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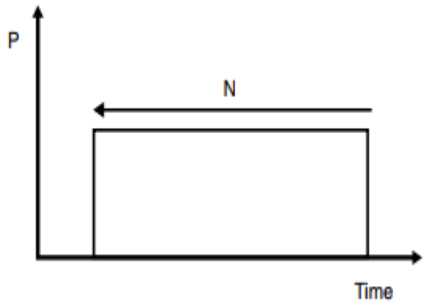
Basics of induction Motors

Name plate details of induction motor Part 4

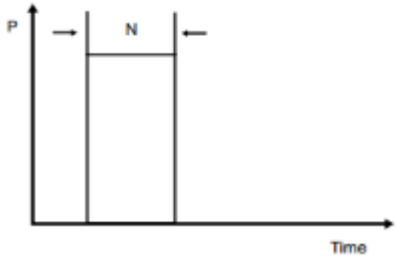
Duty Cycles:

Unless otherwise specified, the rating of the motor will be regarded as its continuous maximum rating (CMR), defined by duty S1 as noted below. But a machine is not always required to operate at a constant load. Sometimes it must operate at varying loads, with a sequence of identical operations, involving starts, stops braking, speed control and reversals, with intermittent idle running and de-energized periods etc. (e.g. a hoist, a crane, a lift or other applications). Using a CMR motor for such applications, with a rating corresponding to the maximum short-time loading will mean an idle capacity during no-load running or de-energized periods and a constant drain on energy, in addition to a higher cost of installation.

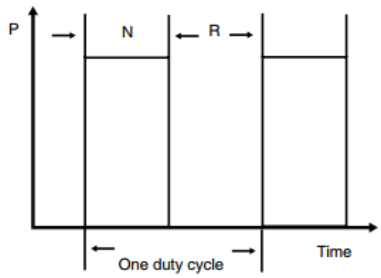
To economize on the size of machine for such applications, IEC 60034-1 has defined a few duty cycles, as noted briefly below. These may be considered while selecting an economical size of machine and yet meet the variable load demands safely. Such motors may be running over-loaded during actual loading but for shorter durations not sufficient to exceed the permissible temperature rise limits. They dissipate excessive heat during idle running or de-energized periods to reach a thermal equilibrium at the end of the load cycle. These duties are described in the following sections.



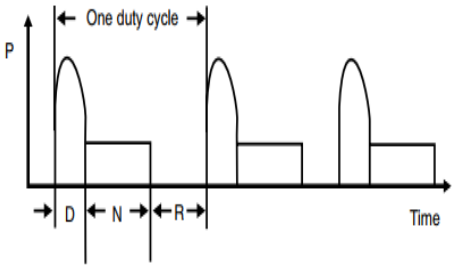
S1	**Continuous running duty** Operation on constant load of sufficient duration for thermal equilibrium to be reached. **Applications:** Paper mill drives, conveyors, pumps, blowers, fans and compressors.



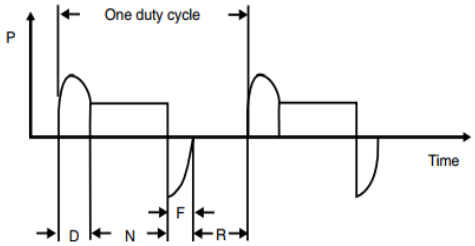
S2	**Short-time duty** Time shorter than that required to reach thermal equilibrium, followed by a rest and a de-energized period of sufficient duration to allow motor temperature to reach ambient temperature or cooling temperature. 10, 30, 60, and 90 minutes are recommended for the rated duration of the duty cycle. **Duration Time:** Ex - S2 60 min. **Applications:** Crane drives, drives for house hold appliances, valve drives, lock gates, sirens, windlasses (hoisting) and capstans.



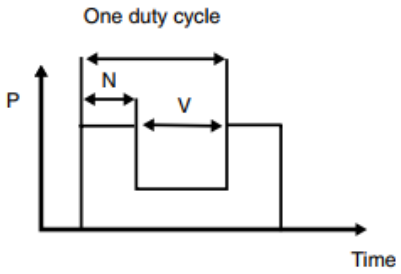
S3	**Intermittent duty** A sequence of identical duty cycles, each including a period of operation at constant load, a rest and a de-energized period. The duty cycle is too short for thermal equilibrium to be reached. The starting current does not significantly affect temperature rise. **Duration Time:** Ex – S3 25%, Duration time – 10 min. **Applications:** Press and drilling machine drives, valve actuators and wire drawing machines.



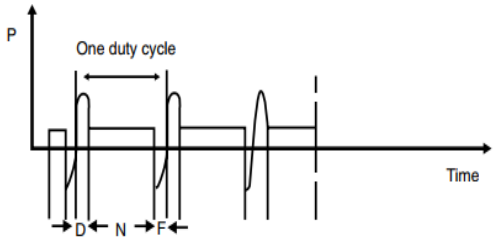
S4	**Intermittent duty with starting** A sequence of identical duty cycles, each cycle including a significant period of starting, operation at constant load, a rest and a de-energized period. **Example:** S4 25 %, 120 c/h, J_L = 0.2 kgm^2, J_M = 0.1 kgm^2. **Applications:** Metal cutting and drilling tool drives, mine hoist, cranes, lifts etc.



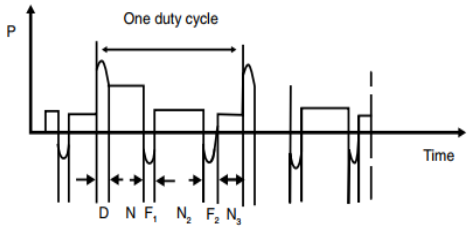
S5	**Intermittent duty with starting and electrical braking** A sequence of identical duty cycles, each cycle consisting of a significant starting period, a period of operation at constant load, a period of rapid electric braking, a rest and a de-energized period. **Example:** S5 40 %, 120 c/h, J_L = 2.6 kgm^2, J_M = 1.3 kgm^2. **Applications:** Mine hoist, rolling mills.



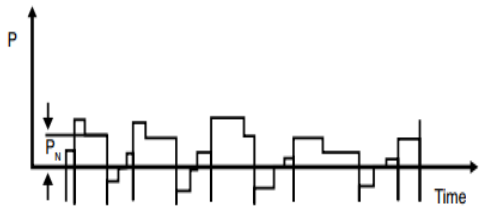
S6	**Continuous operation periodic duty** A sequence of identical duty cycles, each cycle consisting of a period at constant load and a period of operation at no-load. The duty cycles are too short for thermal equilibrium to be reached. **Example:** S6 40 %. **Applications:** Pressing, cutting drives, conveyor belts and machine tools.



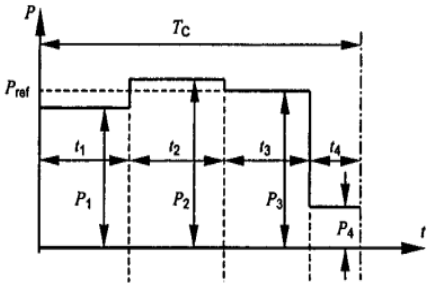
S7	**Continuous operation periodic duty with electrical braking** A sequence of identical duty cycles, each cycle consisting of a starting period, a period of operation at constant load, and a period of braking. The braking method is electrical braking such as counter-current braking. The duty cycles are too short for thermal equilibrium to be reached. **Examples:** Example S7, 500 c/h, J_L = 0.08 kgm^2, J_M =0.08 kgm^2. **Applications:** Blooming mill.



S8	**Continuous-operation periodic duty with related load speed changes** A sequence of identical duty cycles, each cycle consisting of a starting period, a period of operation at constant load corresponding to a predetermined speed, followed by one or more periods of operation at other constant loads corresponding to different speeds. There is no rest or a de-energized period. The duty cycles are too short for thermal equilibrium to be reached. **Example:** S8, 30 c/h, J_L = 63.8 kgm^2, J_M = 2.2 kgm^2. **Applications:** Speed changing applications.



S9	**Duty with non-periodic load and speed variations** A duty in which, generally, load and speed vary non-periodically within the permissible operating range. This duty includes frequently applied overloads that may greatly exceed the full loads. For this duty type, suitable full load values should be taken as the basis of the overload concept.



S10	**Duty with discrete constant loads and speeds** A duty consisting of a specific number of discrete values of load (or equivalent loading) and if applicable, speed, each load/speed combination being maintained for sufficient time to allow the machine to reach thermal equilibrium. The minimum load within a duty cycle may have the value zero (no-load or deenergized and at rest).