



# armfield

## MULTI-PUMP TEST RIG

**C3 MKII**  
issue 1



C3 MKII Multi-Pump Test Rig

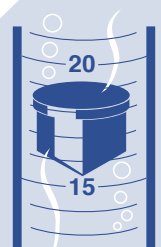
*The Armfield Multi-Pump Test Rig has been designed to demonstrate the operating characteristics (head-flow curves and efficiency) of a series of different types of pumps, each having a broadly similar input power.*

*The rig can accommodate both rotodynamic and positive displacement pumps, and is supplied with the most common example of each type as standard (i.e. a centrifugal pump and a gear pump). A range of other pump types is available as accessories, (including axial, turbine, flexible impeller, diaphragm and plunger, plus a second centrifugal pump for series/parallel demonstrations). Up to four pumps can be accommodated within the rig simultaneously for use within a single laboratory period, and each can be run without disconnecting any pipework or connections. Further pumps can also be interchanged straightforwardly.*

*This totally new system benefits from electronic instrumentation, optional data logging and the use of a state of the art sensorless vector drive to accurately determine the torque provided by the drive motors.*

*As an option the unit can be fitted with two identical centrifugal pumps to allow simple series/parallel pump configurations to be demonstrated.*

Applied Fluid Mechanics



## DEMONSTRATION CAPABILITIES

- *Determining the performance of different types of pumps at constant speed by producing a set of characteristic curves*

*For rotodynamic pumps:*

- *Pressure head v flow*
- *Power absorbed v flow*
- *Pump efficiency v flow*

*For positive displacement pumps:*

- *Flow v pressure head*
- *Power absorbed v pressure head*
- *Volumetric efficiency v pressure head*

- *Determining the effect of speed on the performance of pumps*
- *Understanding the difference between rotodynamic pumps and positive displacement pumps*
- *Understanding the effect of system resistance*
- *Investigating the effect of suction losses on a centrifugal pump*
- *Demonstration of the effect of running two centrifugal pumps in series and parallel (Requires C3-MkII-20SP)*
- *Understanding the characteristics of a reciprocating pump (requires C3-MkII-25 or C3-MkII-26 and C3-MKII-40)*

## DESCRIPTION

*The equipment comprises a water reservoir, and five pump positions, (four active). Each pump position uses pipework and sensors optimised to the type of pumps it is intended for.*

*Positions 1, 2a and 2b are optimised for high flows at low heads, such as the rotodynamic pumps whereas positions (3) and (4) are suitable for lower flows but higher pressures, as obtained from the positive displacement pumps. Note: Position (2a) and Position (2b) are mutually exclusive in as much as they share the same motor drive.*

*The following table defines which types of pumps are available for each position:*

<i>Position</i>	<i>Instrumented Flow Capability</i>	<i>Instrumented Pressure Capability</i>	<i>Pump Options</i>
<i>1</i>	<i>300 L/min</i>	<i>20m</i>	<i>- Centrifugal (C3-MkII-20) (included as standard)</i>
<i>2a</i>	<i>300 L/min</i>	<i>20m</i>	<i>- Flexible Impeller (C3-MkII-23) or - Second Centrifugal (C3-MkII-20SP) for series/parallel operation</i>
<i>2b</i>	<i>300 L/min</i>	<i>3.4m</i>	<i>- Axial (C3-MkII-22)</i>
<i>3</i>	<i>75 L/min</i>	<i>70m</i>	<i>- Gear (C3-MkII-21) (included as standard)</i>
<i>4</i>	<i>75 L/min</i>	<i>70m</i>	<i>- Turbine (C3-MkII-24) or - Diaphragm (C3-MkII-25) or - Plunger (C3-MkII-26)</i>

To switch between any of the four installed active pumps, (or series/parallel configuration) is simple, requiring only isolating valve changes and control panel selection.

To change over an installed pump for one of the other options is still straightforward, but requires plumbing changes (easy release fastenings), topping up the tank with water (to replace any lost) and re-programming some inverter settings. Additional pumps and options can be purchased at any time, and fitted by the user.

A PLC control panel is used to allow the correct combination of suction, head, flow, pump speed and torque to be unambiguously displayed for the selected pump test.

## ACCESSORIES

### PUMPS AVAILABLE:

#### **C3-MkII-20 Centrifugal Pump**

*(included in standard Supply)*

A brass bodied Centrifugal pump with plastic Impellor and Stainless steel shaft. Maximum flow 137l/min and maximum head 9m.

#### **C3-MkII-20SP Second Centrifugal Pump**

*(Optional)*

A second Centrifugal pump, identical to C3-20, and including the additional valves required to perform a Series/Parallel pump demonstration.

#### **C3-MkII-21 Gear Pump**

*(included in standard Supply)*

A corrosion resistant bronze bodied gear pump, with stainless steel shafts and bronze helical gears for quiet operation. Maximum flow 13.7 l/min and maximum head 60m (limited by system relief valve).

#### **C3-MkII-22 Axial Flow Pump**

*(Optional)*

A purpose designed axial flow pump, housed in a clear acrylic casing. Maximum flow 100l/min and maximum head 1.8m.

#### **C3-MkII-23 Flexible Impellor Pump**

*(Optional)*

A bronze pump head with stainless steel shaft and flexible impellor. Maximum flow 120l/min at 3m head.

#### **C3-MkII-24 Turbine Pump**

*(Optional)*

A straight bladed bronze turbine impellor with a bronze pump body and stainless steel shaft. Maximum flow 24 l/min and maximum head 30m.

#### **C3-MkII-25 Diaphragm Pump** *(optional, also requires C3-MkII-40 volumetric measurement system)*

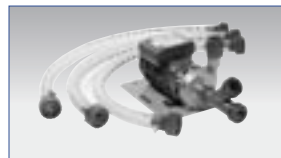
A diaphragm pump with uPVC wetted parts, with a diaphragm 150 mm (6 inch) diameter and a 25mm (1 inch) stroke. Maximum flow 5.8 l/min at a maximum head of 60m (limited by system relief valve).

#### **C3-MkII-26 Plunger Pump**

*(option, also requires C3-MkII-40 volumetric measurement system)*

A plunger pump with stainless steel wetted parts, with a bore of 34mm (1 3/8 inch) and a stroke of 25mm (1in). Maximum flow 5.3 l/min at maximum head of 60m (limited by system relief valve).

Each pump accessory comes on its own baseplate, assembled complete with all pipes, valves and fittings to allow it to be easily fitted to the C3-MkII. Different types of fitting are used for different positions in order to help prevent incorrect fitting.



C3-MkII-20SP  
Second Centrifugal Pump



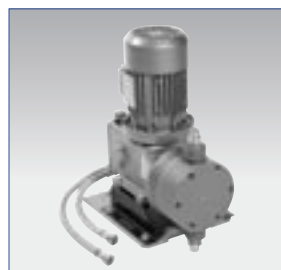
C3-MkII-22  
Axial Flow Pump



C3-MkII-23  
Flexible Impellor Pump



C3-MkII-24  
Turbine Pump



C3-MkII-25  
Diaphragm Pump

## ACCESSORIES - continued

### **C3-MkII-40**

#### **Volumetric Measurement System**

The reciprocating pumps (C3-MkII-25 and C3-MkII-26) are not suitable for electronic flow measurement due to the pulsating nature of the flow. To accurately measure the flow rate from these pumps requires a Volumetric Measurement System, where the volume of water flowing over a period of time can be measured. The C3-MkII-40 is a water column of 8 litres capacity, with a vertical scale. The bottom of this column is connected to the input of the reciprocating pump, and the time taken for the water level to change between 2 points is measured.

### **C3-MkII-304IFD**

#### **Data Logger and Educational Software**

The data logger and education software option allows the results to be logged to a Windows PC (not supplied) via a USB port. A wide range of data logging, data display and graph plotting options are available.

See Armsoft datasheet for details:  
[www.armfield.co.uk/armsoft](http://www.armfield.co.uk/armsoft)

## SERVICES REQUIRED (C3-MkII)

Electrical supply:

C3-MKII-A 220-240V, 50Hz, 10 Amps

C3-MKII-B 110-120V, 60Hz, 20 Amps

C3-MKII-G 220-240V, 60Hz, 10 Amps

Clean water: 120 litres (initial fill only, no permanent connection required)

Armfield Limited  
Bridge House West Street Ringwood  
Hampshire England BH24 1DY  
Tel: +44 (0)1425 478781  
Fax: +44 (0)1425 470916  
E mail: [sales@armfield.co.uk](mailto:sales@armfield.co.uk)  
URL: <http://www.armfield.co.uk>

USA Office:  
Armfield Inc.  
436 West Commodore Blvd (#2)  
Jackson NJ 08527  
Tel: (732) 928-3332  
Fax: (732) 928-3542  
E mail: [info@armfieldinc.com](mailto:info@armfieldinc.com)

## ORDERING SPECIFICATION

- A mobile self contained multi-pump test rig, containing all the services and instrumentation for determining the characteristic curves of 8 different pumps at different speeds.
- For rotodynamic pumps:
  - Pressure head v flow
  - Power absorbed v flow
  - Pump efficiency v flowFor positive displacement pumps:
  - Flow v pressure head
  - Power absorbed v pressure head
  - Volumetric efficiency v pressure head
- Contains five different pump positions (4 active at the same time.) Digital readout allows mounting of selected pump.
- Centrifugal pump and gear pump supplied as standard.
- Axial pump, flexible impeller pump, turbine pump, diaphragm pump, plunger pump and a second centrifugal pump are all available as accessories
- Series/parallel pump demonstrations can be performed with the second centrifugal pump option.
- Control valve incorporated upstream of each pump (except axial pump) to demonstrate the effect of suction loss on performance.
- A PLC control panel is used to allow the correct combination of suction, head, flow, pump speed and torque to be unambiguously displayed for the selected pump test.
- Electronic measurement of flow, pressure head and suction head.
- Optional volumetric flow measurement system for reciprocating pumps.
- Optional data logging and educational software.

### OVERALL DIMENSIONS

Height: 1.50m

Width: 2.20m

Depth: 0.75m

### SHIPPING SPECIFICATIONS

C3-MkII

Volume: 3.9m<sup>3</sup>

Gross weight: 500kg