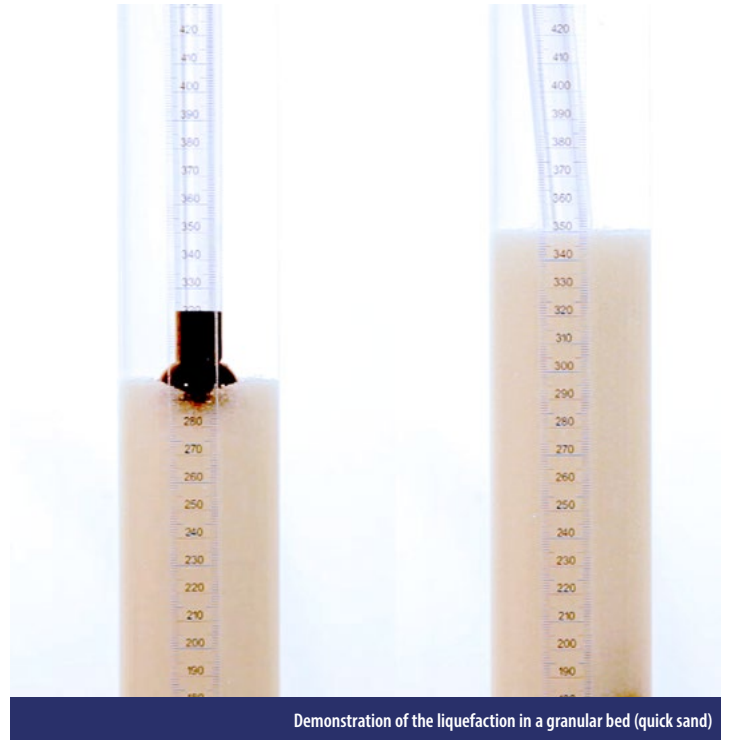


Experimental content

- ▶ Determining the voidage of granular material
- ▶ Flow through fixed and fluidised beds using water as the fluidising medium
- ▶ Flow through fixed and fluidised beds using air as the fluidising medium
- ▶ To determine the pressure drop (head loss) across the beds with different particle sizes
- ▶ Verification of Carman-Kozeny's equation
- ▶ To compare the predicted onset of fluidisation with the measured pressure drop
- ▶ To compare the onset of fluidisation between two particle sizes
- ▶ To observe the onset of fluidisation and differentiate between the characteristics of a fixed bed and fluidised bed
- ▶ To observe the onset of fluidisation and differentiate between the characteristics of a fixed bed and a fluidised bed for different particle sizes.
- ▶ To investigate the difference between different sized granular material on fluidisation characteristics, using air as the fluidising medium.
- ▶ Demonstration of liquefaction and liquefied soil phenomena (e.g. quicksand)
- ▶ To investigate the characteristics associated with water flowing vertically upwards through beds of different granular material



Flow rates and pressures for each column is clearly displayed via the LCD screen



Demonstration of the liquefaction in a granular bed (quick sand)

Description

Upward flow of fluid through a bed of particles is a naturally occurring phenomenon, for example in the movement of ground water. Industrial applications include ion exchange, extraction of soluble components from raw materials and other chemical processes.

The Armfield CEL-MKII apparatus facilitates the study of flow through fixed and fluidised particle beds. The simultaneous study of air and water systems and the phenomenon of 'bubbling' can be observed.

The apparatus comprises three clear acrylic columns mounted above a moulded ABS base. The base contains a water reservoir with a variable speed submersible pump that pumps water through an electronic flow meter into the base of the left-hand column. This column features an overflow pipe that returns the water back into the sump.

The two air columns are fed by variable pressure regulators, which can be used to adjust the air flow rate through the column. The air flow rate is measured using pressure sensors at discharge orifices at the top of the columns. The integral microcontroller calculates the flow rates from the pressure readings and displays these on the front panel.

Pressure drops on all three columns are measured by differential pressure sensors connected to tapping points at the top and bottom of the columns.

All process measurements are displayed simultaneously on the front panel display and are available on the USB output for data logging. The software also provides powerful graph-plotting facilities.



Individual flow rate regulators for each column

Requirements

Scale



Electricity Requirements:

Requires 24V DC at 5A – The equipment is supplied with a universal mains adaptor suitable for 100V to 240V AC, 50/60Hz

Compressed Air:

50 l/min at 2 bar minimum (8 bar max)

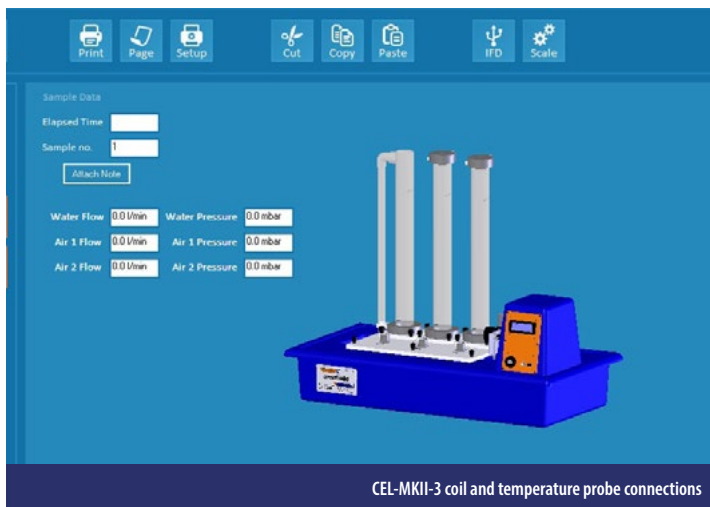
(Air inlet connection for 6mm rigid plastic pneumatic tube supplied)

Note:

Armfield can provide a suitable portable air compressor, see below

Computer:

Software requires the user to have a PC running Windows 7 or above with a USB port.



Essential accessories / equipment

Air compressor - AC1

Max pressure	8 bar
Max air flow	100 l/min at 1 bar
Capacity	6l
Motor power	820W
Weight	8.8kg
Noise	80dB typical at 1m

Overall dimensions

Dimensions	CEL-MKII	AC1
Length	1.00m	0.45m
Width	0.50m	0.29m
Height	0.83m	0.40m

Packed and crated shipping specifications

Volume	0.6m ³	0.3m ³
Gross weight	35Kg	20Kg

Ordering specifications

- ▶ A benchtop apparatus for the study of fixed and fluidised beds of solid particles
- ▶ Three cylindrical columns, one for water and two for air, each column with a diameter of 50mm and height of 550mm
- ▶ Columns mounted above a blue ABS moulded base containing an 8l water reservoir
- ▶ Two sizes of bed material supplied, ranges: 0.5-0.75mm and 0.2-0.3mm
- ▶ Complete with a demonstration of liquefaction and how the properties of liquefied particles change with agitation
- ▶ Variable speed submersible pump to recirculate water up to a rate of 2 l/min
- ▶ Each column has tapping points and differential pressure sensors
- ▶ Air flow rate measured by orifice pressure sensors with the flow rate being calculated by an integral microcontroller
- ▶ Electronic front panel display shows flow rates and pressure drops for all three columns simultaneously
- ▶ Powered by universal power adaptor with worldwide approvals
- ▶ Supplied with powerful data logging software (PC not supplied)

Complementary products

- ▶ CEK MKII - Fluid Mixing Studies
- ▶ CEN MKII - Solids Handling Study Bench
- ▶ CEQ - Corrosion Studies Kit
- ▶ CERa MKII - Gaseous Diffusion Coefficient Apparatus
- ▶ CERb - Liquid Diffusion Coefficient Apparatus
- ▶ CES - Wetted Wall Gas Absorption Column
- ▶ CEU - Catalytic Reactors
- ▶ CEXC - Computer Controlled Chemical Reactor Teaching Equipment + 5 reactor types
- ▶ UOP5 MKII - Liquid/Liquid Extraction Unit
- ▶ UOP7 MKII - Gas Absorption Column

Ordering codes

CEL-MKII

CEL-MKII-EU	with Schuko mains lead
CEL-MKII-UK	with UK mains lead
CEL-MKII-B	with USA 115V mains lead

AC1

AC1-A	220-240V / 1ph / 50Hz
AC1-B	120V / 1ph / 60Hz
AC1-G	220-240V / 1ph / 60Hz

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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Aftercare

Installation
Commissioning
Training
Service and maintenance
Support: armfieldassist.com