cussons
TECHNOLOGY

P3120 mounted within P3105 wind channel and P3106 wind fan and bench

P3120 Vertical Axis Wind Generator Module

INTRODUCTION

The P3120 Vertical Axis Wind Turbine (VAWT) is able to measure torque generated from a 400mm diameter, 400mm height vertical axis wind turbine. The turbine rotor is laid out as a Giromill with the straight driving blades acting as a part of the axle, so that there is no central shaft to disturb the flow. The bearings above and below the rotor are held in location by the P3105 wind channel or P3125/P3107 external mounting kit. The unit is provided with a control box that displays current, voltage, and wind generator speed. The P3120 reads torque by the use of weights whilst P3120e uses a load cell. Speed is measured with a tacho generator.

EXPERIMENTAL CAPABILITY

The module is designed to allow a variety of wind turbine blades to be mounted between the hubs and placed in the wind flow. A variable field motor allows some control over the speed of the generator whilst current and voltage outputs are displayed.

The following experiments can be conducted

- Determination of the energy available from an air stream,
- The effect of relative wind velocities and blade angles
- The use of aerofoil lift and drag
- The effect of stall on wind generator performance
- The use of lift to generate torque

The experiments are intended to provide a realistic understanding of the way that a vertical axis wind turbine works and this is fully covered in the theory. It is possible to run the unit either as Savonius Turbine or as a Darrieus Turbine (with a Tip Speed Ratio greater than 1). However the relatively low Reynolds numbers that can be achieved means that the even when acting as a Darrieus Rotor torque is created more from the drag effect of the wind than from the lift generated by the aerofoils. This does not inhibit students from learning about the principles of lift in a changing angle of attack.

The rotor is designed to operate in wind speeds of 5 to 15 m/s and at rotational speeds of 100 to 1500 r.p.m.

DESCRIPTION

The P3120 Vertical Wind Generator Module comprises of two stub shafts and bearing assemblies designed to be mounted within Cussons P3105 Wind Channel or in free air on P3125/P3107 kits. The shafts are provided with hubs to which two or four rigid vertical axis blades can be attached. Normally straight blades (Giromill blades) are fitted although there is room for curved blades to be attached.

One shaft drives a DC variable field motor configured to act as a electrical power generator. The output of the motor is taken to a control box with a variable rheostat, to provide a load bank. Variation of the field voltage provides a degree of ability to control the speed of the wind generator. The speed of rotation, whilst proportional to the field voltage, is also measured directly by a small tacho-generator.

Torque can be measured either mechanically (P3120) or by load cells (P3120e). Mechanical readings of torque are taken by adding weights (outside the wind channel) to a torque arm taken from the motor stator, whilst the load cell is applied in a similar manner.

TENDER SPECIFICATION

The P3120 Vertical Axis Wind Generator Module is to provide the means to measure torque generated from a 400mm diameter wind turbine. The module is to comprise of two stub shafts and hubs for the mounting of suitable blades. The shafts are to be supplied with bearings and housings suitable for mounting on Cussons P3105 Wind Channel or P3125 External Mounting Kit. One shaft is to drive a small variable speed motor configured to act as a power generator. The unit is to be provided with a control box that displays current, voltage and wind generator speed. The P3120 is to read torque by weights, whilst the P3120e is to use a load cell. Speed is to be measured with a tacho generator.

P3120 rotor with P3122 Aerofoil blades within P3105 wind Channel and P3106 Wind Fan and Bench

DATA ACQUISITION

Product P3120e provides a range of signals suitable for acceptance by most data acquisition systems. Cussons recommends the use of its P7141 Data Acquisition Module for use with the P3120e system. P7141 provides a plug in data acquisition module connected to a PC, supplied as a current production specification at the time of order.

PACKING DIMS / POWER REQUIRED

Length 0.6m Width 0.6m Depth 0.3m

Single Phase Power Supply; please specify at time of order

REQUIRED ACCESSORIES

Mounting. The user must acquire either P3106 Wind Channel or P3125 External Mounting or provide their own mounting

Blades. The user should acquire either one or more of Cussons blade sets P3122, P3123, P4124 or provide their own blades.

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