Glossary

Standard AC Motors

1. Ratings

Ratings

Motor rating limitations pertaining to temperature rise are divided into two categories: continuous and short-term ratings. These establish working limitations on output, as well as on voltage, frequency and speed(r/min), and are known as rated output, rated voltage, rated frequency and rated speed(r/min).

Continuous and Short-term Ratings

The period during which output can continue without abnormality is called a rating period. When continuous operation at rated output is possible, it is known as the continuous rating. When operation at rated output is only possible for a limited period, it is known as the short-term rating.

2. Output Power

Output Power

The amount of work that can be performed in a given period of time is determined by the motor's speed and torque. This rated output value is marked on each motor.

$$\text{Output Power [Watts]} = 1.047\times10^{-1}\times T\times N$$

where:

1.047×10^{-1} : Constant
T [N·m] : Torque
N [r/min] : Speed

Rated Output Power

When optimum characteristics are achieved at rated voltage and frequency in continuous operation, the motor is said to be operating at the rated output. The speed and torque which produces the rated output are called the rated speed and the rated torque. Generally, the term "output" refers to the rated output.

3. Torque

Starting Torque ①

This term refers to the torque generated the instant the motor starts. If the motor is subjected to a load greater than this torque, it will not operate.

Stalling Torque ②

This is the maximum torque under which the motor will operate at a given voltage and frequency. If a load greater than this torque is applied to the motor, it will stall.

Rated Torque ③

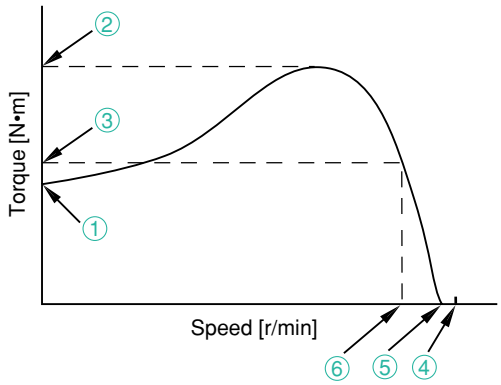
This is the torque created when the motor is continuously producing rated output at rated voltage and frequency. It is the torque at rated speed.

Static Frictional Torque

Static frictional torque is the torque output required to hold a load when the motor is stopped by an electromagnetic brake or similar device.

Permissible Torque

The permissible torque is the maximum torque that can be used when the motor is running. It is limited by the motor's rated torque, temperature rise and the strength of the gearhead used with the motor.



Speed-Torque Characteristics

① Starting torque
② Stalling torque
③ Rated Torque
④ Synchronous speed
⑤ No-load speed
⑥ Rated speed

4. Speed

Synchronous Speed ④

This is an intrinsic factor determined by the number of poles and the line frequency. It is calculated according to the following formula, and is normally indicated in r/min.

$$Ns = \frac{120f}{P}\text{[r/min]}$$

where:

Ns : Synchronous speed [r/min]
f : Frequency [Hz]
P : Number of poles
120 : Constant

For example, for a 4-pole motor with the line frequency of 50Hz, this would be:

$$Ns = \frac{120\times50}{4} = 1500\text{ [r/min]}$$

■ No-load Speed ⑤
The speed of induction or reversible motors under no-load conditions is 20 ~ 60 r/min lower than synchronous speed because of rotor slip.

■ Rated Speed ⑥
This is the appropriate speed of the motor at rated output. From the standpoint of utility, it is the most desirable speed.

■ Slip
The following formula is one method of expressing speed:

$$S = \frac{Ns-N}{Ns} \text{ or } N = Ns\,(1-S)$$

where :
(S : slip)
Ns: Synchronous speed [r/min]
N : Speed under a given load [r/min]

In the case of a 4-pole, 50Hz induction motor operated with a slip of S=0.1, this becomes:

$$N = \frac{120\times50}{4}(1\times0.1) = 1500\ (1-0.1) = 1350\ [\text{r/min}]$$

5. Overrun

■ Overrun
This is the number of revolutions the motor makes between the time when power is cut off and the time when it stops. It is normally indicated either by an angle or by revolutions.

6. Gearhead

■ Gear Ratio
The gear ratio is the ratio by which the gearhead reduces the motor speed [r/min]. The speed at the gearhead's output shaft is the reciprocal of the gear ratio × motor speed.

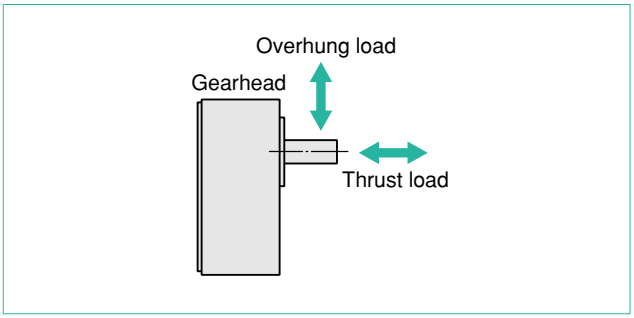
■ Maximum Permissible Torque
This is the maximum load torque that can be applied to the gearhead. It is dependent upon such mechanical strength factors as the size and construction of the gears and bearings, and thus varies according to the type and gear ratio of the gearhead.

■ Service Factor
This is a coefficient used to estimate the life of a gearhead. These values are determined from experience in service life tests under various loads and usage conditions.

■ Gearhead Efficiency
This is the efficiency of transmission when the torque is increased with the gearhead engaged. It is expressed as a percentage(%) and is determined by the friction in the gears and bearings used in the gearhead and the resistance of the lubrication oil. The transmission efficiency is usually 90% for each stage of reduction gears, and is 81% for gearheads with only two stage gearheads. As the reduction ratio becomes larger, the number of stages of gears increases, with a consequent reduction in the gear efficiency to 73%, 66% and 59% for each stage of gears added.

■ Overhung Load
This is the load on the gearhead output shaft in the radial direction. The maximum overhung load on a gearhead is called the permissible overhung load and varies with the gearhead type and the distance from the shaft end. This is equivalent to tension under belt drive.

■ Thrust Load
This is the load that is placed in the direction of the gearhead output axis shaft. The maximum thrust load on the gearhead is called the permissible thrust load and differs by the type of gearhead.



7. Others

■ CW, CCW
This shows the motor rotation direction.
CW is clockwise as seen from the output shaft side and CCW is counter-clockwise.