

**DC MOTOR CHARACTERISTICS**

**Motor Curves**

**Description**

DC motor performances are generally defined using the relationship between torque and the other major 4 parameters (current-I, speed-N, output power-P and efficiency- $\eta$ ) as illustrated in figure 1. Speed-N and current-I curves are directly related to torque. (I) is proportional to torque while (N) is inversely proportional. The peaks of output power (P) and efficiency ( $\eta$ ) exist at different torque points as shown in figure 1. Output power (P) curve draws a parabola variable by  $T_s$ , while efficiency ( $\eta$ ) decreases straight down beyond the peak.

As  $P_{max}$  exists at half the starting torque ( $T_s/2$ ) point and maximum efficiency at a much lower point, both peaks can not be obtained at the same time. This means that it is not possible to operate a motor simultaneously at maximum power and efficiency.

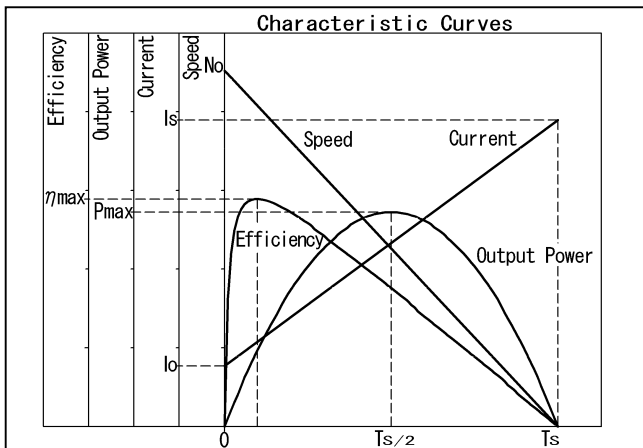


Figure 1

In this catalogue only the speed-N and current-I versus torque curves are illustrated, while for output power-P and efficiency- $\eta$  the maximum values reached when the motor is supplied with nominal voltage are indicated. In addition, for easy motor selection the working area in continuous operation is also displayed as illustrated in figure 2.

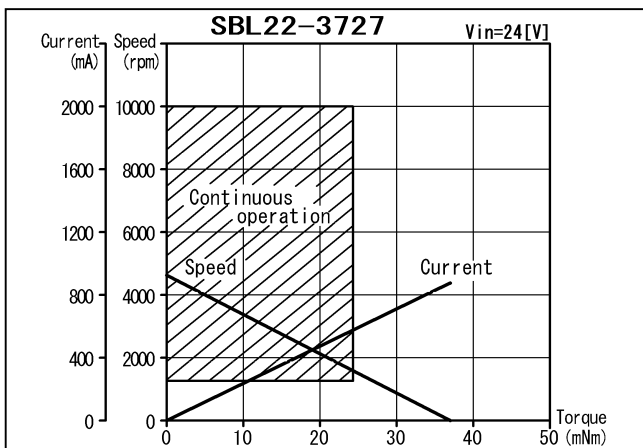


Figure 2

The working area is defined by the maximum continuous motor speed and torque (for sensorless brushless motors the minimum speed is also considered). An ideal motor life should be achievable in normal conditions where the shaft loads are not exceeded if the motor is operated within this area. Since the working area is independent of the motor voltage supply, to operate in all the working area it is necessary to select the appropriate voltage supply. For example, when the SBL22-3727 brushless motor is supplied with 24V, no-load speed is 4825 rpm, as shown in figure 2. To operate at higher speed it is necessary to increase the voltage supply. Since no-load speed ( $N_0$ ) and starting torque ( $T_s$ ) are both proportional to voltage, the speed versus torque curve reacts parallel to voltage, while the speed/torque gradient (slope) remains constant as shown in figure 3, and the output power varies as shown in figure 4.

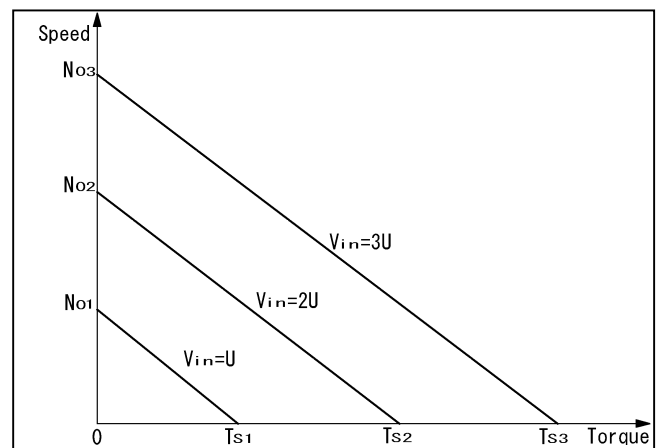


Figure 3

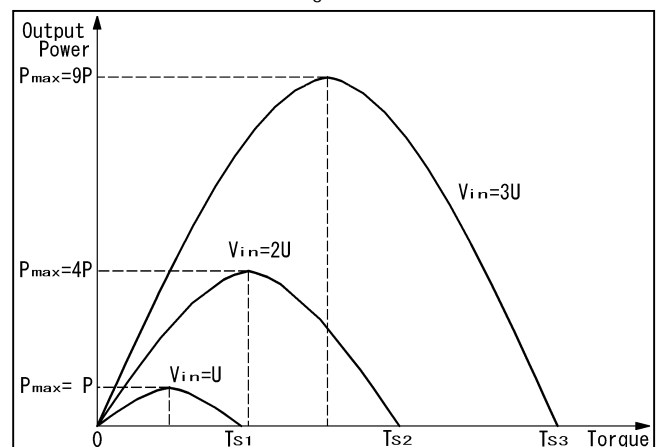


Figure 4

**Life expectancy**

Since product life is strongly affected not only by the output speed and torque, but also by the environmental conditions (temperature, humidity, vibration, etc.), operating mode (linear/switching drive circuit, start/stop and CW/CCW operation) and shaft load (axial and radial load), tests in the application are always recommended.