

CASE STUDY - Wind Turbine Rotor Blade Machining

- **Requirement:** A leading European manufacturer of wind turbines required the face of the composite rotor to be machined at 2.4m diameter. The rotor blade had composite structure with both steel and GRP. The flatness tolerance was to be within 0.20mm at 2.4m and machining time within 1 hour. Since its introduction we have now developed machines for 45m, 50m and recently 61m blades.
- **Locations:** UK, Denmark, India, USA, Germany, Portugal
- **Equipment:** Mirage WP2500, WP3500 with adapted base to mount on the 3 off moulded installation bolt holes within the blade GRP structure. A specifically developed power pack and trolley were also supplied to assist in providing the shortest floor – floor machining time possible. More recently a new fast mount hydraulic clamping system to further reduce setting time.

The machine is mounted using the special base to the 3 mounting points or through our patented hydraulic chuck allowing both the structure and machine to remain in it's "free state" to get the best accuracy from the structure and machine possible. The high spots on the flange are then recorded and depth of cut set with the digital scale. The machine is fitted with a 125mm face mill and machining commences at 400 mm/min giving a rotation time of 20 mins. Floor to floor machining times of 30 minutes now possible and they have been used in the production of over 10,000 blades.



Left: the WP2500 system machining a 43m blade end in the UK.

Below: the surface finish achieved.



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- **Requirement:** A leading Australian wind tower manufacturer required the end flange of the tower to be machined within 1 hour and within a flatness tolerance of 0.15mm at 2.7m diameter. The fabrication required the WP4300 to clamp into the tower and machine the flange.
- **Locations:** Australia, USA, Sweden
- **Equipment:** Mirage WP4300 with strengthened base is used to mount into the tower fabrication and is locked in place using an eight jaw chuck system. The machine has rotational drive and milling spindle to enable orbital milling capability and orbital scroll milling. Recently a new hydraulic clamping system is incorporated into the machine to reduce setting time.

The machine is mounted using the eight jaw chucking system with four off having an adjusting feature built in to allow fast easy levelling. Four off additional jaws are used to provide rigidity and the machine has a hydraulic rotary distributor to enable correct hose orientation. The machine is mounted to the tower fabrication locked in place, levelled and then machining can commence. High spots can be removed locally and we now complete 3 flanges / day a saving of over 80% on previous methods.



Left: the WP4300 mounted into a tower flange

Below: flatness tolerance required 0.30mm with 0.8 – 1.6 μm Ra Finish



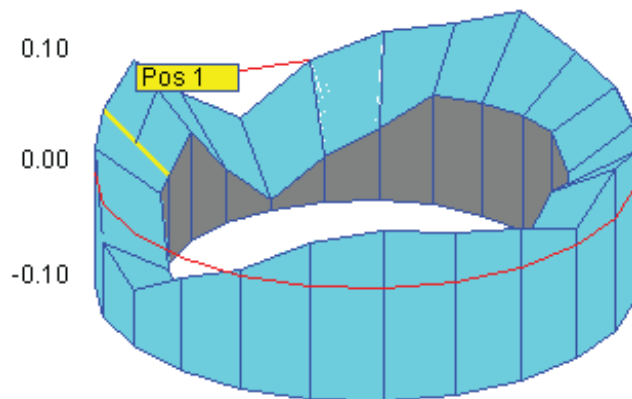
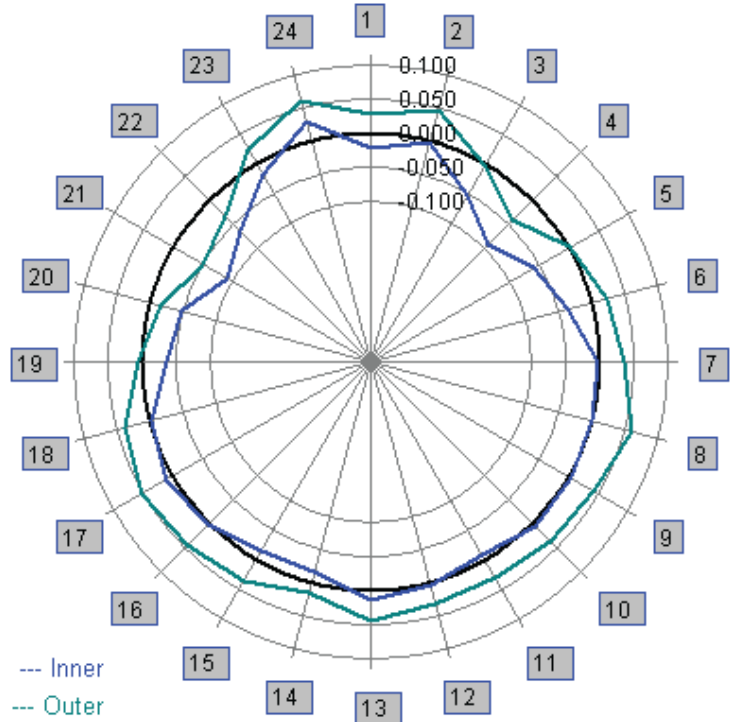
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Easylink 2.2 P37
 Gordon Calgie, RPG (SA) Pty Ltd
 9:04:29 AM 12/04/2009

Filename: //NBH T49 MACHINE
 Date: 09.12.04
 Time: 06:24
 Program: Flange
 Unit: mm

Corrected results			
Number	Ref	Inner	Outer
1		-0.02	0.03
2		0.00	0.05
3		-0.05	0.00
4		-0.09	-0.04
5		-0.06	0.00
6		-0.04	0.02
7		0.00	0.04
8		0.00	0.06
9		0.00	0.04
10		0.01	0.04
11		-0.01	0.03
12		0.00	0.03
13		0.01	0.04
14		-0.02	0.01
15		-0.02	0.03
16		0.00	0.04
17		0.01	0.05
18		0.00	0.04
19		-0.03	0.01
20		-0.05	-0.02
21		-0.09	-0.05
22		-0.06	-0.03
23		-0.02	0.02
24		0.03	0.06
Max:		0.03	0.06
Min:		-0.09	-0.05
P-P:		0.12	0.11



Flatness readings from WP4300 - tower flange machining at RPG