

Multi-Pump Test Rig - C3 - MKII

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

UP TO FOUR PUMPS AT THE SAME TIME
 ROTODYNAMIC AND POSITIVE DISPLACEMENT PUMPS
 ELECTRONIC INSTRUMENTATION, CONTROL & DATA LOGGING SUPPLIED AS STANDARD
 CENTRIFUGAL PUMP & GEAR PUMP SUPPLIED AS STANDARD



C3-MKII - Pump accessories
 (Standard & optional pumps available)

Experimental content

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

► **For rotodynamic pumps:**

- Pressure head vs flow
- Power absorbed vs flow
- Pump efficiency vs flow

► **For positive displacement pumps:**

- Flow vs pressure head
- Power absorbed vs pressure head
- Volumetric efficiency vs pressure head

► **Rotodynamic Pumps**

- Centrifugal Pump
- Centrifugal Pump in series and parallel
- Axial Flow Pump
- Turbine Pump

► **Positive Displacement Pump**

- Gear Pump
- Flexible Impeller Pump
- Diaphragm pump
- Plunger Pump (Piston Pump)

Detailed experimental content

- ▶ **Determining the performance of different types of pumps at constant speed by producing a set of characteristic curves:**
 - Understanding the difference between rotodynamic pumps and positive displacement pumps
 - Understanding the effect of system resistance
 - Determining the effect of speed on the performance of pumps
 - Investigating the effect of suction losses on a centrifugal pump
 - Demonstrating the effect of running two centrifugal pumps in series and parallel
- ▶ **Rotodynamic pumps**
- ▶ **Centrifugal Pump**
 - To investigate the performance characteristics of a centrifugal pump
 - To explore the following characteristic curves for a centrifugal pump
 - Total head produced by the pump against discharge volume flow rate
 - Power input to the pump against discharge volume flow rate
 - Hydraulic power against discharge volume flow rate
 - Overall efficiency of the pump against discharge volume flow rate
- ▶ **Axial Flow Pump**
 - To investigate the performance of an axial flow pump
 - To explore the following characteristic curves for an axial pump
 - Total head produced by the pump against discharge volume flow rate
 - Power input to the pump against discharge volume flow rate
 - Hydraulic power against discharge volume flow rate
 - Overall pump efficiency against discharge volume flow rate
- ▶ **Turbine Pump**
 - To investigate the performance of a turbine pump
 - To explore the following characteristic curves for a turbine pump
 - Power input to the pump against discharge flow rate
 - Hydraulic power against discharge volume flow rate
 - Overall pump efficiency against discharge flow rate
- ▶ **Series and Parallel Pumps**
 - To investigate the performance of two similar Centrifugal pumps when connected and operated in Series and in Parallel.
 - Total head against Volume Flow rate
 - Power Input against Volume Flow rate
 - Hydraulic Power against Volume Flow rate
 - Overall efficiency against Volume Flow rate
- ▶ **Positive Displacement Pump**
- ▶ **Gear Pump**
 - To investigate the performance characteristics of a gear pump
 - To explore the following characteristic curves for a gear pump
 - Discharge volume flow rate against total head
 - Power input to the pump against total head
 - Hydraulic power against total head
 - Overall pump efficiency against total head
- ▶ **Flexible Impeller Pump**
 - To investigate the performance of a flexible impeller pump
 - Explore the following characteristic curves for a flexible impeller pump
 - Total head against discharge volume flow rate
 - Power input to the pump against discharge volume flow rate
 - Overall pump efficiency against discharge volume flow rate
 - Volumetric pump efficiency against discharge volume flow rate
- ▶ **Diaphragm pump**
 - To investigate the performance of a diaphragm pump
 - To explore the following characteristic curves for a diaphragm pump
 - Volume flow rate against peak outlet pressure
 - Power input to the pump against peak outlet pressure
 - Pump volumetric efficiency against peak outlet pressure
- ▶ **Plunger Pump (Piston Pump)**
 - To investigate the performance of a plunger pump
 - To explore the following characteristic curves for a plunger pump
 - Volume flow rate against peak outlet pressure
 - Power input to the pump against peak outlet pressure
 - Pump volumetric efficiency against peak outlet pressure

Position	Instrumented flow capability	Instrumented pressure capability	Pump options
1	300 l/min	20m	<ul style="list-style-type: none"> • Centrifugal (C3-MKII-20) included as standard
2a	300 l/min	20m	<ul style="list-style-type: none"> • Flexible impeller (C3-MKII-23) • Second centrifugal (C3-MKII-20SP) for series/parallel operation
2b	300 l/min	3.4m	<ul style="list-style-type: none"> • Axial (C3-MKII-22)
3	75 l/min	70m	<ul style="list-style-type: none"> • Gear (C3-MKII-21) included as standard
4	75 l/min	70m	<ul style="list-style-type: none"> • Turbine (C3-MKII-24) • Diaphragm (C3-MKII-25) • Plunger (C3-MKII-26)

Accessories supplied as standard

C3-MKII-20 Centrifugal pump

A brass-bodied centrifugal pump with plastic impeller and stainless steel shaft. Maximum flow 137 l/min and maximum head 9m.



C3-MKII-21 Gear pump

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).



Optional accessories

C3-MKII-20SP Second centrifugal pump

A second centrifugal pump, identical to C3-MKII-20, includes the additional valves required to perform a series/parallel pump demonstration.



C3-MKII-22 Axial flow pump

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

*** MUST BE SPECIFIED AT TIME OF ORDER AS CANNOT BE RETRO FITTED**



C3-MKII-23 Flexible impeller pump

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



C3-MKII-24 Turbine pump

A straight-bladed bronze turbine impeller 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 150mm diameter and a 25mm stroke.

Maximum flow 5.8 l/min at a maximum head of 60m (limited by system relief valve).



C3-MKII-26 Plunger pump

(optional, also requires C3-MKII-40 Volumetric measurement system)

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



C3-MKII-40 Volumetric measurement system

(essential for C3-MKII-25 and C3-MKII-26)

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 an eight-litre water column 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 two points is measured.



Description

The Armfield Multi-Pump Test Rig can accommodate both rotodynamic and positive displacement pumps and is supplied with the most common example of each type as standard (ie a centrifugal pump and a gear pump).

A range of other pump types are 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 simultaneously within the rig for use within a single laboratory period and each can be run without disconnecting any pipework or connections. Further pumps can also be easily interchanged.

Each pump accessory comes on its own baseplate, assembled complete with all pipes, valves and fittings to enable 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.

This new system benefits from electronic instrumentation, control and data logging using a PC (not supplied) and the use of a 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 enable simple series/parallel pump configurations to be demonstrated.

Requirements

Scale



Electrical supply:

C3-MKII-A: 220-240V / 1ph / 50Hz / 10A

C3-MKII-G: 220-240V / 1ph / 60Hz / 10A

G version has optional 1.5kVA transformer available to accommodate 120V/1ph/60Hz supply.

Computer:

The user must have a PC with a USB port, running Windows 7 or above.

Clean water:

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

Ordering codes

C3-MKII-A	Multi Pump Test Rig	C3-MKII-24	Turbine Pump
C3-MKII-G	Multi Pump Test Rig	C3-MKII-25	Diaphragm Pump
C3-MKII-20SP	Second Centrifugal Pump	C3-MKII-26	Plunger Pump
C3-MKII-22	Axial Flow Pump	C3-MKII-40	Volumetric Measurement System
C3-MKII-23	Flexible Impeller Pump		

Overall dimensions

Length	2.20m
Width	0.75m
Height	1.50m

Packed and crated shipping specifications

Volume	3.9m ³
Gross weight	500kg

Ordering specification

- ▶ A mobile self-contained Multi-Pump Test Rig, containing all the services and instrumentation for determining the characteristic curves of eight different pumps at different speeds
- ▶ For rotodynamic pumps:
 - ▶ Pressure head vs flow
 - ▶ Power absorbed vs flow
 - ▶ Pump efficiency vs flow
- ▶ For positive displacement pumps:
 - ▶ Flow vs pressure head
 - ▶ Power absorbed vs pressure head
 - ▶ Volumetric efficiency vs pressure head
- ▶ Contains five different pump positions (four active at the same time). Digital readout enables 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 PC (not supplied) is used to set the required speed of the pump(s) on test. A separate mimic diagram for the selected pump(s) on test displays the important measured and calculated variables
- ▶ Electronic measurement of flow, pressure head, suction head and motor torque
- ▶ Optional volumetric flow measurement system for reciprocating pumps
- ▶ Data logging and educational software included



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



armfield.co.uk

Aftercare

Installation
Commissioning
Training
Service and maintenance
Support: armfieldassist.com