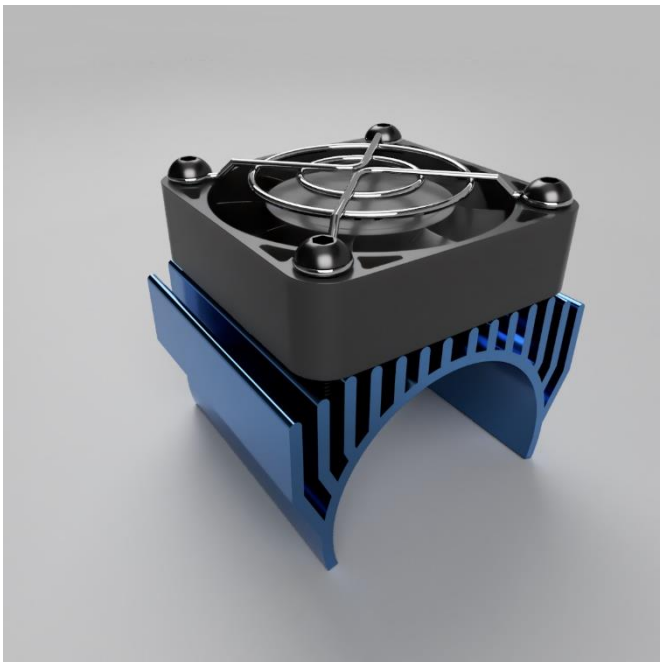

Brushless DC motors operating under high load conditions generate significant heat due to copper losses in the windings, iron losses in the magnetic core, and mechanical losses. In compact motor sizes, such as 36 mm diameter motors (e.g. 3650 and 3660 classes), heat dissipation is often limited by the small external surface area and by installation constraints typical of RC vehicles and embedded systems.

To improve thermal performance, an aluminum motor heatsink is clamped around the motor can, increasing the effective heat transfer area. The addition of a 40 mm axial cooling fan mounted on a dedicated shroud enables forced convection, substantially enhancing heat removal compared to natural convection alone. The fan shroud plays a functional role by directing airflow along the heatsink fins and reducing recirculation losses.

In this exercise, the thermal loss generated by the motor under specified operating conditions is assumed to be 150 W. The objective is to analyze the heat transfer from the motor to the ambient environment, evaluate the resulting heat flux and temperature distribution, and assess the effectiveness of the heatsink–fan assembly in maintaining the motor temperature within acceptable limits for safe and reliable operation (max T 90°C).

Assume exchanging heat with air at 25°C