

Monolithic Carbon Fiber Wind Mill Blade

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First single piece (Monolithic) molded blade of this size in INDIA till date

The monolithic Carbon Fiber Wind Mill Blade is a unique example of detailed engineering and exquisite craftsmanship.

This blade is 1500 mm long having 3.4 kgs of weight. It used Carbon fiber as a reinforcement, structural foam as core and vinyl resins as matrix. The blade is made using Vacuum Assisted Resin Transfer molding process.

Salient Features :

a. Single piece construction : A specially designed & molded foam is used as an inner core, with appropriate layup to get structural strength & outer shell to get the aerofoil

b. Optimized Layup sequence : A mix of unidirectional & multi-axial carbon fiber, Foam layup to get the desired strength with minimum weight for best functional performance

c. Critical Design optimization : The best of the CAD & CAE tools were deployed to achieve a critical to function design optimization to get the correct combination of material & process.

d. Process optimization : Process designed and developed to get 8 blades / day with only 2 % wastage

e. Indigenous Development : The entire development from design-material selection-optimization-process design-tooling development to production achieved by inhouse Mahindra Composite Team & other Development partners

f. Competitive cost : The development cost for this project was almost 80% less & the product is 40% cheaper than those available from US

g. Mold Development : Mold designed and developed using best of the materials from around the world to suit Indian molding conditions & requirements.



Development Process

1.Product Design : Lay up design using UD & Multi Axial Carbon fabric, structural PE foam,Resin. Design optimization for light weight & high strength using best of the CAE tools.

2. Process Design : To cater to the Monolithic – single piece requirement of the molded product, Vacuum assisted RTM process was customized. The correct formulation of Vinyl ester resin to suit the carbon fabric and the foam core was arrived at.

3.Tooling (Mold) Development : Appropriate molds were developed using tool grade resin to suit vacuum molding.

4. Part molding : To get the required weight of the component various optimization techniques were deployed. We achieved a wastage of only two percent of the raw material before starting serial production

5. Balancing : A unique 2 component balancing technique was evolved using lead pallets.

6. Production : The facility is designed for making 5 blades a day, which is a landmark

Uniqueness :

Light weight – High strength wind mill blade which is an import substitute delivering stringent functional requirement of the Wind Mill power generation.

- a. Monolithic Construction
- b. Appropriate Tooling (Molds) – processing ease and productivity
- c. Ease of manufacturing & use of appropriate and best raw materials
- d. Competitive Cost
- e. Low cycle time
- f. Import Substitute

