cussons
TECHNOLOGY

P3130—P3137
WIND TURBINE ABSORBING DYNAMOMETERS AND WIND GENERATOR

Experimental Capability

- Measure Power Coefficient & Tip Speed Ratio Variation with wind-speed
- Compare power coefficients to theoretical limits (Betz limit)
- Produce power curves for stall- & pitch-regulated turbines
- Measure overturning moment on support tower & determine thrust coefficient
- Relate Power, Thrust & Torque coefficients
- Investigate effects of blade angle on attack on Tip Speed Ratio and Power Coefficient
- Compare performance of different blade profiles
- Mechanical forces on blades due to gravity

Features

- Fixed or variable speed operation
- Air speed, motor speed, volts, amps, & bending moment parameters can be data logged & displayed on a PC.
- Optional bending moments measurement on 2 blades (P3132/P3133)
- Slipring or non contacting telemetry versions available for reduced friction
- Customer can use his own Wind Tunnel

Introduction

Wind energy is one of the fastest growing and cost effective means of generating electricity. Cussons Technology Ltd provides a range of wind generator products to permit realistic experiments on various wind turbine blades either supplied with the unit or designed and developed by students themselves

Wind Turbine Dynamometers

Cussons have developed 3 types of Wind Turbine Dynamometers designed to extract and measure the energy produced by the wind. These comprise a basic unit with measurement of motor Volts & Amps & strain gauged strut for overturning moment (P3131)
Two more advanced versions are available with blade bending moments measured by strain gauges via either slip rings (P3132) or non contacting radio telemetry (P3133)
The units are designed for use with the Cussons P3130 Wind Generator Set , OR in a suitably sized customer wind tunnel OR in open air.
NB It is recognised that due to the small size Reynolds number scaling is not practical .

Description

The turbine dynamometer is mounted on a vertical pedestal supported from the wind generator frame. The pedestal has +/- 20 degrees yaw adjustment in relation to the airflow axis from the fan. A DC motor is used which will produce sufficient power at low rotational speeds. (This eliminates the requirement for a gearbox thus reducing friction). The DC motor is directly connected to the turbine shaft to generate electrical current which is fed into a 4 quadrant DC drive.

A potentiometer on the control panel is used to adjust the load which is then dissipated back to the supply. The voltage, current and turbine speed are measured and the data is logged.

The base of the wind turbine tower is mounted in bearings & has a strain gauged load cell attached.

This allows the overturning moment due to thrust on the rotor & nacelle to be measured and logged. Optional strain gauged blade root elements allow demonstration of the Bending moments developed on a wind turbine blade. With one strain gauged element parallel to the air flow & the other perpendicular to it, the effect of lift & drag forces on turbine blades can be investigated. In addition the element perpendicular to the airflow shows the effects of gravity acting on the blades as they rotate.

P3130: Wind Generator

The P3130 wind Generator is designed to test small size wind power type turbines of up to 450 mm blade diameter. The equipment is sized to allow its use inside a laboratory that does not have access to a wind tunnel.

The equipment includes a speed controlled wind generator fan giving a maximum discharge flow of 10m/s in a 500mm diameter duct. This wind speed is considered to be representative of wind speed ratings for this size of turbine.

The discharge flow is passed through a honeycomb type flow straightening element. This reduces the swirl induced in the air onto the test turbine face

The wind speed is accurately controlled by varying the fan speed using an inverter drive module. The airflow speed is measured using a pitot static tube & a low range differential pressure transducer.

Extent of supply:

The equipment comprises a wind fan generator and an instrumentation box complete with flat screen monitor and PC for datalogging display

Wind Turbine Options

P3131: Wind Turbine Dynamometer –Basic. (Instrumented strut , Motor V , I and supplied with 2/4 and 3 blade simple hubs and blades).

This unit measures the Volts and Amps generated by the motor and has a strain gauge load cell incorporated into the strut to measure the overturning moment.

P3132: Wind Turbine Dynamometer -Slip rings. (Instrumented Strut , Motor V, I , Blade Instrumentation for 2 Blades via Slip Rings for Blade Bending Moments).

In addition, this unit has two instrumented blades to measure the root blade bending moments .

P3133: Wind Turbine Dynamometer—Telemetry (Instrumented Strut , Motor V, I , Blade Instrumentation for 2 Blades via Non contacting Radio-Telemetry for Blade Bending Moments).

As P3132 but the signals are transmitted by a non contacting telemetry system thus eliminating any friction caused by the brushes.

Hub and Blades options

P3134: 2 or 4 Blade Instrumented Hub.

Includes 2 strain gauged blade root elements to measure blade bending moments in two planes. One set of flat blades & one set of foil blades are included. Combination gauge supplied to measure variation in pitch

P3136: 3 Blade Instrumented Hub

Includes 2 strain gauged blade root elements to measure blade bending moments in two planes. One set of flat blades & one set of foil blades are included. Combination gauge supplied to measure variation in pitch

Wind Generators

P3130: Wind Generator Set

Comprising a wind fan generator, mobile base plate and control module c/w computer monitor & PC.

P3135: Control module.

Where customer has a Wind Tunnel and doesn't require the P3130 Wind Generator.

Shipping Details

Gross Weight: 400 kgs

Dimensions: 209 x 87 x 153 cms

Cussons Technology Ltd.

102 Great Clowes Street, Manchester M7 1RH, England

Tel. +(44)161 833 0036 Fax. +(44)161 834 4688

E-mail: sales@cussons.co.uk Web: www.cussons.co.uk