

Turnkey training test beds

Training notes & procedures

Test bed user training

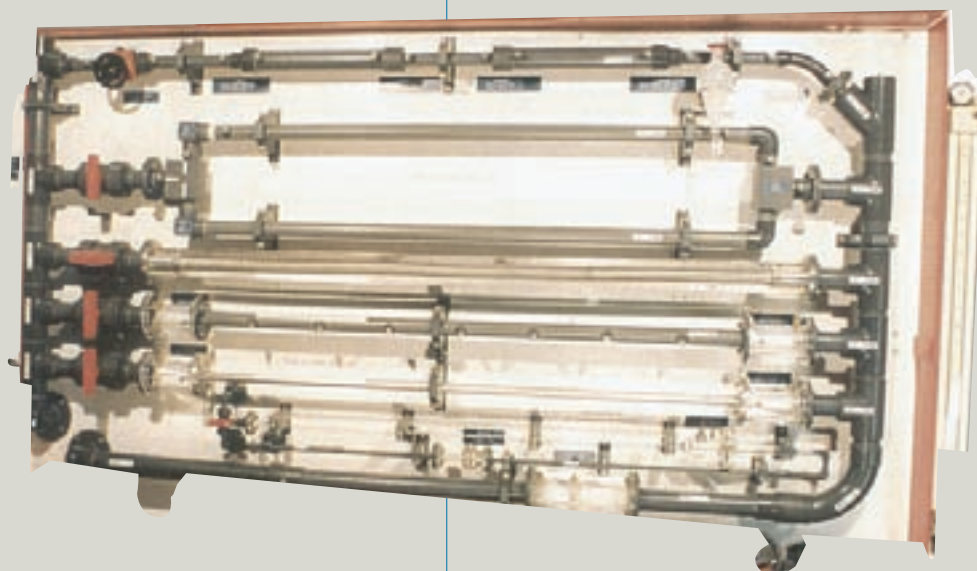
**WIDE RANGE OF TRAINING PROJECTS IN FLUID
MECHANICS (EXCLUDING WIND TUNNELS)**

D2T draws from long experience in aerodynamic test systems to offer a range of training solutions for students of fluid mechanics.

Most of these practical training projects have been developed by Francis

Chometon, lecturer at CNAM and Jacques Laurent, lecturer at CNAM and Professor of Aerodynamics at Saint-Cyr.

The D2T design team is available for the design and development of new training projects on request.



All D2T products are warranted against defects in materials and workmanship for one year from date of delivery to the original purchaser. Specifications are subject to change without notice.

TP-HS1 : SHOCK TUBE

TRAINING AIMS

DYNAMIC CALIBRATION OF SINGLE PRESSURE SENSOR

In this configuration, a range of pressures may be applied to a pressure sensor, with a constant pressure being applied for sufficient time to record the first few oscillations in the response of the sensor.

The student may investigate and measure:

- Sensor damping coefficient and resonant frequency
- Sensor bandwidth, as determined from frequency response

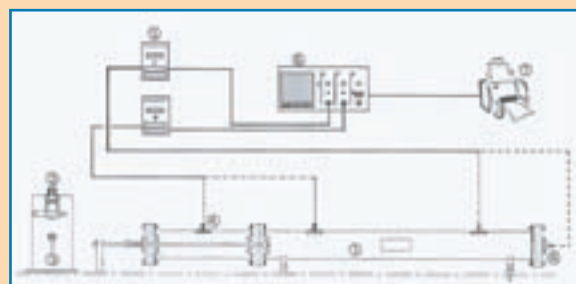
TRANSIENT MEASUREMENTS

In this configuration, the change in pressure over time as a result of a transient surge into the shock tube may be investigated.

The transient phenomena occurring in the shock tube include the propagation of positive and negative shock pulses and their mutual interaction.

D2T EQUIPMENT SUPPLIED

- Shock tube
- Pressure regulator
- Three-way valve
- Sensors (two)
- Amplifiers (2 two)
- Oscilloscope
- Printer



SERVICES REQUIRED

- Single compressed air supply
- Four mains supplies (220 V / 50 Hz).

TP-HS2 – DYNAMIC CHARACTERISTICS OF PRESSURE SENSOR IN PNEUMATIC CIRCUIT

TRAINING AIMS

This experiment consists of a test bed to demonstrate the relationship between a pressure sensor and the pressure being measured.

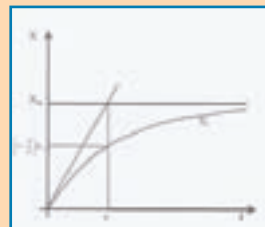
It may also be used to demonstrate Poiseuille's Law relating to laminar flow in pipes.

OPTIONS

- Table manufactured from aluminium profile with wood and beige melamine top.
- Experimental notes and corrections.

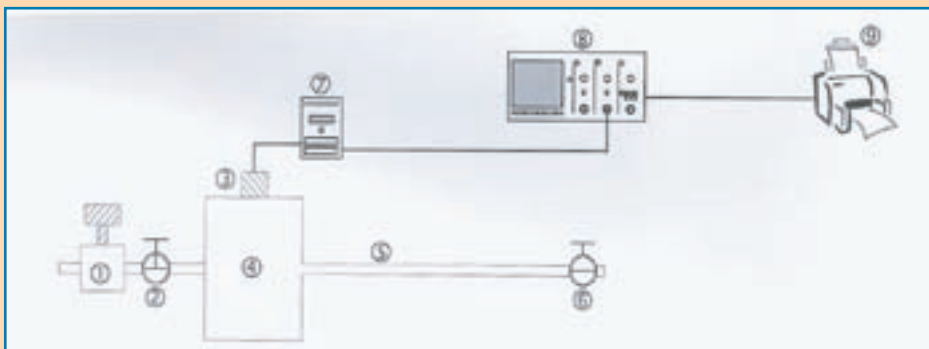
SERVICES REQUIRED

- Single compressed air supply
- Three mains supplies (220 V / 50 Hz).



D2T EQUIPMENT SUPPLIED

- Pressure regulator
- Three-way valve
- Pressure sensor to be investigated
- Air receiver
- Flexible tube
- Pressure release valve
- Amplifier and signal conditioner
- Oscilloscope
- Printer



TP-HS3 – COMPRESSIBLE FLOW IN CONVERGING TUBE

TRAINING AIMS

This experiment consists of a test bed to demonstrate compressible flows, the static pressure profile, $p(x)$, along the axis of a converging cylindrical tube fed with a variable pressure, p_i , while the external pressure remains constant.

OPTIONS

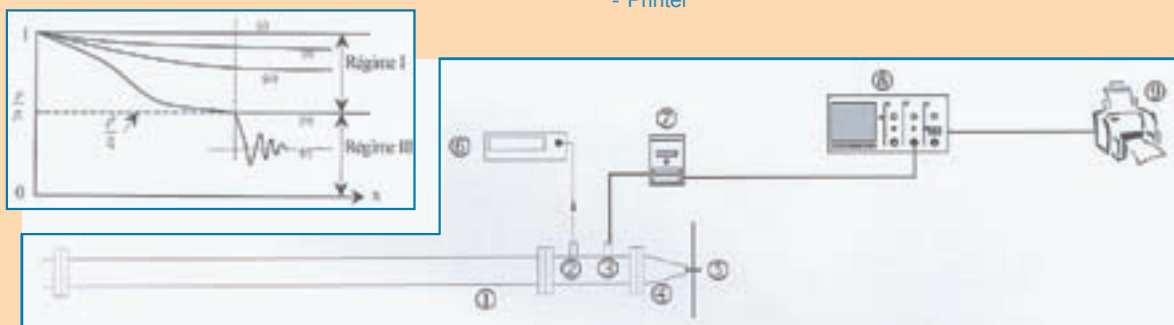
- Table manufactured from aluminium profile with beige wood and melamine top and shelf.
- Experimental notes and corrections.

SERVICES REQUIRED

- Single compressed air supply
- Five mains supplies (220 V / 50 Hz).

D2T EQUIPMENT SUPPLIED

- Air receiver
- Heater element
- Absolute pressure sensors
- Converging tube
- Telescopic probe and motorized probe carrier
- Display
- Amplifier and signal conditioner
- Oscilloscope
- Printer



TP-HS4 – STATIC CALIBRATION OF MUTUAL-INDUCTANCE

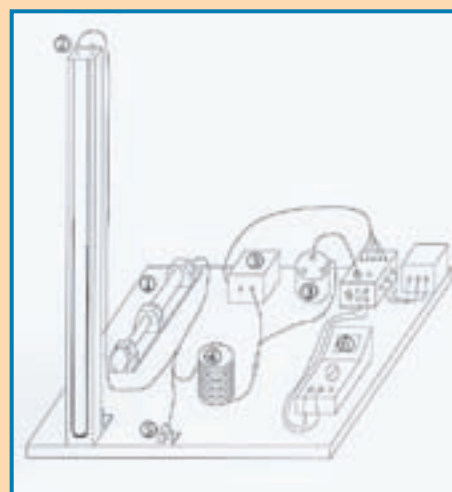
TRAINING AIMS

This experiment consists of a test bed to measure the calibration curves for two different types of pressure sensors. These curves may be used to determine the following sensor characteristics:

- Sensitivity
- Linearity
- Hysteresis error
- Mobility error

D2T EQUIPMENT SUPPLIED

- Pressure generator with a moveable piston to set the pressure in the range ± 0.1 bar.
- U-tube manometer with a CE millimetre scale and a range of ± 0.1 bar.
- Two pressure sensors with a range of ± 50 mb, one a mutual inductance type, the other a potentiometric cell.
- Air receiver consisting of a tube, 4 mm in diameter and 3.70 metres long.
- System to purge the pneumatic circuit.
- High-sensitivity multimeter.



OPTIONS

- Table manufactured from aluminium profile with a beige wood and melamine top.
- Experimental notes and corrections.

SERVICES REQUIRED

- Three mains supplies (220 V / 50 Hz).

All D2T products are warranted against defects in materials and workmanship for one year from date of delivery to the original purchaser. Specifications are subject to change without notice.

TP-H55 – BOUNDARY LAYER ADJACENT TO ROTATING DISC

TRAINING AIMS

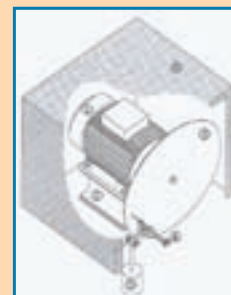
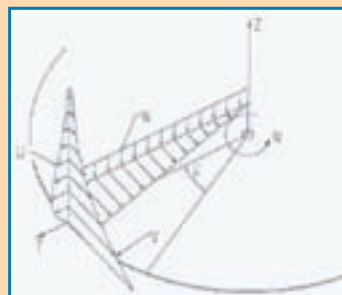
This experiment consists of a test bed to investigate the boundary layer developed adjacent to a thin rotating disc. The following experiments can be performed:

- Investigation of the velocity profiles in the boundary layer using a hot wire anemometer (1), both in the laminar and smooth turbulence regions. Calculation of the associated moment coefficients.
- Determination of the relative roughness of rotating discs (2) in the rough turbulence region.

It can also be used to demonstrate Poiseuille's Law relating to laminar flow in pipes.

D2T EQUIPMENT SUPPLIED

- 380 V three-phase motor (IP55).
- Not shown: Control unit incorporating speed controller, RPM indicator, safety systems and relays.
- Motor frame.
- Rotating discs
- One smooth



OPTIONS

- Experimental notes and corrections.
- (1) Hot wire anemometer system.
- (2) Two rough surface discs (one fine and one coarse).

SERVICES REQUIRED

- Single three mains supply (380 V).
- Wall mounting position adjacent to the motor for the control cabinet.

TP-H56 – PLANE JET

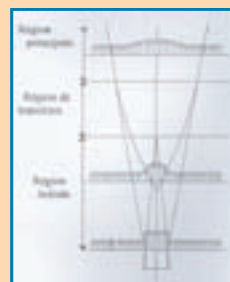
TRAINING AIMS

This experiment consists of a test bed to perform the following investigations:

- Investigation of the complete structure of a free turbulent plane jet in order to demonstrate the initial, transition and steady state regions.
- Demonstration of the consistent nature of the velocity profiles in the initial and steady state regions.
- Measurement of turbulence using a hot wire anemometer (1). This may also be used to demonstrate the mixing length and to determine the constants needed to solve the jet equations in the initial region using Tollmien's method.

D2T EQUIPMENT SUPPLIED

- Converging tube.
- Not shown: Centrifugal blower and frame, control unit incorporating speed controller, RPM indicator, safety systems and relays.
- Lateral wooden panel (2 off) with cut-outs and inserts for mounting a clinometer at various positions along the X axis.
- Clinometer (3-hole probe) and mounting with position readout along the Z axis.
- Stepper motor driven moveable hot wire probe support with translation and rotation readout.



OPTIONS

- Experimental notes and corrections.
- (1) Hot wire anemometer system.

SERVICES REQUIRED

- Single three mains supply (380 V).
- Wall mounting position adjacent to the motor for the control cabinet.

TP-HS7 - PRESSURE LOSS IN PIPES

TRAINING AIMS

- Investigation of the pressure loss during laminar flow through pipes of small cross-sectional area (low flow rate networks).
- Investigation of the pressure loss through high flow rate networks using five distinct types of pipe of varying cross-sectional area and surface roughness. Configurations also include parallel connections, valves, elbows, venturi and sudden increases in pipe diameter.
- Investigation into the two types of flow (laminar and turbulent) by injecting a coloured solution into the moving fluid.

DESCRIPTION

- Free standing system with a storage tank for 250 litres of demineralised water.
- System is built on a metal framework and can be moved on castors.
- Behind the front panel, the chassis supports the 250 litre water tank, motor and pump, electrical control cabinet, two calibrated vessels used to measure the flow rate, two pressure switches to protect the manometers and pipework for distributing, recycling, and emptying the fluid.

- Length:	3.93 m
- Width:	0.761 m
- Height:	2.060 m
- Weight when empty:	825 kg
- Weight when filled:	1060 kg
- Flowrate:	14 m ³ /h
- Manometer height:	14 HMT
- Power:	1.5 kW at 3000 RPM

D2T EQUIPMENT SUPPLIED

- All pipework and fitting for investigating pressure loss.
- Regulators, selector, regulator and by-pass valves.
- Measurement and control equipment including graduated volumetric columns, diaphragm chronometer, venturi tube, manometers and pressure sensors.
- Fluid supply system, including 250 litre demineralised water tank, stop-cock, sealing rings, nylon end-pieces and PVC connection pipes.
- Motor and stainless steel centrifugal monoblock pump, ABS type NP 62-117.
- All accessories, including flexible transparent PVC tubing with self-sealing connectors, two Prolabo storage tanks with a capacity of 500 ml for visualization and rinsing liquids.

OPTIONAL EQUIPMENT

- D2T is able to design and supply additional equipment on request..

SERVICES REQUIRED

- Single three mains supply (380 V).
- Waste water connection.

