<u>armfield</u>



Computer Controlled Subsonic Wind Tunnel - C15

A compact benchtop wind tunnel, with visible working section.

A wide range of accessories and instrumentation options are available, allowing a comprehensive study of Subsonic Aerodynamics and Fluid Mechanics. COMPUTER CONTROL & DATA CAPTURE AS STANDARD



Experimental content

- To convert a head measurement using a manometer to an equivalent pressure reading
- To demonstrate the use of a static pressure reading to determine tunnel air velocity
- ► To convert head and pressure readings to alternative engineering units
- To demonstrate the difference between Static pressure, Dynamic pressure and Total pressure and how Dynamic pressure can be used to determine air velocity
- ► To show how velocity varies in the test section because of the velocity profile
- To investigate the variation in Static Head resulting from a change in cross-sectional area
- ► To investigate the Bernoulli equation



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- ► The visualisation of flow around a bluff body at different velocities
- The measurement of pressure distribution around a circular cylinder at different velocities
- Comparison of drag for shapes of equal equatorial diameter
- ► Visualisation of flow around different body shapes
- Measurement of the wake profile behind different shapes
- To investigate the pressure distribution around a symmetrical aerofoil at different angles
- ► To investigate the pressure distribution across the wake behind the wing
- To measure the depth of the boundary layer on smooth and rough flat plates
- To evaluate models or instruments of the students own design and/or manufacture



33ue. 2	Applications			
JRL: http://www.armfield.co.uk/c15	ChE	ME	CE	IP

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Manometer Options – C15-11 & C15-12

The **C15-11 Inclined Manometer Bank** features 13 transparent tubes offset at a angle for precise visual measurement of small pressure differences, you can further increase the visibility by adding blue dye crystals provided. The **C15-12 Electronic Manometer Bank** includes 16 differential pressure sensors and integrates seamlessly with a PC for digital data acquisition and control. Both units can operate simultaneously, offering students both visual (qualitative) and digital (quantitative) data.

Pressure Experiments and Accessories (Requires C15-11 and/or C15-12)

C15-14: A Miniature Pitot Static Tube that can be located in the roof of the working section at three alternative positions; the start of the working section and upstream and downstream of the model mounting position.

C15-15: The Wake Survey Rake is a 10-tube rake aligned vertically and positioned downstream of the model designed to face the airflow; the mounting can be offset by 2.5mm enabling up to 20 pressure readings in the wake region for detailed flow analysis.

C15-21: A NACA0015 aerofoil with 10 pressure tapping points along one side, enabling detailed pressure distribution measurements from leading to trailing edge. Thanks to its symmetrical design, the wing can be flipped to observe both high- and low-pressure regions.

C15-23: A plain cylinder, incorporating 10 equi-spaced tapping points around half of the circumference allow pressure distribution around the cylinder to be measured. The cylinder can be rotated through 180° to plot the pressure distribution over the whole circumference.

C15-24: A Venturi profile that occupies the full working section of the tunnel, it incorporates 11 pressure tapings and is manufactured from clear acrylic for full visualization.

C15-25: A flattened Pitot tube mounted on a traversing micrometre measures air velocity at varying distances from a flat plate surface, both smooth and artificially roughened plates are provided to compare laminar and turbulent boundary layers.

Driven Pressure Experiment (Requires C15-19 plus C15-11 and/or C15-12)

The C15-18-FC* with the C15-18-01 is a PC controlled driven 360-degree model interface with single pressure tapping enabling the study of pressure acting on a cylinder at various velocities and angular positions, both integrate seamlessly with the C15 digital data acquisition and control software.

*FC denotes the unit must be ordered with the wind tunnel for calibration purposes.



Lift & Drag Balances Options - C15-13, C15-16 & C15-17

C15-13-FC*: A two-component electronic balance providing lift (x-axis) & drag (y-axis) forces acting on the fitted model.

C15-16-FC*: A three- component electronic balance providing lift (x-axis) & drag (y-axis) forces acting on the fitted model, additionally the counter & clockwise moments are provided.

C15-17-FC*: A PC controlled driven three-component electronic balance with an adjustable range of +/-50° providing lift (x-axis) & drag (y-axis) forces acting on the fitted model, additionally the counter & clockwise moments are provided. (Requires the C15-19)

The three lift & drag balance options are designed for seamless integration with the C15 digital data acquisition and control software.

(*FC denotes the unit be ordered with the wind tunnel for calibration purposes.)

Lift & Drag Experiments and Accessories (Requires C15-13/-16/-17)

C15-20: A NACA 0015 aerofoil, with mounting rod for connection to the lift & drag balances, enabling multiple forces to be measured at different angles of attack. This aerofoil is identical to the C15-21 to allow direct comparison of lift and pressure characteristics.

C15:22: Seven different models are provided for use with the lift and drag balances for investigations into the influence of shape on the drag forces. Five models are supplied with a common equatorial diameter, thus all presenting the same cross section to the airflow, Additionally a dimpled golf ball and plain sphere demonstrate the difference in drag force due to the dimples.



ISO 9001:2015

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Description

The C15-10 is a computer controlled compact wind tunnel designed for benchtop operation. Air is drawn through the working section by a variable speed fan at the discharge end of the tunnel providing up to 34m/s air velocity.

A honeycomb flow straightener is incorporated at the inlet, and a 9:4:1 contraction ratio which ensures a uniform airflow through the working section.

The working section is fabricated from clear acrylic to provide optimum visibility of the models and appropriate model connection points are included in the side wall and roof of the working section to provide ease of use.

The wind tunnel is supplied as standard with an in-depth software interface providing control of the fan speed and additionally display important parameters such as static pressure and air velocity.

The Armfield C15-10 can be optionally supplied with two variants of manometry banks, a 13 tube water manometer used to simultaneously



Requirements

РС

USB

Scale



- ► C15-10-A: 220-240V/1/Phase, 50Hz, 10Amps
- C15-10-G: 220-240V/1/Phase, 60Hz, 10Amps

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

The user must have a PC with a USB port, running Windows 7 above. An additional USB port will be required when using the optional C15-12

Overall dimensions

Length	2.250m		
Width	0.700m		
Height	0.460m		
Packed and crated shipping specifications			
Packed and crated shipping sp	ecifications		
Packed and crated shipping sp Volume	ecifications 1.5m ³		

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.

display differential pressure or a sixteen channel electronic manometer allowing direct integration into the supplied software.

The wind tunnel can be supplied with a range of optional accessories including drag bodies, lift bodies, pressure distribution, boundary layers studies and measuring instruments.

The optional models are mounted through a circular hatch using quick release clamps (120mm diameter). The placement of the optional models has been designed to minimise the disturbance to air flow and reduction in flow rate, whilst incorporating an angular scale allowing the model to be manually rotated to known angles.

The working section incorporates an innovative technique for flow visualisation around any of the optional models avoiding the need for either smoke or dry ice. A lightweight twine follows the flow contour around the model and shows if and where boundary layer separation (breakaway) occurs.

Technical Details

- ► Motor Rating: 0.51 kW 3 phase, 220V∆ (maximum speed 50 Hz through inverter)
- ▶ Working Section: 150mm x 150mm x 455mm
- Air Velocity: variable 0 to 34m/s
- ▶ Profiled Inlet: 9:4:1 (nominal) Contraction ratio
- Flow Visualization: Lightweight twine



Ordering codes

C15-10-A	Computer Controlled Wind Tunnel
C15-10-G	Computer Controlled Wind Tunnel
C15-11	Inclined Manometer Bank
C15-12	Electronic Manometer Bank
C15-13-FC	Lift and Drag Balance (requires C15-20 or C15-22)
C15-14	Pitot Static Tube (requires C15-11 or C15-12)
C15-15	Wake Survey Rake (requires C15-11 or C15-12)
C15-16-FC	3-Component Balance
C15-17-FC	3-Component Driven Balance - Armsoft
C15-18-FC	Driven 360 degree model unit (requires C15-19-FC)
C15-18-01	C15 pressure cylinder for 360 drive unit
C15-19-FC	Wind Tunnel Accessory PSU
C15-20	Lift & Drag Aerofoil (requires C15-13)
C15-21	Pressure Wing (requires C15-11 or C15-12)
C15-22	Drag Models (requires C15-13)
C15-23	Pressure Cylinder (requires C15-11 or C15-12)
C15-24	Bernoulli Apparatus (requires C15-11 or C15-12)
C15-25	Boundary Layer Plate (requires C15-11 or C15-12)
C15-26	Project Kit
C-Smoke - A or B	Probe smoke generator

Armfield standard warranty applies with this product



Aftercare

Installation Commissioning Training Service and maintenance Support: armfieldassist.com