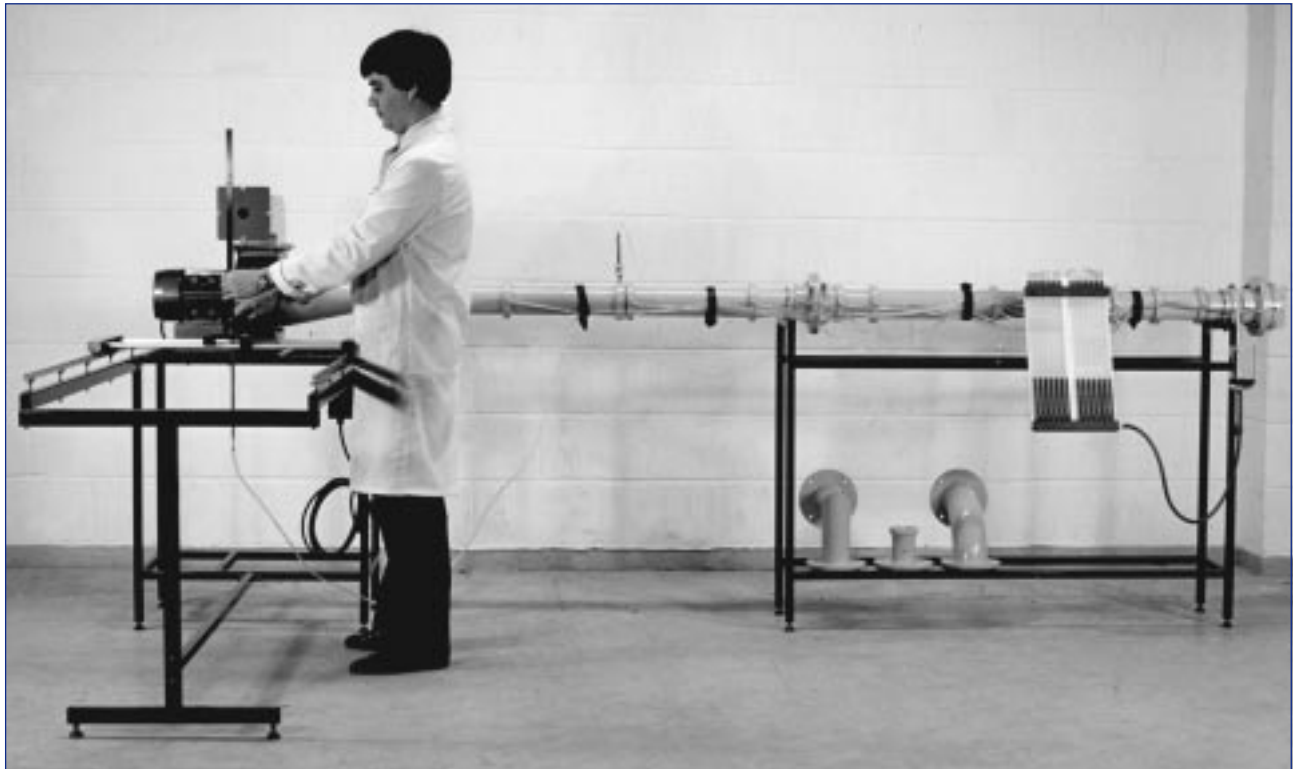




armfield

AIR FLOW STUDIES

F6
issue 8



The Armfield Air Flow Unit has been designed to demonstrate how to measure the important characteristics of industrial air distribution systems, as well as to show how certain basic principles of fluid mechanics are applied to analyse flow in ducts and jets.

DEMONSTRATION CAPABILITIES

- *using the laws of conservation of mass and momentum to describe quantitatively flow in geometries of practical importance*
- *using manometers to measure pressure drop*
- *using a Pitot-static tube to measure flow*
- *employing nozzles and orifices to measure flow*
- *understanding and measuring velocity profiles*
- *relating pressure loss in a duct to flow rate*
- *measuring the flow resistance of duct fittings*
- *understanding the use of Reynolds' numbers*
- *measuring the dispersion of a jet*

Basic Fluid Mechanics

F



DESCRIPTION

The equipment comprises a long smooth walled pipe connected to the suction side of an electrically driven centrifugal fan. The fan discharge pipe terminates in a flow control damper for closed conduit work or a plate containing a small aperture for jet dispersion measurements.

Air enters the smooth walled pipe through one of the two flow measurement nozzles provided. Pressure tapings along the length of the pipe permit the pressure gradient to be determined.

A bend or mitred cascade elbow may be fitted at the inlet to the smooth wall pipe for comparison of pressure losses.

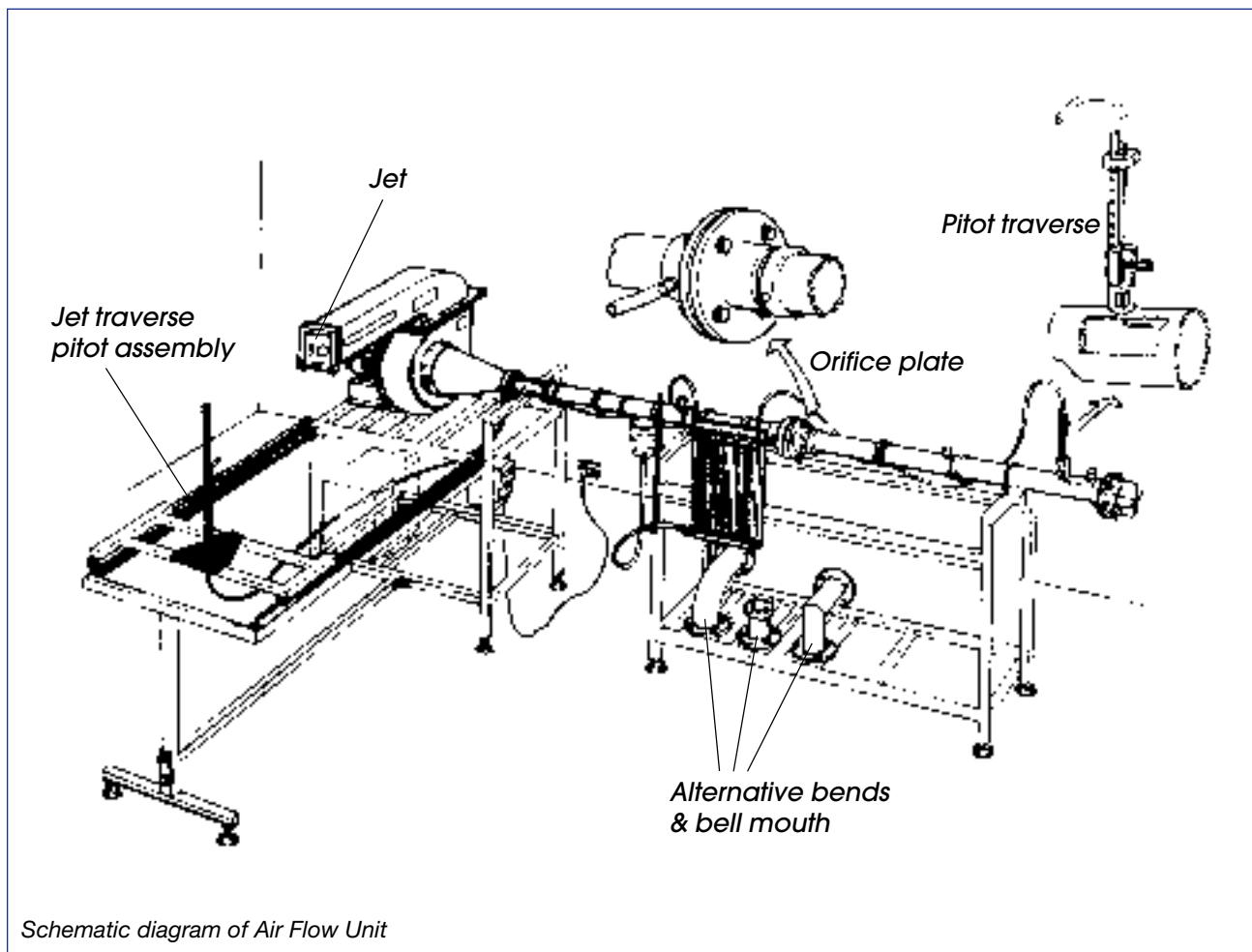
Boundary layer growth is determined by the measurement of the velocity profile at five stations along the pipe using a traversing Pitot tube.

A conventional flow measuring orifice plate is supplied for installing in the pipe upstream of the fan for additional demonstrations of pressure loss and recovery.

Air jet studies are carried out on the discharge side of the fan. A Pitot tube is traversed vertically and horizontally at different distances from the discharge orifice to investigate the dispersion properties.

The equipment is mounted on a floor standing steel frame with an adjacent support for the extended suction pipe.

Pressure measurements are made on a multi-tube inclinable manometer mounted on the support frame.



Schematic diagram of Air Flow Unit

TECHNICAL DETAILS

Centrifugal fan capacity: 218 l/s at STP

Pipe velocity range: 0-35m/s

Inlet pipe: dia. 80mm
length 2.75m

Interchangeable nozzles: dia. 50mm
and 80mm

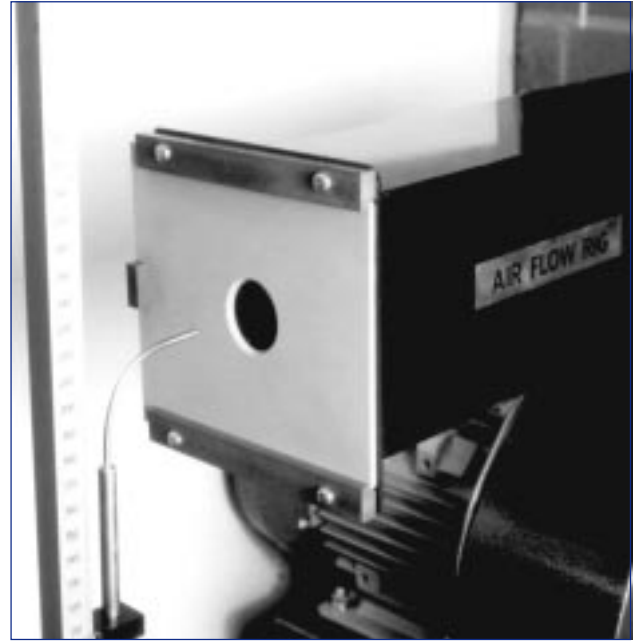
Internal pipe orifice: dia. 50mm

Jet discharge pipe orifice: dia. 30mm

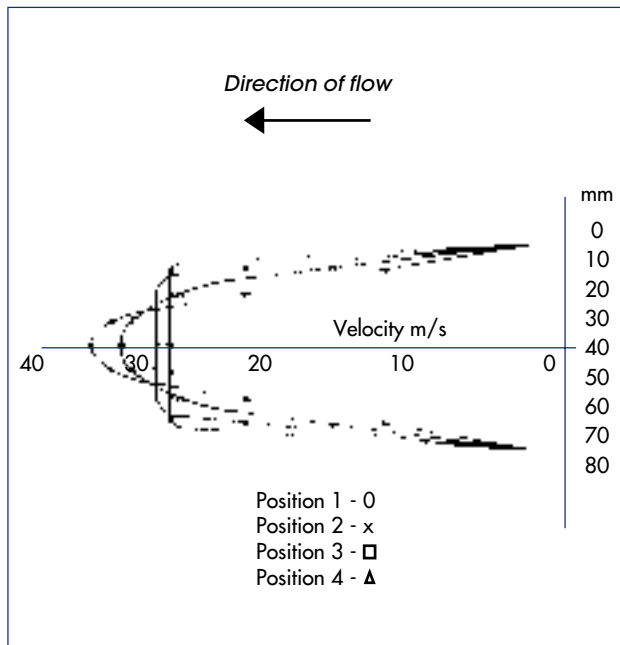
**Jet traverse range
(downstream LxW):** 600mm x 140mm

Manometer range: 0 - 283mm H₂O

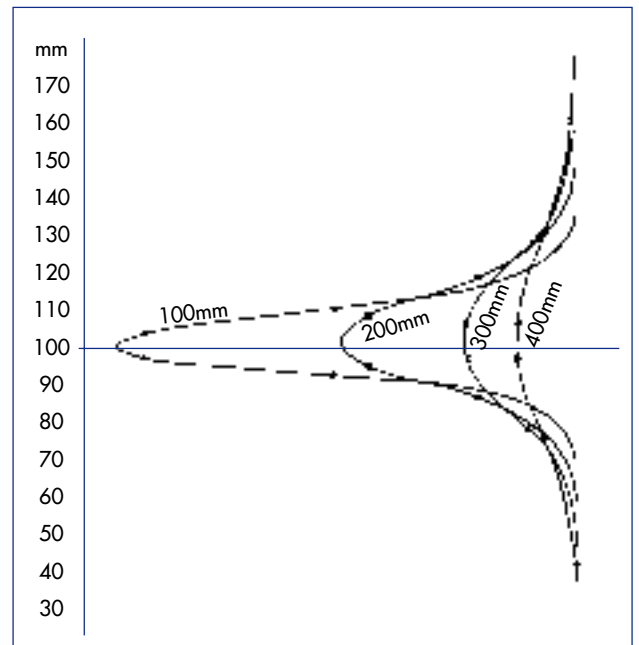
Manometer fluid: Kerosene
(s.g.0.78)



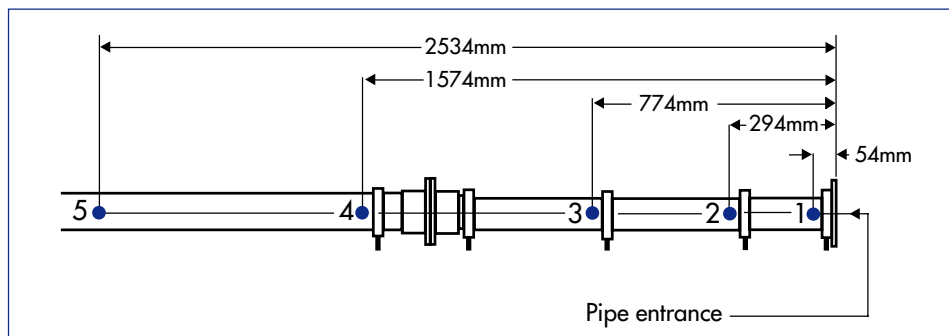
Pitot tube and discharge orifice



Velocity profile in a pipe



Jet dispersion at various distances from orifice plate

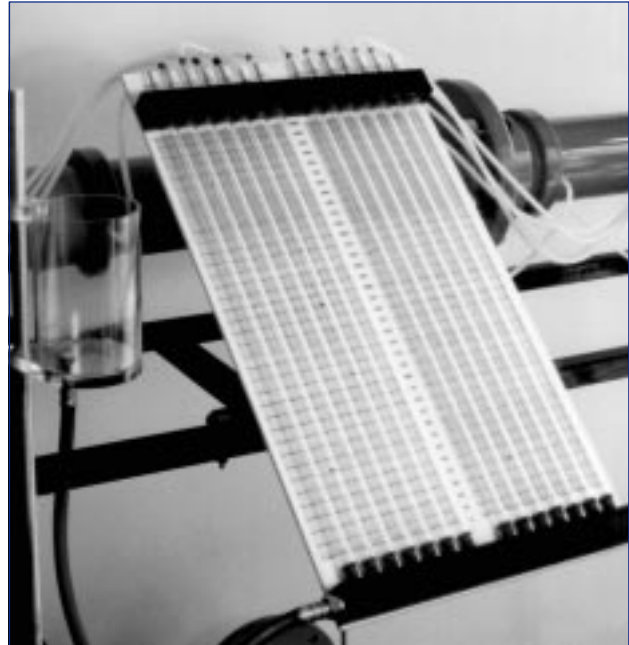


Pitot tube position in pipe

ORDERING SPECIFICATION

- *The unit is self-contained and only requires connection to a single-phase mains electrical supply.*
- *Turbulence in the 80 mm diameter test pipe is minimised by locating the pipe at the inlet of the centrifugal fan.*
- *A profiled bellmouth inlet prevents air-separation from the wall of the pipe at the entrance and straightening vanes suppress the formation of vortices.*
- *Tappings along the test pipe allow the pressure gradient to be measured with air velocity variable up to a maximum of 35 m/s.*
- *A Pitot tube can be traversed across the pipe at five locations to allow boundary layer growth/development of velocity profile to be determined.*
- *Air flowrate is determined from differential pressure measurements across an orifice plate or two different inlet nozzles.*
- *Different bends and elbows can be fitted to allow frictional losses in fittings to be compared.*
- *Air jet dispersion experiments are carried out on the discharge side of the fan.*
- *A Pitot tube can be traversed laterally (across) and longitudinally (along) the jet to measure the changes in velocity as the jet disperses.*
- *All pressure measurements are performed using a bank of fourteen manometer tubes that can be inclined to increase sensitivity.*

- *An instruction manual is supplied that describes how to perform the airflow experiments and interpret the results, as well as how to install, commission and maintain the equipment.*



A 14-tube manometer board for measuring pressure drops

COMPLEMENTARY PRODUCTS

- F1: *Hydraulics Bench and Accessories*
- F1-301: *Computer-aided Learning Programs (PC Windows™)*
- F5: *Osborne Reynolds' Demonstration*
- F9092: *Fluid Properties & Hydrostatics Bench*
- F10: *Cavitation Demonstration*
- F12: *Particle Drag Coefficients*
- F14: *Hydrogen Bubble Flow Visualisation System*

SERVICES REQUIRED

Electrical supply:

- F6-A: *220-240V/1ph/50Hz*
- F6-B: *120V/1ph/60Hz*

OVERALL DIMENSIONS

- Height: 0.7m*
- Width: 3.8m*
- Depth: 1.9m*

SHIPPING SPECIFICATION

- Volume: 2.3m³*
- Gross weight: 220kg*

*Specifications may change without notice
iss8/5k/1203/B&S.*

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