The Advantages of a Fiberglass Fan and Blower

October, 2014

As Engineers, our goal is to design systems that are efficient and able to be cost effective over the life of the project. The challenge is to provide a balance, between life expectancy of products and cost to the project. FRP is an alternative material, which will provide a cost effective solution, on projects for the following reasons -

What is Fiberglass Reinforced Polymer (FRP)?

Fiberglass Reinforced Polymer(FRP): A complex non-isotropic material, in which two or more distinct, structurally complementary substances, glass fiber and thermoset polymer resin, combine to produce structural or functional properties not present in the individual component.

FRP is capable of being molded into complex shapes at reasonable cost. It is often problematic to fabricate complex shapes out of metals. This is apparent in the high plume dilution nozzle which involves a venturi configuration inside the bifurcated nozzle.

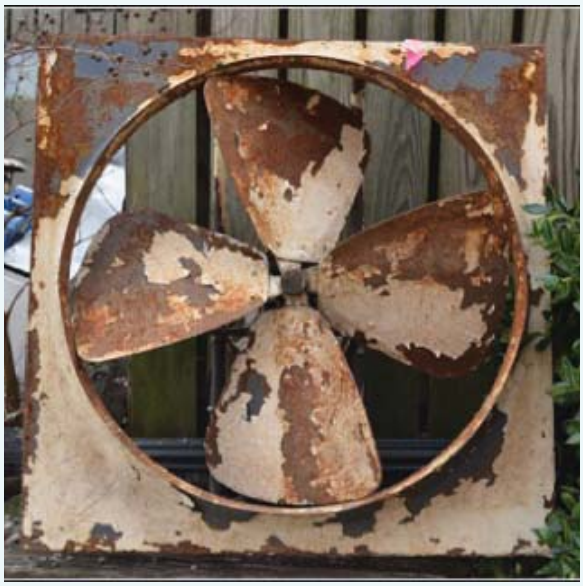
The first known FRP product was a boat hull manufactured in the mid 1930's as part of a manufacturing experiment using a fiberglass fabric and polyester resin laid in a foam mold. From this somewhat inauspicious beginning, FRP composites applications have revolutionized entire industries, including aerospace, marine, electrical, corrosion resistance and automotive/transportation.

Typical Applications for FRP Fans

Typical applications for FRP fans include any process in which corrosive fumes must be captured, moved, cleaned or vented. Fume–Scrubber systems will utilize FRP fans due to the very nature of high humidity and wet corrosive environment. Galvanizing and etching processes will utilize FRP fans in the exhaust hoods. Waste Water Treatment Plants, laboratory exhausts and chemical laden industrial processes.

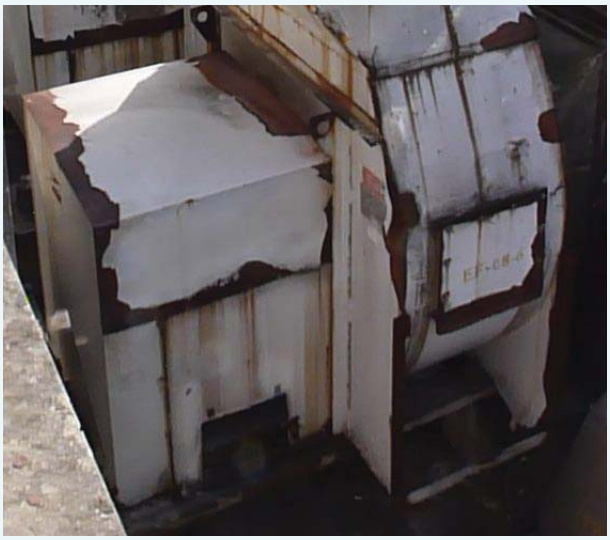
A Competitive alternative to stainless steel

FRP is an economical alternative to 304 series stainless steel and is significantly less expensive than 316 series stainless steel, Corrosion-Resistant Alloys or titanium. For example, the cost savings realized by using FRP rather than 316 Stainless steel in fan Class I construction is typically in the order 50%, 316 Stainless steel in fan Class III construction is typically in the order 75%. In addition to the economic advantage, FRP fans often provide better performance than special alloys in handling airstreams that are particularly corrosive to metals.



Fans made of rigid polyvinyl chloride (PVC) have an all-round corrosion resistance and generally cost less than fans manufactured from FRP. However PVC has two limiting physical characteristics severely limiting its use in fans. PVC becomes quite brittle at temperatures below freezing; PVC loses its' strength very rapidly with increasing temperatures, to the extent that make even ordinary summertime rooftop operation is marginal. Wheels sag and go out of balance, striking the housing.

Coated steel fans vary greatly in the degree of protection provided; cost is proportioned accordingly to the surface preparation required and type of coating applied. Coatings run the scale from little different than ordinary machinery enamel to baked



on phenolic applied to a sandblasted metal. Cost for coated fans range from 30% less than FRP fans for the lowest application of coated steel applied to about 50% more expensive for a high level of phenolic coating. Coated fans regardless of the stated level of corrosion resistance of the coating have the inherent failure. This inherent failure is due to the coating having the high possibility of a pin-hole fault occurring during application or damage associated with handling or use, which allows the environment to attack the base material. In some instances the high level coating may not be able to be applied to the fan wheel, thus exposing the heart of the fan to early failure and the client early and increased maintenance costs.

FRP fans are built with UV inhibitors and Antimony Trioxide is added to the resin and glass fibre to achieve Class I flame spread below 25. This ensures a life expectancy of the FRP material anywhere from 25 years to 50 years in any environment, when properly applied, installed and maintained.

While the benefits of FRP fans and blowers are many, note that the maximum temperature for FRP fans, depending on the corrosive constituent, is 250°F. For saturated airstreams, an optional resin based ceramic liner for the FRP is applied.

It is not recommended to use FRP fans and blowers directly in material handling applications.

Weight and Strength - A Comparison Between Steel and FRP

When using FRP in the manufacture of fans and associated equipment, the strength to weight ratio of FRP are clear advantages when designing structural support as well as transportation and handling of the equipment.

With a thermal conductivity of only 4 BTU in./ (hrft²°F) compared to that of steel 323 BTU in./ (hrft²°F), heat loss or the concern for condensation forming on material is almost eliminated, thus making FRP a favourable material in climates that vary greatly between summer and winter temperatures.

A comparison between fiberglass, steel and aluminum can be seen on the following page.

Property	FRP Composites Pultruded GRFP		Steel A 709 Grade 50	Aluminum 6061-T651 & 6061-T6
Density (lb/ft³)	107 - 120		490	169
Tensile Strength (psi)	30,000 (LW)	7,000 (CW)	65,000	45,000
Tensile Modulus ($x10^6$psi)	2.8 (LW)	1 (CW)	30	10
Flex Strength (psi)	30,000 (LW)	10,000 (CW)	65,000	45,000
Flexural Modulus ($x10^6$ psi)	1.8 (LW)	0.8 (CW)	30	10
Thermal Conductivity {BTU in./(hrft²°F)}	4		323	1,160
Thermal Expansion ($x10^{-6}$in./in/°F)	7 to 8		6 to 8	13

LW = Lengthwise / CW = Crosswise

References: Datasheets from www.matweb.com

Weight benefit of an FRP fan can range from 10% through to 30% weight advantage; the big range is due to the variance in fan size and comparable motor size. See chart below:

Propeller Fan Direct Drive Horizontal Mounted Fan			
	Model AXPR 36" FRP Fan and Impellor	SS-2-36 Model 36" Steel fan 17,116CFM	Percentage Weight Saving
18,094 CFM @ 0.3" W.G	135lbs Base Fan	159lbs Base Fan	15%
Airfoil Centrifugal SWSI Class III Utility Fan			
	Model DHK 3650 Class III FRP Fan and Impellor	BAE-SW 365 Model Steel Fan Class III	Percentage Weight Saving
20,000 CFM @ 12" W.G	1265 lbs Base Fan	1778 lbs Base Fan	28%

FRP - Spark Resistant meeting AMCA Standard 99-0401-86

AMCA "A" - All parts of the fan in contact with the air or gas being handled shall be made of nonferrous material.

M.K. Plastics belt driven FRP fans meet the AMCA"A" requirement, with an optional surface additive applied to the components in the airstream.

FRP material has good electrical insulation and dissipation properties which make the FRP fans suitable applications where corrosion resistance combined with spark resistance are required, for many spark resistant applications that do not deal with corrosion resistant requirements.

Resin/Glass composites are non-conductive materials, although high static electric charges can develop. Such static buildup is negated by using a conductive carbon graphite liner earthed outside the fan assembly.

For assistance with fan selection software, corrosion resistance guides, technical literature, please go to our website www.mkplastics.com - where you will all so find the listing for our global network of Representatives.

50TH ANNIVERSARY 1963/2013 M.K.Plastics CORPORATION

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