

General Motor Knowledge
Part 6
Lynn R. Dutro
January 15, 1993
GMK6.WP5

What keeps Morrill motors from overheating? In these days of increasing product liability cases, this is becoming a hot topic.

Motors are generally protected from overheating in one of two ways. We are able to use either method to protect our motors, depending on motor output. The motors that I want to talk about this month are known as "Thermally Protected" motors.

Our thermally protected motor, marked TP on the backcap, is protected by a device called a thermal protector. It is the glass tube wedged next to the winding. As current flows through the winding, the winding heats just like in an electric heater. $\text{Power In} = \text{Power Out} + \text{Heat Generated}$. Remember our SP-B203, it has 2.3 watts of power available at the shaft with 11 watts of electrical power as input, there is 8.7 watts lost in the conversion. This lost power shows-up as heat. The thermal protector is sensitive to the temperature of the winding that it is next to. The protector will open like a switch to turn off the motor before the winding gets to hot. This is a good place to remind you of the importance that the thermal protector be held snugly against one of the coils. You should not be able to see "daylight" between the protector and the coil.

The test that both UL and CSA specify to determine if the thermal protector is proper for the motor is an 18-day endurance test. Any fan blade or bracket that might conduct heat away from the motor is removed for this test. The motor is mounted on a block that will not conduct heat away such as wood. The rotor is locked so that it will not turn. This will simulate the worst possible condition of trash sucked into the fan blade to prevent it from turning. With the rotor locked, there is no output power and all of the input power becomes heat. The motor is then powered at full voltage. Our thermally protected motors must be able to operate for 18 days under these conditions. There must not be any evidence of charred or burned windings. During this test the average winding temperature must not exceed 347 degrees fahrenheit or 175 degrees on the celsius scale. The thermal protectors that we specify will open at a temperature well below these limits.

Our SP-B9, 9-watt output motor, has a locked rotor watts input of just over 50 watts. If something should accidentally block the rotor, the thermal protector would open, otherwise the motor would get as hot as a 50 watt light bulb. Yes, 347 degrees fahrenheit sounds high, but you cook at higher temperatures even most light bulbs get hotter than that. This is a common temperature for a totally enclosed motor such as ours.

Next month I would like to discuss the second type of over-temperature protection.