

for Magnetic Clutches and Brakes

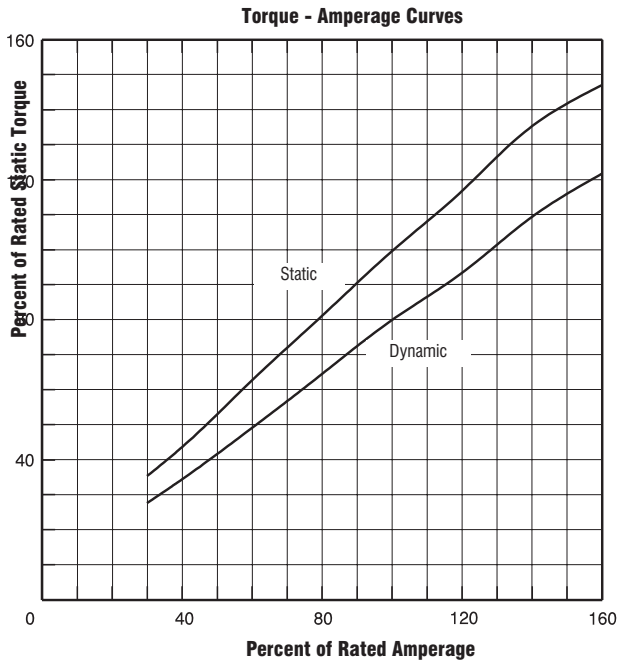
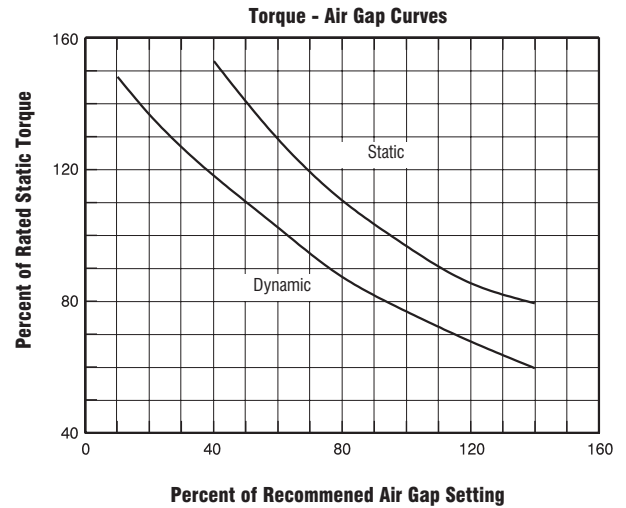
General

Technical Section Y of the catalog contains useful information pertaining to the selection, mounting, alignment and control of clutches and brakes in general. Formulas, symbols and units are also identified. It is recommended that Section Y be reviewed before attempting to size a specific product for an application.

Torque Rating

SC clutch ratings are at rated d.c. current in the coil and at rated air gap. For continuous duty allow 20% increase in coil resistance and corresponding loss in current and torque.

The Torque-Amperage characteristic curves illustrate the relationship between coil current and torque transmitted. By proper control of coil



current, the torque transmitted can be controlled. It is possible to operate above rated current to transmit greater torque, provided it is limited to brief periods to prevent coil overheating.

Air gap setting affects the torque which can be transmitted. The Torque-Air Gap characteristic curves illustrate that for a given coil current the torque increases as the air gap is reduced and decreases as the air gap increases. At any air gap setting, the torque will vary with current as shown by the Torque-Amperage curves.

SB brakes are spring set - electrically released and are, therefore, on-off elements. Torque cannot be modulated by varying current.

Example

Determine the dynamic torque of an SC450 clutch at 0.46 amp.

$$\begin{aligned} \% \text{ rated amp} &= \frac{\text{operating amp}}{\text{rated amp}} \cdot 100 \\ &= \frac{0.46}{0.383} \cdot 100 = 120\% \end{aligned}$$

From curves;

$$\begin{aligned} M_e &= 94\% \text{ of rated static torque} \\ &= 0.94 \cdot 560 \text{ lb}\cdot\text{in} \end{aligned}$$

Example

Determine the static torque of an SC775 with an air gap of 0.012 in.

$$\begin{aligned} \% \text{ air gap} &= \frac{\text{operating air gap}}{\text{recommended air gap}} \cdot 100 \\ &= \frac{0.012}{0.018} \cdot 100 = 67\% \end{aligned}$$

From curves;

$$\begin{aligned} M_e &= 125\% \text{ of rated static torque} \\ &= 1.25 \cdot 5500 \text{ lb}\cdot\text{in} \\ M_e &= 6875 \text{ lb}\cdot\text{in} (777,5 \text{ N}\cdot\text{m}) \end{aligned}$$

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Thermal Capacity

Thermal capacity is greatly influenced by the manner in which cooling oil is applied to the disc pack. Cooling oil is usually sprayed or splashed on the outside of the disc pack. Clutches can also be operated partially submerged in oil. However, care should be taken to insure that the oil level and speed of rotation do not combine to generate excessive heat through churning of the oil.

A plain mineral type oil SAE 10 or 20, should be used for cooling. Conventional additives such as rust or oxidation inhibitors and anti-foam agents will not affect operation. Oils with sulfur, chlorine, lead or sulfurized fatty materials should be avoided.

Thermal capacities under spray or splash conditions are shown in the following graph. The vertical scale represents the maximum amount of thermal energy generated during each operating cycle. The horizontal scale indicates the cyclic rate. If the crosspoint falls between two curves, the next larger size unit should be selected.

The energy per cycle value obtained from the curves is a conservative figure which will produce a safe temperature rise. Operating above these values will result in high temperatures and increased wear.

Operating Temperatures

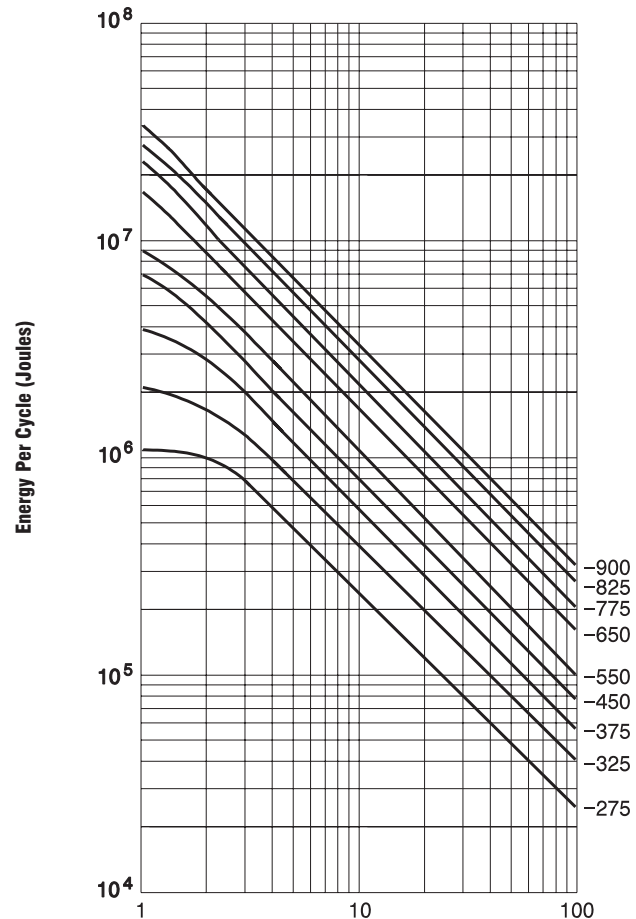
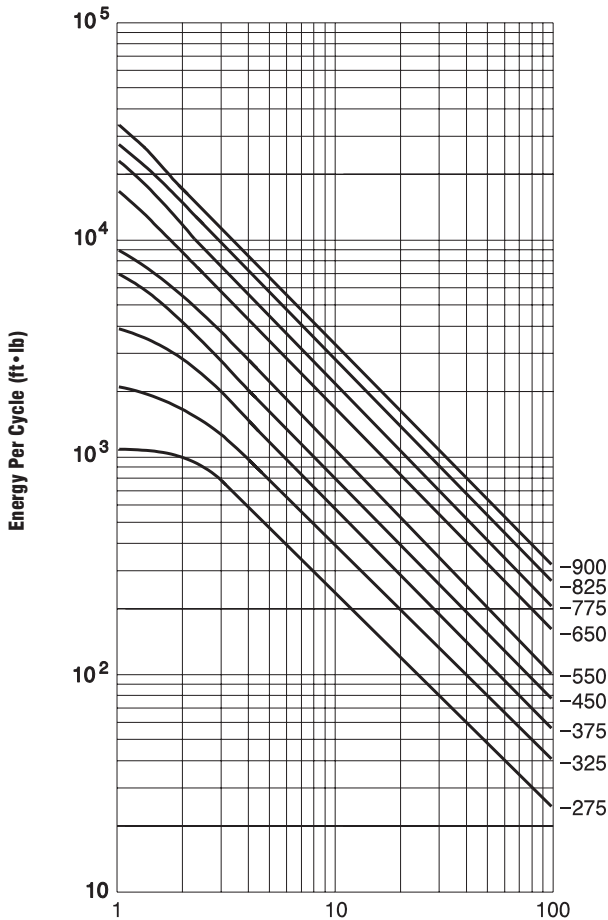
High operating temperatures will shorten clutch or brake life. Adequate oil cooling must be provided.

The coils are encapsulated in a high temperature epoxy resin and can tolerate temperatures up to 120°C (248°F) without shortening coil life. They are designed so that they can be energized continuously without exceeding the maximum allowable temperature.

Operating continuously, the disc pack can tolerate temperatures up to 150°C (302°F) without damaging the friction or steel plates.

SB and SC Thermal Capacities

Spray or Splash



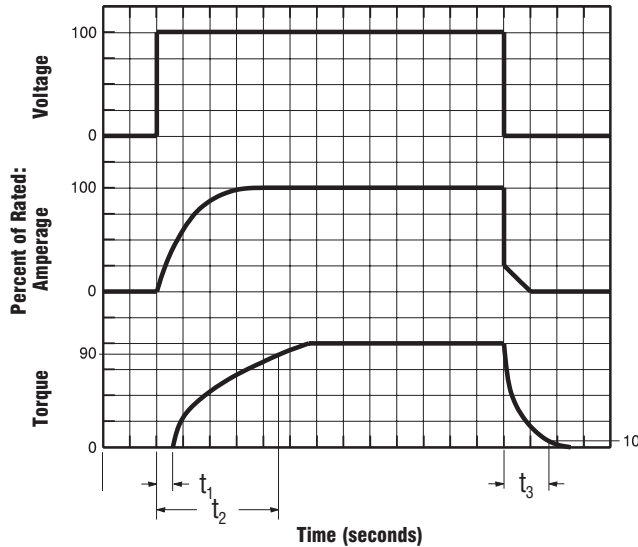
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Response Time

Typical coil response time is shown below. Because of electrical inductance, the current builds up in an exponential manner.

t_1 is the mechanical lag time necessary to take up disc clearance.

Coil Response vs Time



t_2 is the time required for the unit to develop 90% of its torque ratings. t_1 is approximately 10% of t_2 . The average torque during the t_2 time interval is approximately 61% of the rated torque.

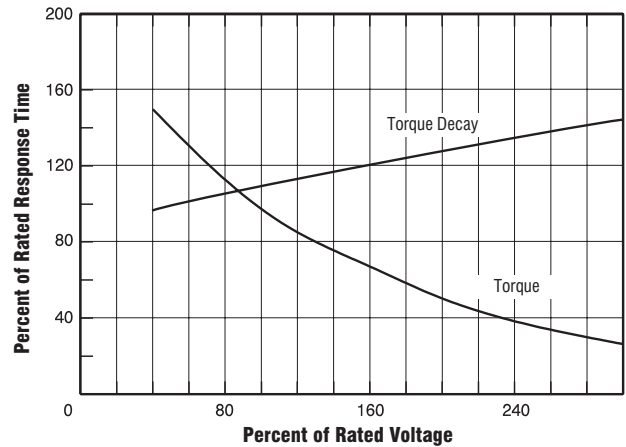
t_3 is the delay time beginning at the instant the coil is deenergized to when torque has decreased to 10% of rating.

Values of torque build-up time (t_2) and decay time (t_3) are given on the catalog sheets.

It is possible to shorten response time by applying higher than rated voltages. The following characteristic curves illustrates how response time varies with voltage. Increased voltage should be limited to just the period of engagement to prevent overheating of the coil.

Clutch response time is only slightly influenced by the setting of the air gap. Torque build-up time increases when the operating gap is larger than normal, and decreased when the gap is smaller than normal. Decay time does not change.

Response Time vs Voltage



Example

Determine the torque build-up time of an SC450 with 100 volts applied.

$$\begin{aligned} \% \text{ rated voltage} &= \frac{\text{operating voltage}}{\text{rated voltage}} \cdot 100 \\ &= \frac{100}{90} \cdot 100 \\ &= 111 \% \end{aligned}$$

From curves;

$$\begin{aligned} t_2 &= 92\% \text{ of rated build-up time} \\ &= 0.92 \cdot 0.198 \\ t_2 &= 0.182 \text{ seconds} \end{aligned}$$