Cast Blade March 23, 2006

Specification for Cast Aluminium alloy blades

Description of the item	:	Aerofoil shaped blade for use in axial fans (Refer ***attached photographs – Annexure A***)
Material	:	Aluminium alloy as per EN AC – Al Si 9 Mg (Casting according to DIN EN 1706) Refer ***Annexure – B*** for mechanical properties
Profile data	:	at various sections along the height of the blade and if required sample blade(s) can be given by the purchaser while ordering – grinding allowance of 0.3 mm to be accounted in casting
Locating features for m/c:		shall be provided in the blade - to suit purchaser's m/c fixture – will be indicated while ordering (Refer sketch attached for typical arrangement)
Process of manufacture:		Sand Casting (Pattern shall be designed by vendor to suit the final profile dimensions).
Heat Treatment required	:	Solution annealed, quenched & age hardened (T6)

Quality control Checks

- Chemical Analysis – each heat
- Mechanical properties verification (Yield, Tensile & Elongation) on atleast two specimen taken from one blade (specimen location as per ***Annexure - B***) out of each lot of 50 nos. The specimen blade not to be accounted in deliverables. The mechanical properties shall also be verified separately on cast test bars – one per melt and heat treatment batch.
- Testing of blade surface by dye-penetrant (after cleaning & heat treatment) in 100% of deliverable blades (refer ***Annexure – B***)
- Radiography test in 100% of deliverable blades (refer ***Annexure –*** B)
- Hardness test on the outer diameter of the blade base in 100% of deliverable blades
- Surface roughness check - maximum Ra 12.5µm
- Allowable waviness 1:200
- Profile check in CMM for the first blade of the new size and in fixture for 100% blades

Note: Bulk manufacture to be taken up after complete acceptance of minimum four sample blades by purchaser. Machining of aerofoil blade profile is not envisaged. Only machining of boss & trimming the height is considered and this machining will be done by purchaser.

Expected requirement :

Sl. No.	Type	Max. height including mounting base (mm)	Approx weight raw cast blade per piece (Kg)	Approx requirement per annum (Nos)
1	FD 250	500	5.6	400
2	PA 250	254	2.9	600
3	FD 500	678	12.7	120
4	PA 500	452	5.7	350

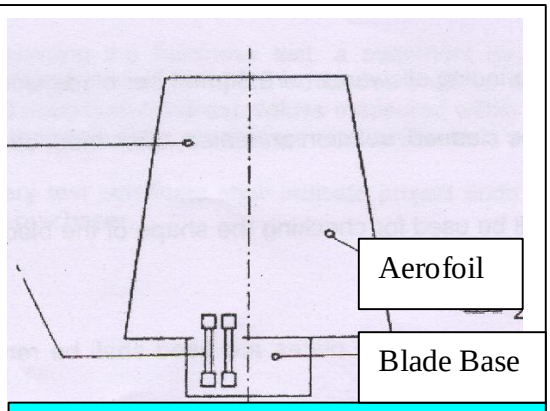
Annexure A

Photograph of cast blade
(after trimming the height & machining the mounting boss)

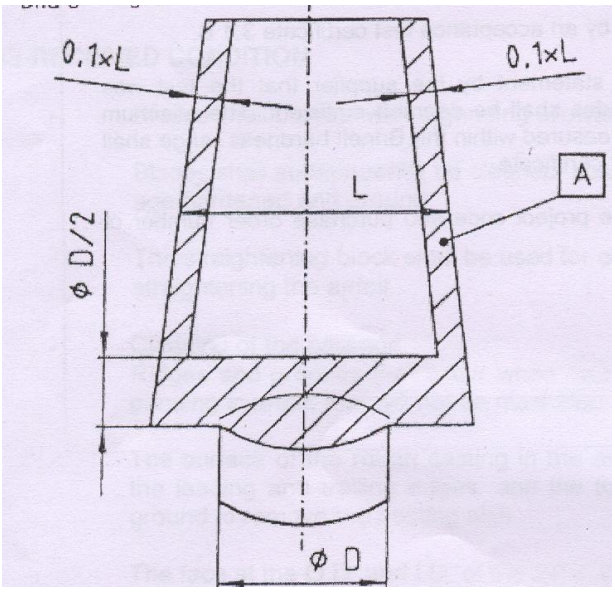
Annexure – B

Mechanical properties

Wall thickness	upto 20 mm	over 20 mm
Yield Strength Rp 0.2 mm (N / Sq. mm)	170	150
Tensile Strength Rm (N / sqmm)	200	180
Fracture Elonfgation A 50 mm (%)	1	1
Brinell Hardness HBW 5 / 250 mm(HB)	75	70



Tensile test specimen to be made from the blade base location – as shown



Maximum acceptable radiography defects as per ASTM E 155 (Refer table below)

Type of defect	Level
Gas Holes	4
Gas Porosity	5
Shrinkage	4
Foreign Material	4

Maximum acceptable indications for dye penetrant test (Refer figure above)

Refer DIN 1690 – Part 2 Table 2
Reference area 105 x 148 mm

Level ES2 for concave side of aerofoil
Level ES3 for convex side of aerofoil
Level ES1 for transverse linear indications in ***Zone A***

Specification for forged aluminium alloy blades

Description of the item	:	Aerofoil shaped blade for use in axial fans (Refer attached photographs)
Material	:	Aluminium alloy as per IS 734 HF 15 (or) AlMgSi1 F31 of DIN 1725 Part - 1
Profile data	:	at various sections along the height of the blade and if required sample blade(s) can be given by the purchaser while ordering
Locating features for m/c:		shall be provided in the blade - to suit purchaser's m/c fixture – will be indicated while ordering (Refer sketch attached for typical arrangement)
Process of manufacture	:	Drop Forging
Heat Treatment preferred	:	Solutionising and precipitation hardening to achieve the required properties

Expected requirement :

Sl. No.	Size	Max. height ("h" in mm)	Approx weight raw forged blade per piece (Kg)	Approx requirement per annum (Nos)	Remarks
1	11	590	2.4	500	Refer sketch attached
2	12	660	3.1	1000	
3	16	850	5.0	500	

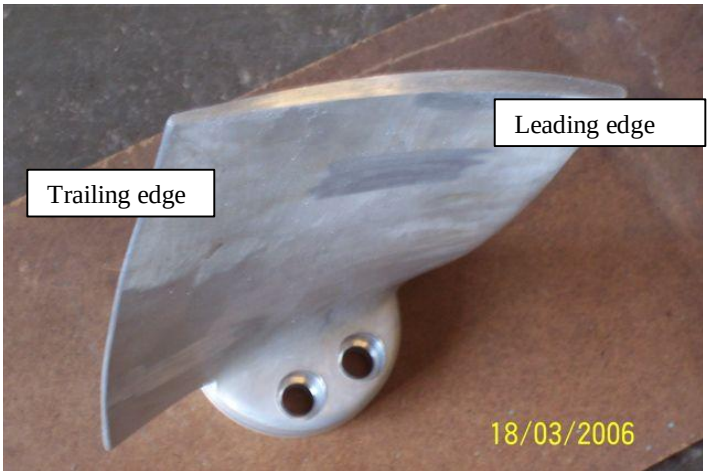
Quality control Checks (Raw material)

- Raw material to be ultrasonically tested before forging.
- Chemistry check melt wise to be done

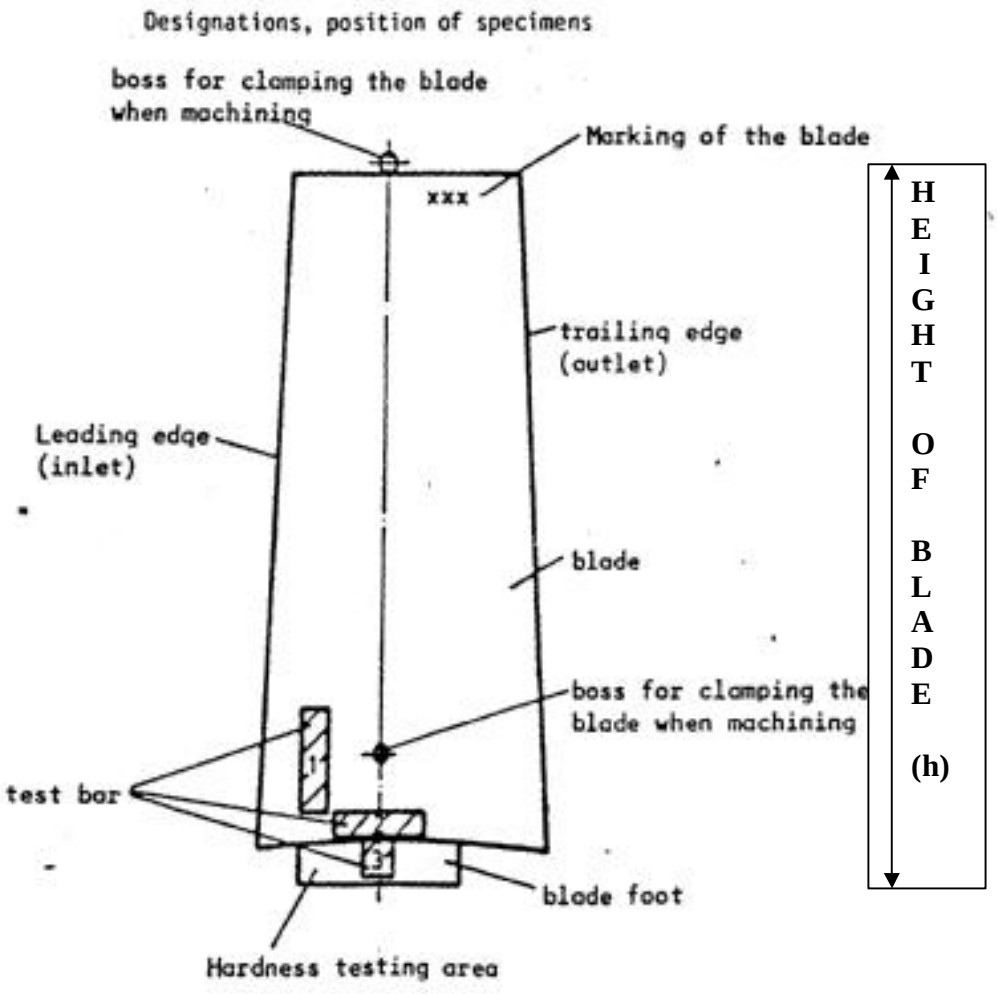
Quality control checks (Forged blade)

- Tensile test on blade in blade-boss area in 3 directions (Refer sketch) (UTS : 310 MPa minimum,YS: 250 MPa mininimum, Elong:6 % minimum)
- Profile inspection on each blade to be done with proper checking fixture
- Blade forging to be dye penetrant tested fully
- Blade forgings at random are checked by RT in root area (Refer sketch)
- Hardness check on blade-boss to be done on all blades(90 HB minimum)
- Surface roughness check - Rt 6.3 to 12.5µm
- Weight tolerance ± 6%

Note: Bulk manufacture to be taken up after complete acceptance of minimum four sample blades by purchaser. Machining of aerofoil blade profile is not envisaged. Only machining of boss & trimming the height is considered and this machining will be done by purchaser.



Photograph of forged blade
(after trimming the height & machining the mounting boss)



Sketch of Blade – test specimen location

Radiography test area