

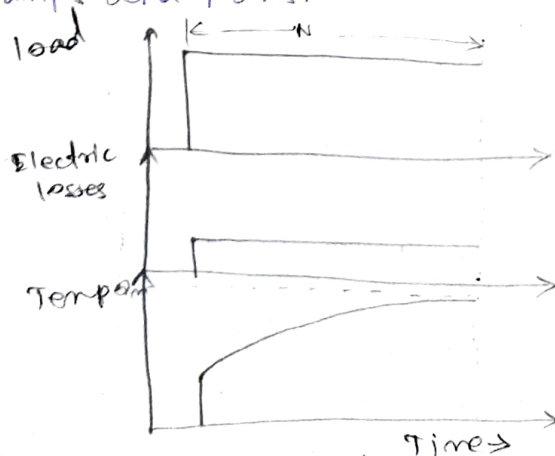
⇒ Classes of Duty :-

The types of duties and Ratings are,

- (i) S_1 : Continuous duty
- (ii) S_2 : Short time duty
- (iii) S_3 : Intermittent periodic duty
- (iv) S_4 : Intermittent periodic duty with starting
- (v) S_5 : Intermittent periodic duty with starting and braking
- (vi) S_6 : continuous duty with intermittent periodic loading.
- (vii) S_7 : continuous duty with starting and Braking
- (viii) S_8 : continuous duty with periodic speed changes.

(i) continuous duty (S_1):

- * Here the motor operation at a constant load-torque for a long duration, it's enough for the motor temperature to reach steady state value.
- * In this operation the motor undergoes constant motor losses.
- * E.g. Paper drives, compressors, conveyer, centrifugal pumps and fans.



N = operation under related conditions,
 θ_m = Max. temp °C

Fig: continuous duty

(ii) Short time duty (S_2):

(21)

- * Here the motor is operated for a short period, which is less than the heating time constant of the motor.
- * The motor is allowed to cool off to ambient temperature before the motor is required to operate again.
- * The period for load is so short that the machine cannot reach its thermal equilibrium i.e. steady temperature rise while the period for rest is so long that the motor temperature drops to the ambient temperature.
- * E.g. ^{Crane Drives} Railway turntable, navigation lock gates.

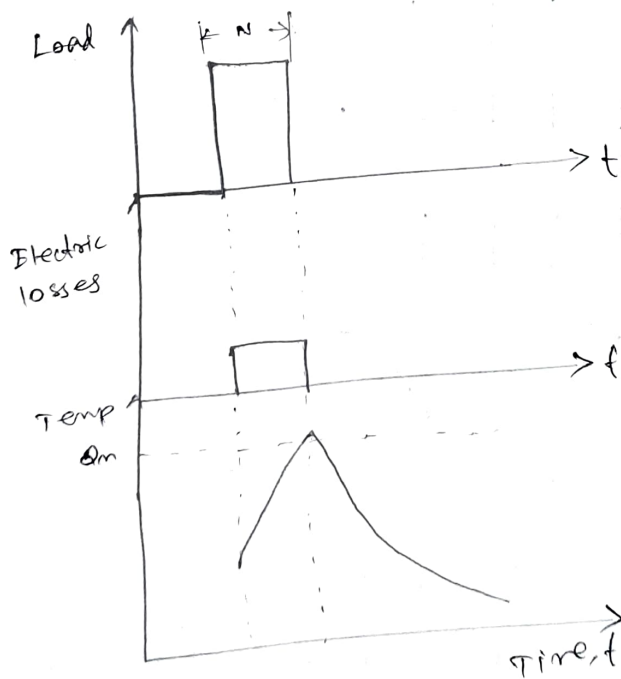


FIG: short time duty.

(iii) Intermittent Periodic duty:-

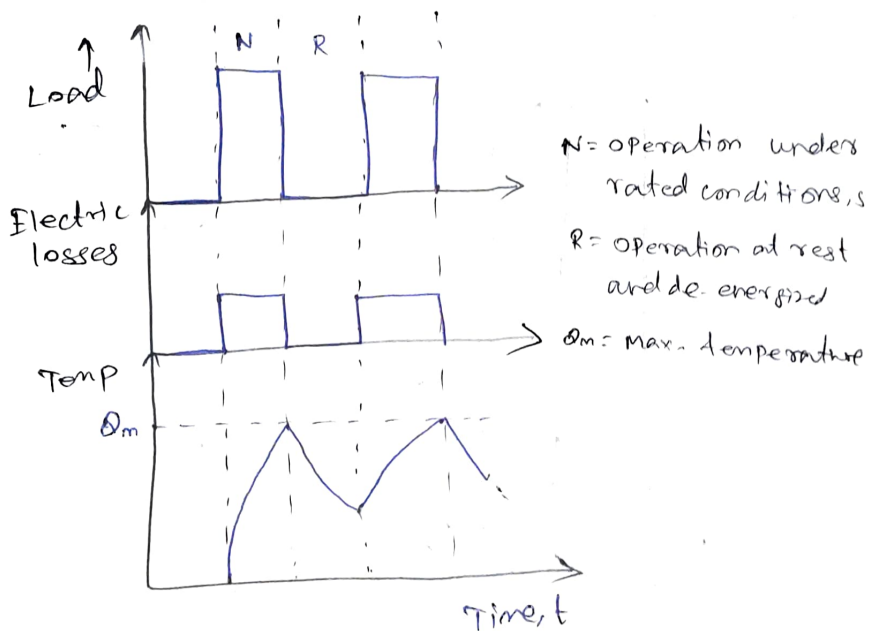
- * Here the operation has number of duty cycles which contains period of running at a constant load and rest period.

* The duration of running period is sufficient to temperature raise to steady state value, while rest period is 3

* The load periods are too short to allow the motor to reach its final steady state value while rest periods are also too small to allow the motor to cool down to the ambient temperature.

* E.g. cranes, lifts

The duty factor, $\epsilon = \frac{N}{N+R}$



(iv) Intermittent periodic duty with starting:

* Here the duty consists of period of starting, period of operation at constant load and a rest period.

* Heat losses during starting is cannot be ignored.

* The operating and rest periods are too short to obtain thermal equilibrium.

* The stopping of motor is obtained by disconnecting electric supply (e.g. by mechanical braking (which

The duty factor is

$$\epsilon = \frac{D+N}{D+N+R}$$

Eg: Metal cutting and Drilling tool drives

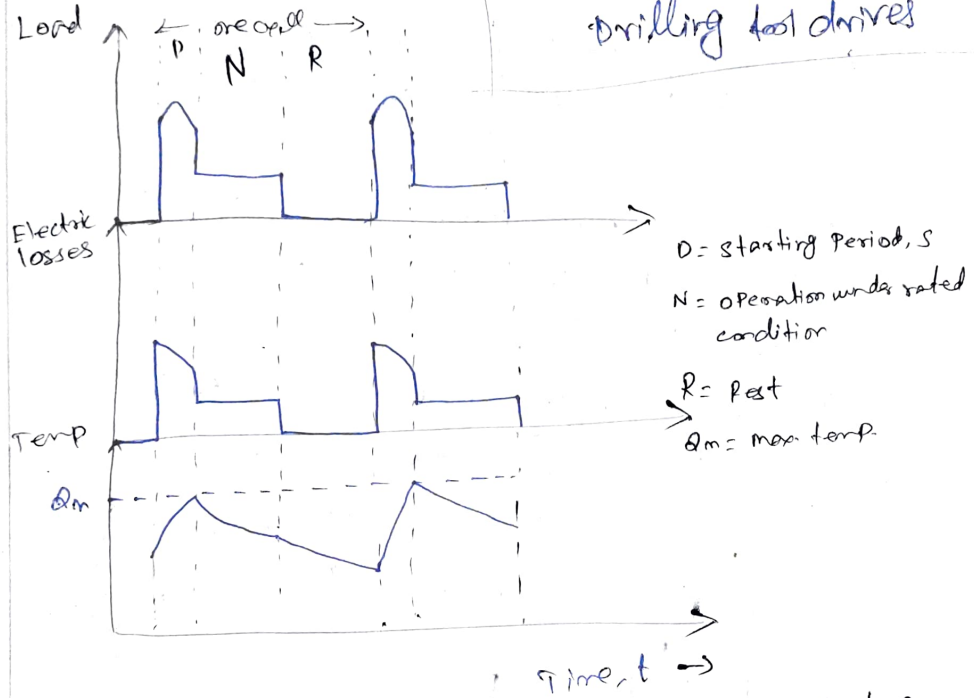
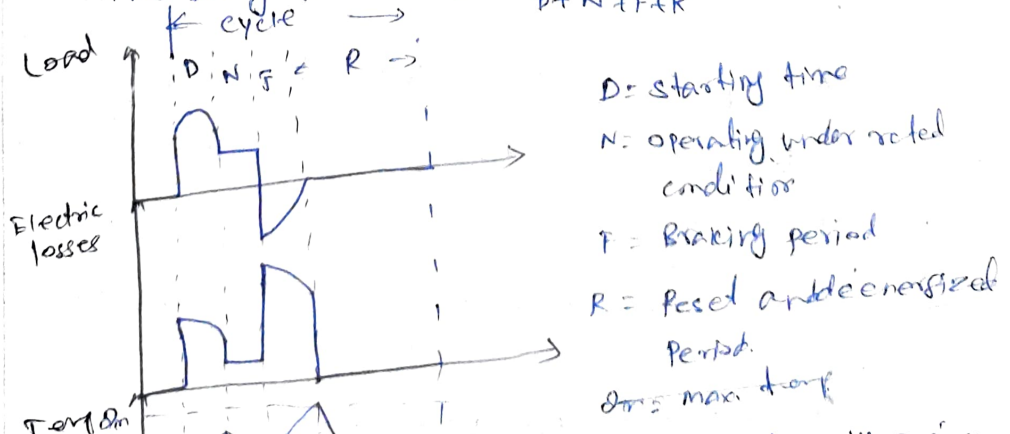


Fig: Intermittent periodic duty with starting.

(v) Intermittent periodic duty with starting and braking:

- * Here the duty consists of period of starting, a period of operation at constant load, braking and rest periods.
- * The operating and rest periods are too short to obtain thermal equilibrium.
- * The Braking is rapid and carried out by electrical.

The duty factor is $\epsilon = \frac{D+N+F}{D+N+F+R}$



Eg: Ball Mill Drive, Mine Hoist

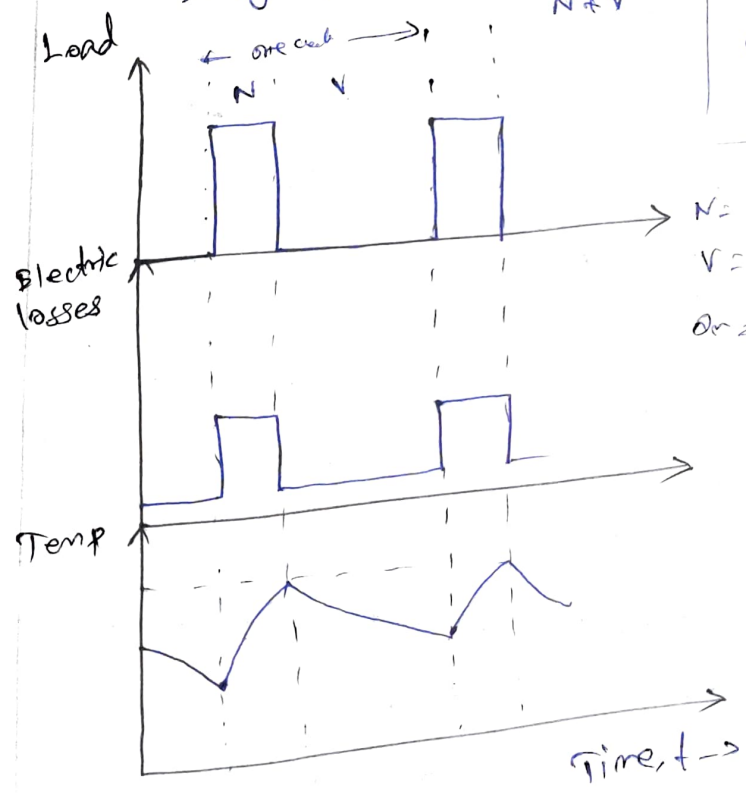
(vi) continuous duty with intermittent periodic

duty :-

- * duty consists of period of operation at constant load and period of operation at no load.
- * IFA machines with excited windings have normal no load voltage excitation during the load period.
- * The operation and no load periods are too short to attain thermal equilibrium.

duty factor, $\epsilon = \frac{N}{N+V}$

Eg: Pressing, cutting, drilling machines

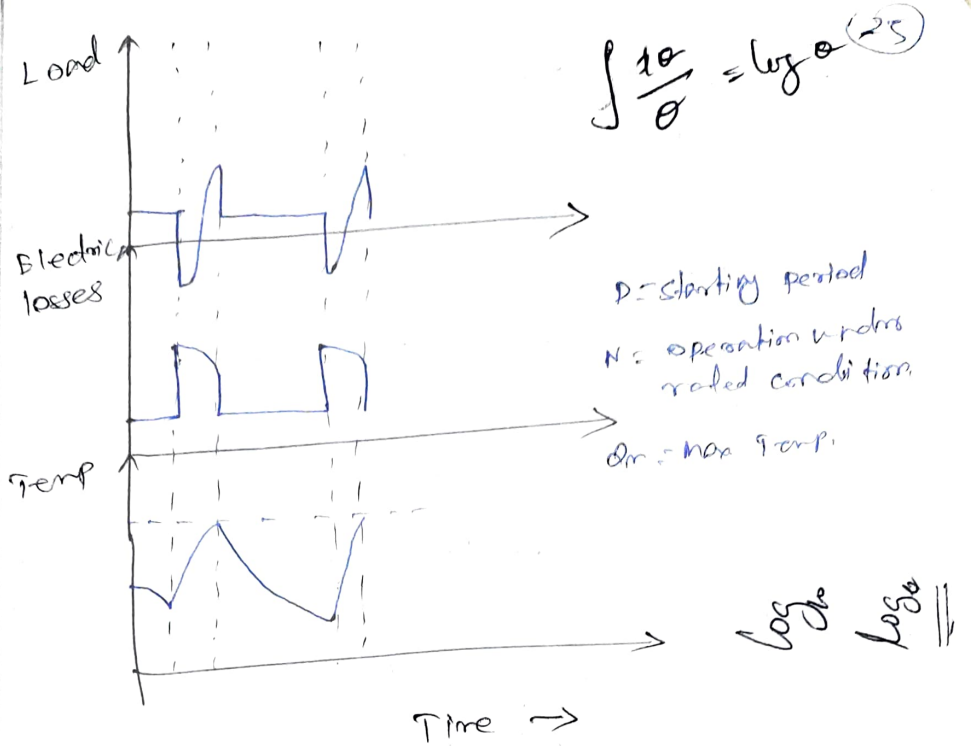


N = operation under rated condition
 V = operation on no load or 2/3 rated power.

(vii) continuous duty with starting and braking

- * duty having period of starting, operation at constant load and a period of electric braking.
- * There is no rest or de-energ period.

Eg: Braking MIM Drive



(viii) continuous with periodic speed changes:-

- * Duty consists of period of operation at constant load corresponding to a determined speed and followed immediately by a period of operation at another load corresponding to a different speed of operation.
- * The operating period is too short to attain thermal equilibrium.
- * There is no rest and de-energised period.

\Rightarrow Selection of Power Rating for Drive Motors:-

- * Drive Motor which is driving a constant load for sufficiently longer period, till it reaches thermal equilibrium.
- * It's rating must be sufficient to drive it without exceeding the specified temperature.
- * The Rating of the Motor selected for such type of duty is called continuous or design Rating.