

## Spindle power rating IEC60034-1

The IEC 60034-1 (IEC=International Electrotechnical Commission) standard describes the capability of a motor based on the duty cycle. The duty cycle types are S1 through S9, but the ones used in CNC machine specifications are S1 and S6.

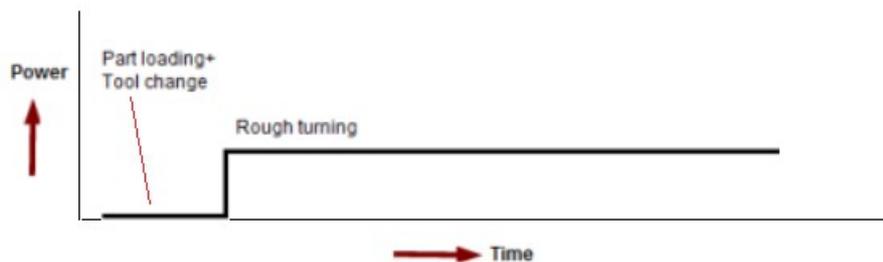
A duty cycle is the pattern of the load on the motor, a graph of Power vs. Time. The duty cycle can be written as a percentage of time that the motor is loaded every 10 minutes. E.g., 40 % means the motor is loaded 4 minutes, idle 6 minutes. See [this document](#) for more details on duty cycles.

The ratings used in CNC machine specifications are S1 and S6.

S1: Continuous running duty: Constant load with duration long enough for the motor to reach a constant temperature.

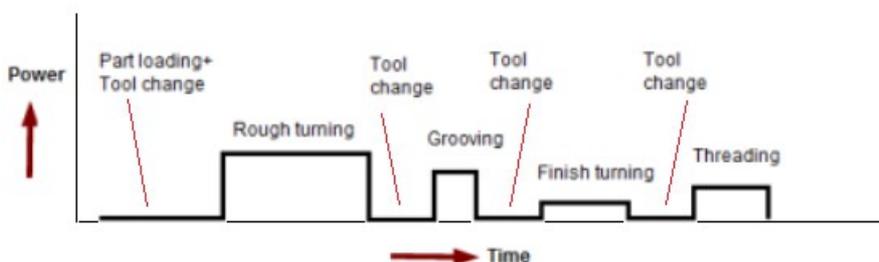
S6: Continuous operation--periodic duty type: The motor is loaded intermittently, separated by periods of zero load but with the motor running. 'Idle' need not mean that the motor is fully stopped.

### Example of S1



If you are turning a 4m. long shaft at cutting speed 200 m/min, feed rate 0.5 mm./rev, a single cut would take an hour. The load is constant for this whole duration. This is a 100 % duty cycle.

### Example of S6



In this duty cycle, after each operation there is a tool change, and the spindle is not typically stopped for the tool change. This graph is for a 50 % duty cycle.

S1 is written as a single continuous rating number. This is the load (power, in kW) that the motor can be subjected to with no rest at all (24 hrs.).

S6 is written as the power available followed by the duty cycle.

### Example

S6-40% / S1                    10.5 / 7 kW

This means the S6 rating is 10.5 kW for a duty cycle of 40 %, and S1 rating is 7 kW.

This motor can withstand 7 kW continuously, or 10.5 kW loaded 40 % of the time (running on zero load 60 % of the time). E.g., if a part's cycle time is 10 minutes, 40 % duty cycle would mean that you're cutting for 4 minutes and not cutting for 6 minutes.

## So what do I do with this gyan ?



### You can make money !

To get the maximum return on your investment in a machine, you need to use its spindle power to the fullest extent. The general thinking on the shop floor is "If I load the machine's motor fully, its life will be reduced". This is wrong, and results in spindle load meters looking like the picture shown below. The load can actually be equal to the S1 (continuous rating) continuously, without damaging the motor.



1. You can calculate the duty cycle for a part (= Cutting time / total cycle time) and use the S6 rating to determine how much you can load the spindle.

OR

2. If you don't want to be bothered with the calculations, just load the motor to the S1 value whenever possible. Roughing operations are the most time consuming, and you can increase the cutting parameters to take advantage of the available spindle power. In finishing operations you cannot do much in terms of using the spindle power because you are only cutting away the finishing allowance, and the feed rate is limited by the surface finish that you want.

### More on IEC60034-1

<http://www.nostop.cn/1com1net/webeditor/UploadFile/200922717728626.pdf>

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