

## EXPERIMENTAL CAPABILITY

A set of blades are essential to carry out any of the tests listed in the literature sheet P3100 Horizontal Axis Wind Generator Module.

A selection of blades allows

- ◆ Direct comparison of twisted blades P3103 with straight blades P3104
- ◆ Direct comparison of aerofoil blades P3102 with momentum blades P3103 (note at this small scale the effect of lift is low compared to a full scale wind turbine)
- ◆ Performance of two, three and four blades operating at different tip speed ratios

## INTRODUCTION

Modern commercial wind generators are designed with aerofoil cross-sections, so that the lift generated by the aerofoil creates torque to drive the generator. In a commercial wind generator the large chord length and relatively high tip velocity of blades creates an airflow with Reynolds Numbers above a million. The limitations imposed by a laboratory wind generator mean that Reynolds numbers of 50,000 are more typical. (The advantages of the laboratory generator are that a constant wind velocity can be set and maintained).

Traditional wind generators used shorter blades, and a low rotational speed, and used the power from the change in momentum of the wind as its motive force. Some mills and generators used straight blades but others use twisted blades, recognising that the angle of attack will vary over the length of the blade depending on the tangential velocity of the blade (varying with the radius from the wind generator axis) relative to the wind velocity. Twisted blades are more expensive to manufacture but generally more efficient.

## Blades for P3100

### P3102 Aerofoil Blades

### P3103 Twisted Momentum

### P3104 Straight Momentum

## P3102 AEROFOIL BLADE DESCRIPTION

The P3102 aerofoil blade set includes four blades designed for use with the Cussons P3100 Horizontal Axis Wind Generator. The blades are machined to the A18 smoothed profile and are 240mm long. The A18 smoothed profile is a high lift low Reynolds number aerofoil suitable for operation in the range of Reynolds numbers 50,000 to 200,000. The blades are twisted approximately 40° twisted over their length.

The blades are therefore optimised for operation at approximately 800 r.p.m. and a wind velocity of 8 m/s although they will operate effectively from 100 to 1500 r.p.m. and a wind velocity of 5m/s up to 15m/s representing a range of root to tip Reynolds numbers from 20,000 to 190,000. However even though the aerofoil is generating lift effectively over its length, the ratio of torque generated by lift, to that generated by momentum change is low.



### **P3102 Aerofoil Blade Technical Specification**

A set of four twisted aerofoil wind generator blades machined to the A18 smoothed profile. The blades are to have a length of 240 mm and are to be twisted approximately 40° over their length. Each blade is to have a root fixture designed to fit in the hub of Cussons P3100 Horizontal Axis Wind Generator and allow the angle of attack to be adjusted and set for each test.

### **P3103 TWISTED MOMENTUM BLADE DESCRIPTION**

The P3103 Twisted Momentum Blade set includes four blades designed for use with the Cussons P3100 Horizontal Axis Wind



Generator. The blades are a flat faced, parallel sided, and are 240mm long. The blades are twisted approximately 40° twisted over their length.

The blades are therefore optimised for operation at approximately 800 r.p.m. and a wind velocity of 8 m/s although they will operate effectively from 100 to 1500 r.p.m. and a wind velocity of 5m/s up to 15m/s.

### **P3103 Twisted Momentum Blade Technical Specification**

A set of four twisted momentum wind generator blades made as parallel-faced blades. The blades are to have a length of xx mm and are to be twisted approximately 40° over their length.

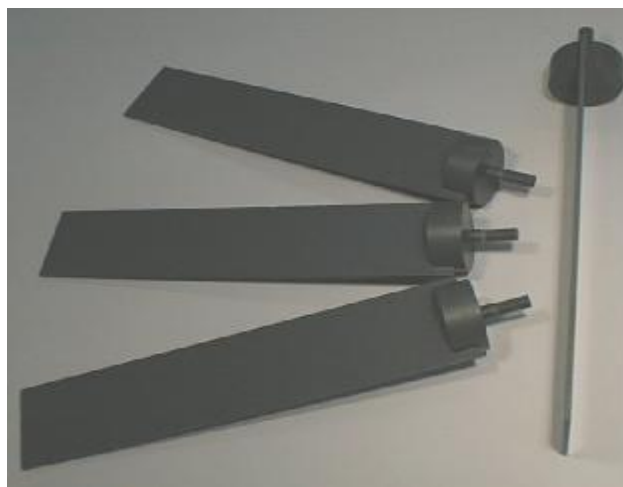
Each blade is to have a root fixture designed to fit in the hub of Cussons P3100 Horizontal Axis Wind Generator and allow the angle of attack to be adjusted and set for each test.

### **P3104 STRAIGHT MOMENTUM BLADE DESCRIPTION**

The P3104 Straight Momentum Blade set includes four blades designed for use with the Cussons P3100 Horizontal Axis Wind Generator. The blades are a flat faced, parallel sided, and are 240mm long.

### **P3104 Straight Momentum Blade Technical Specification**

A set of four straight momentum wind generator blades made as parallel faced blades. The blades



are to have a length of 240 mm. Each blade is to have a root fixture designed to fit in the hub of Cussons P3100 Horizontal Axis Wind Generator and allow the angle of attack to be adjusted and set for each test.

### **DIMENSIONS**

All blade packages are shipped in a case  
Length 0.7m width 0.2m depth 0.15m

### **REQUIRED ACCESSORIES**

All blade sets are designed for use with Cussons P3100 Horizontal Axis Wind Generator Module, (which in turn should be mounted in either P3106 Wind Channel, P3125 External Mounting) or on the users own wind generator.

**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

The Company may alter detail specifications at its discretion and without notice, in line with its policy of continuous development.