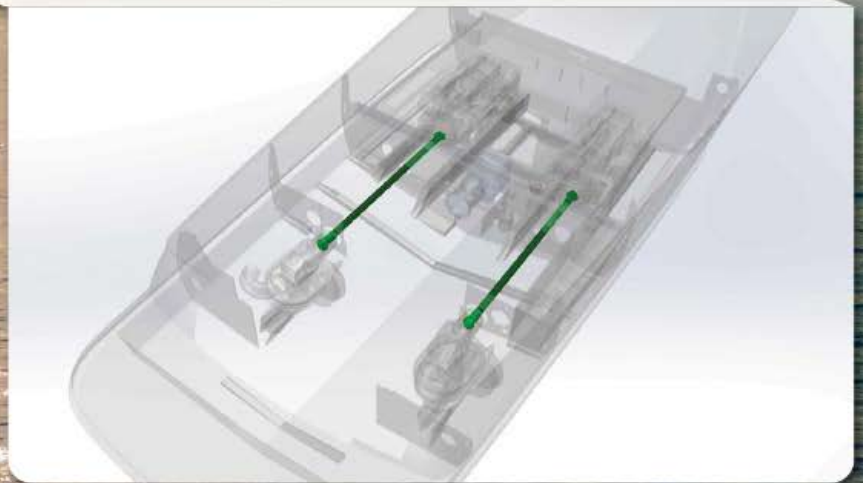




MACHINE SERVICE, INC.

# *Carbon Fiber Composite Drivelines*



***WE DRIVE SUCCESS***



## ***Innovation That Drives Success***



**Machine Service, Inc.** has developed a flexible marine carbon fiber reinforced propulsion drive shaft that can be custom fit to your specific needs. These drivelines are a perfect solution whether you are manufacturing a luxury yacht, cruise ship, passenger vessel or other marine craft.

This hybrid shaft eliminates vibrations in marine applications that previously could be felt or even heard. The dampening principles created by carbon fiber generates a unique modulus, which allows these shafts to be longer, stronger and lightweight.

Carbon fiber drive shafts are becoming more prevalent, commonly used in automotive, commercial, defense, industrial and marine industries. They are utilized in the most demanding and specialized fields because of their unique blend of capabilities, including:

**Higher Torque Capacity**  
**Higher RPM**  
**Better Reliability**

**Increased Safety**  
**Lighter Weight**  
**Reduced noise, vibration and harmonics**



## More Torque

Independent testing by a trusted vehicle manufacturer periodical showed rear wheel horsepower increased by more than 5% with only the switch from a conventional steel driveshaft to a carbon fiber driveshaft. This is primarily due to the lighter rotational mass of the carbon fiber driveshaft. A lightweight carbon fiber driveshaft allows more engine power to be transferred to the system.



## Higher RPM

Driveline vibration is a common problem that can limit the RPM. In racing scenarios, metal driveshafts experience harmonic whip, limiting usable RPM and forcing them to run the engine well below redline in each gear. For one application, a carbon fiber driveshaft was developed that allowed a 1000 RPM increase in usable engine speed and gave the engine a chance to work at its power peak. Since 1987, many racers in all areas of motorsports have discovered the extra RPM and the resulting tuning flexibility carbon fiber drive shafts provide.

## Better Reliability

All drive shafts twist to some degree when torque is applied. The resistance to this twist is measured as torsional spring rate. Carbon fiber (composite) drive shafts have a torsional spring rate a little less than aluminum and about half that of steel. The advantage of a lower spring rate is less driveline shock and a reduction of stress on other drivetrain components.



### Better Reliability

Standard metal shafts have continual twist when torque is applied eventually causing all metal shafts to twist very slightly. Over time, the shaft ends become permanently out of phase by several degrees and vibration begins to wear down components. On the other hand, carbon fiber drive shafts have a near perfect *elastic memory*, therefore carbon fiber drive shafts will not fail by becoming permanently twisted.



### Increased Safety

Carbon fiber drive shafts are built for strength for torque transfer and can be broken with a hard blow from the side. The result is that when a u-joint or yoke fails, the carbon fiber composite begins to disintegrate when it contacts the chassis. As the composite comes apart, the shaft simply turns into a bunch of loose carbon fibers instead of tearing up the hull.

### Lighter Weight

A lighter carbon fiber shaft increases your fuel economy and decreases your rotational mass, which, as mentioned earlier, increases torque. It also makes installation easier.



### Reduced noise, vibration and harmonics

Not only is a smoother ride easier on your operator it is easier on your equipment. As a result, the carbon fiber drive shafts are subjected to less stress and tend to last longer. The same can then

be said for the other components of your powertrain. Finally, a constant velocity universal joint can be incorporated in the driveline tube for premium torsional cancellation.



**MACHINE SERVICE, INC.**

1000 Ashwaubenon Street

P.O. Box 10265

Green Bay, WI 54307-0265

Phone (920) 339-3000 • Fax (920) 339-3003