

## **Designing Maximum-Performance Electric Cooling Fans**

A well-designed electric radiator cooling fan is critical to prevent engine overheating in a variety of demanding driving conditions. The heat generated in stop-and-go-driving, when racing, and from hot weather, can kill engines. Electric cooling fans will provide the airflow needed to dissipate excess engine heat with the least impact on horsepower and fuel economy. Without airflow, a radiator can become simply a holding tank for hot coolant.

So what does it take to create a cooling fan that can efficiently deliver the required airflow without increasing power consumption? The engineers at Maradyne High Performance fans have addressed all of the critical design factors to develop a range of effective and reliable radiator fans for many different applications.

The company's flagship fan can be found on the cars of several Nationwide and Cup Series teams, a demanding application where cooling is critical to winning performance. Maradyne fans offer a proven way to keep daily drivers, street rods, muscle cars and off-road vehicles cool.

### **Factors that Impact Fan Performance**

Maradyne engineers make precise calculations to create the optimal angle of airflow through the fan at three points – hub, fan middle and outer tip, working with factors such as blade width, blade pitch angle, number of blades and blade velocity.

This yields the ideal design and balance in a hypothetical set of conditions. To make it fully functional in the real world of engine cooling, engineers need to optimize the blade pitch at static pressure and RPM conditions which replicate most automotive applications. Essential aspects of optimum high-performance fan design include:

- **Balanced Blades** – Prevent additional stress and wear on the motor, which can shorten its lifespan.
- **AMP Draw** – A critical part of the design process is to create an efficient fan that can achieve maximum performance with the least amount of amp draw.
- **Concentric Rings** – To create a stable surrounding for the blades of larger fans (16-inch diameter), durable glass-filled nylon concentric rings are used to tie fan blade tips together. Two rings, one outer and one inner, are used on 16-inch fans to add stiffness to the blade and prevent it from flexing rearward (into the shroud) at high RPM. Smaller fans (14- to 12-inch fans) have one outer ring preventing blade

flex and distortion. The rings also reduce noise by preventing harmonic vibrations that can occur when individual blades rotate at high speeds.

- Sealed Motor – One of the key factors that impacts longevity and performance of electric fans is the motor that drives them. When air is hot, heavy with humidity or in harsh off-road applications where dust and water come into play, a well-built motor is essential. Maradyne's Champion Series motors carry an IP68 certification, indicating that they meet stringent waterproof & dustproof standards and are constructed with quality internal componentry.

## **Practical Design & Testing**

With a theoretical "best design" in place, Maradyne then rapid prototypes the designs to analyze fan variations in their test facilities to further optimize performance. Analysis will include a range of tests at various static pressures to measure airflow, speed, torque and amp draw.

In addition to stringent internal testing, real-world validation is obtained from the many racing teams that utilize Maradyne fans in demanding off-road and on-track conditions. "Our fans can perform and survive the punishment of TORC Off-Road racing and the Nationwide and Cup series, proving that they can handle the toughest conditions," said CJ Clayton, national sales manager for Maradyne High Performance Fans.

## **Conclusion**

Maradyne engineers are invested in creating industry-leading electric cooling fans known for high performance and durability. To choose a fan to keep your vehicle running well, Maradyne offers a comprehensive catalog featuring an extensive application guide. Additional details and assistance can be found at [www.maradyneHP.com](http://www.maradyneHP.com), or call the Maradyne Tech Line at 800.403.7953.

*AUTHOR'S NOTE: CJ Clayton, national sales manager for Maradyne High Performance Fans, has over 25 years of automotive industry experience and a passion for performance, from dragsters and hot rods to off-road vehicles. An electric fan and engine cooling expert, he has outlined some points to consider about the benefits and selection of an electric cooling fan.*