

A wind tunnel is a duct through which air is either blown or pulled out to simulate air flow over objects. The model of the object to be tested, called the prototype, is placed in the test section of the wind tunnel and the pressures, forces and moments experienced by the model at various wind speeds and in different orientation with reference to the wind are measured using special transducers. The results of wind tunnel measurements can be utilized to generate the design data for the prototype.

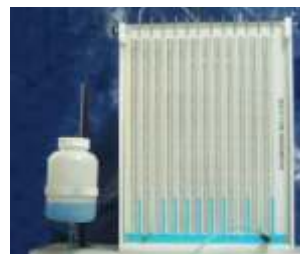
Wind tunnels are useful research and educational tools for students to study problems related to several areas including fluid mechanics and aerodynamics. Low speed wind tunnels are employed for teaching and research in aeronautical, mechanical, automobile, civil, architectural, environmental and marine engineering departments of educational institutions.

Low Speed Wind Tunnel with a test section of 0.4m square 32447 is a suction type open circuit wind tunnel designed to test models and to conduct teaching and basic research experiments related to fluid mechanics and aerodynamics. All tunnel components are supported on metal frames and include lockable castors for mobility. The wind tunnel components are constructed as per existing standard

practices of wind tunnel construction and are made of wood and mild steel (suitably surface treated to avoid corrosion) construction. The inside surface will be smooth to ensure clean flow in the tunnel. The combination of bell mouth entry, settling chamber with honey comb and screens and nozzle contraction provide tunnel mean flow uniformity and turbulence values required for any basic and applied aerodynamic research. The square test section is removable and is designed for easy installation and changing of models, accessories and instrumentation. Transparent Plexiglas windows are provided to facilitate optical measurement techniques and flow visualization. Diffuser transition is designed to decelerate the flow without flow separation from the walls. The drive system consists of a six-bladed fan and a variable speed motor and controller. Wind tunnel test speeds up to about 40m/s can be obtained. Vibration during tunnel operation is minimized by suitable mounting of the fan drive system. The model support system is provided to position models in the test section and conduct tests at various angles of incidence. A three component floor mounted balance is provided to make force measurements. Model having standard geometrical details such as symmetric aerofoil section with surface pressure tapings is provided. Models will be selected based on the wind tunnel blockage considerations. Tunnel operation, control, data acquisition and processing of data are through a computer based system.



COMPUTER BASE SYSTEM



MANOMETER



Basic experiments:

1. Measurement of static and total pressures in wind tunnel.
2. Application of Pitot probe for mean velocity measurement in wind tunnel.
3. Wind tunnel flow velocity and fan speed measurement and calibration.

Note: Specifications are subject to change.

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4. Surface pressure measurements on a symmetric aerofoil.
5. Study of static pressure distributions on airfoil at different incidences.
6. Lift, drag and pitching moment measurements on aerofoil model.
7. Balance measurements on airfoil at different incidences.
8. Aerofoil wake survey.
9. Smoke flow visualization.
10. Pressure and force measurements on different models.



SMOKE METER

PC Software Capability

1. Display the graphs of pressure distribution on symmetric airfoil model.
2. Display the lift and drag force and pitching moment vs. angle of attack characteristics of the symmetrical aerofoil model.
3. Display the coefficient of drag, lift and pitching moment for aerofoil model.
4. Display the boundary layer graphs.
5. Display of wake survey graphs.
6. Display the air speed vs. fan speed graphs.



Important features and specifications:

- Suction type, open circuit, horizontal wind tunnel.
- Test velocity range: 0.5 to 40 m/s (continuous).
- Total head variation: within +/- 0.5%.
- Mean flow uniformity: within +/- 0.3%.
- Boundary layer thickness: within 25 mm in the test section wall at 40m/s.
- Test section, 0.4m x 0.4m x 1.4m long, steel frame and fine quality wood construction with Plexiglas top and side windows, detachable.
- Bell mouth entry, 1.6m X 1.6m, wood.
- Setting chamber, 1.4m X 1.4m, wood.
- Honey comb (200mm deep and 15mm mesh).
- Screens, 3 Nos. stainless steel / Aluminum.
- Contraction, contraction ratio 12:1.
- Diffuser transition (wood) and safety screen (to protect fan).
- Axial flow fan, FRP, 6-bladed, 0.9m dia. with housing.
- DC motor fan drive with RPM controller equipped with a potentiometer for manual operation, Approximately 20 kW, 1800 RPM, digital speed indicator and control unit. (DC motor with Thyristor controller can be supplied as option)
- 2-D Probe traverse, fitted with motorized vertical and horizontal traversing systems with a digital position indicator for probes.
- Floor mounted model support and incidence mechanism – turn table, steel / Aluminum
- Control panel with digital display of fan drive and tunnel test parameters.
- PC based tunnel speed control and data acquisition system (32 channels).
- Software for pressure data and balance data reduction.
- Balance calibration software.
- Symmetric aerofoil model with surface pressure taps (No. of taps: 14), Aluminum.
- Circular cylinder model with pressure taps, Aluminum.
- Half wing model with pressure taps, Aluminum.
- Bridge model with pressure taps, Aluminum.
- Automobile model with pressure taps, Aluminum.
- Building model with pressure taps, Aluminum.
- Force measurement model of symmetric airfoil



Accessories Probes and Instrumentation:

- Static pressure taps on test section top wall (at 100mm intervals).
- Pitot probe (2Nos.) with mountings, stainless steel / brass.
- Pitot-static probe (2Nos.) with mountings, stainless steel / Aluminum / brass.
- Multi-tube water manometer, 10 tubes, 500mm long, consisting of glass pipes, PVC tubes, Perspex reservoir and steel frame.
- Low pressure electronic differential pressure transducer and 32 channel scanning device.
- Wake rake for wake survey, 12 probes, stainless steel / brass.

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- Boundary layer probe, stainless steel tubes / brass.
- Noise detector.
- Smoke generator and rake set.
- Three Component Balance, Data Acquisition System and Instrumentations, external floor mounted strain gage type, with signal conditioning unit, computer based data acquisition, instrumentation system and digital display. Range: Drag: +/-70N, Lift: +/- 1500N and pitching moment: +/- 70 Nm. (Balance of any other ranges can be supplied on request). Full scale output (before amplification): about 2 mV/V excitation
- Motorized system with stepper motor control for changing model incidence.
- Balance calibration system.
- Connectors and tubing.



PRESSURE SCANNER



3 COMPONENT
BALANCE



STRAIN GAUGE
AMPLIFIER

WIND TUNNEL CONTROL PANEL

All MCB 240Vac control circuit must turn **ON**

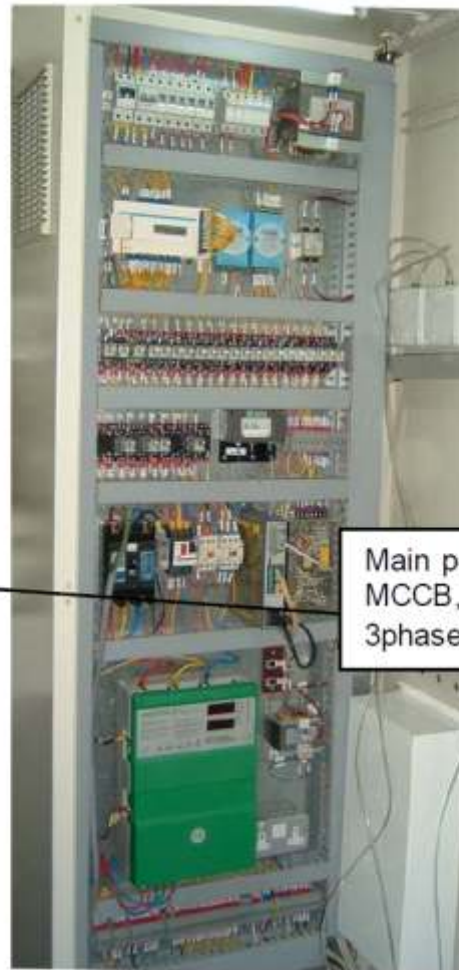
All fuse must connected for 24Vdc supply to PLC, sensor & controller

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Fan drive cooling blower starter must turn **ON**, before running the fan

Main power supply MCCB, 415Vac 3phase must turn **ON**



A

B

C

- A. Depress the power switch (1) to turn on the control system power, depress (0) to shutdown the system power.
- B. Depress the fan switch (1) to enable the fan running, but the fan speed needs to be set through PC depress (0) to inhibit the fan running.
- C. Depress the emergency stop button would be totally cut off the power supply. Regardless the power switch is turn ON at console bench. If the emergency stop is active, it needs to be release, by turning red knob clockwise.

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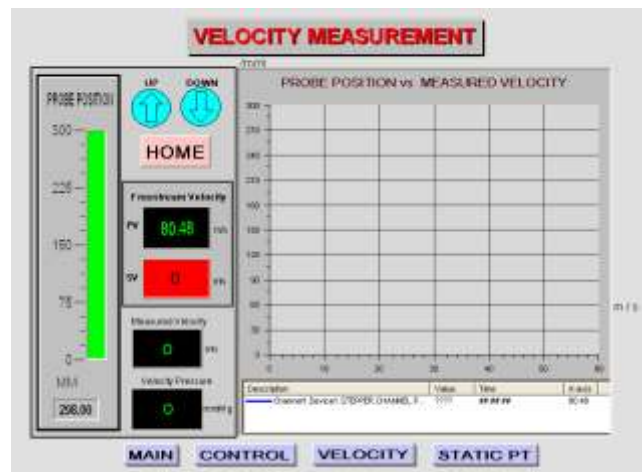
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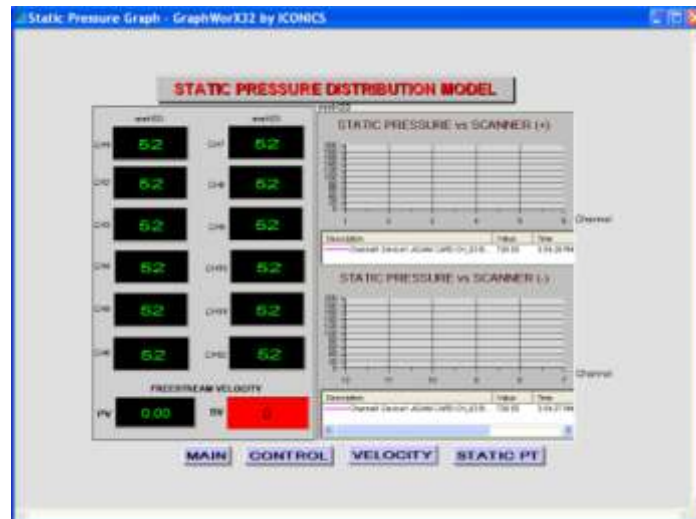
PC Based Tunnel Speed Control and Data Acquisition System



CONTROL SYSTEM



VELOCITY MEASUREMENT



STATIC PRESSURE DISTRIBUTION MODEL

Overall dimensions: Length: 8m, Width: 2.5m, Height: 2.5m.

Required services: Electric supply, 415V, 3 Ph. 50Hz.

The manual describing the details of the wind tunnel, operation, maintenance, test data sample, test sheets, tables and other related materials for teaching will be supplied with the equipment.

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