

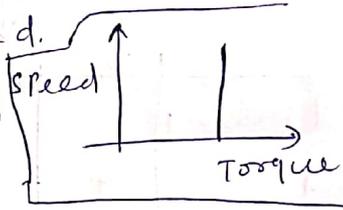
Drives classification

(1) Nature of supply (i) AC (ii) DC

(2) Types of load. a) lifting load. eg (cranes, hoist)

* Torque constant of speed.

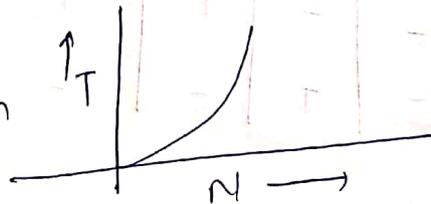
* (ω) independent of speed



(b) Air load

$T \propto (\text{Speed})^2$

eg - Blowers, fan



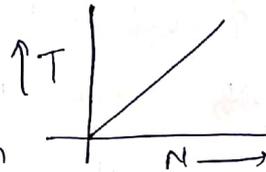
(c) Load due to friction (or) friction load

Torque \propto speed

friction is 2 type

→ Dry / fluid friction

- wet / fluid friction

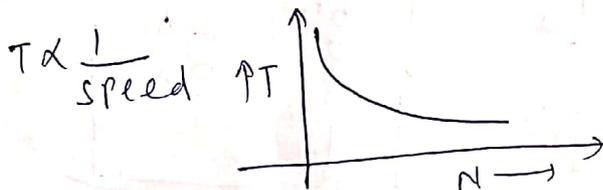


To remove friction we use lubricant

* If lubricant is not used - Dry friction

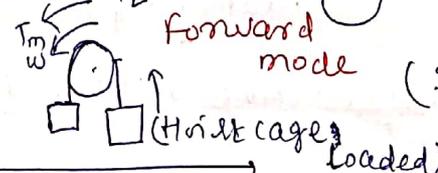
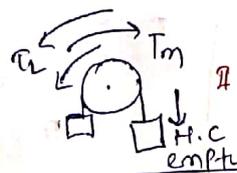
* If lubricant is used - wet / fluid friction.

d) Deformation load eg. crushing

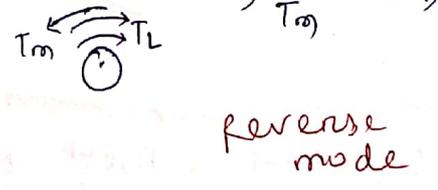
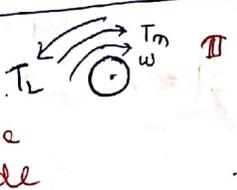


(3) Quadrant operation

forward mode

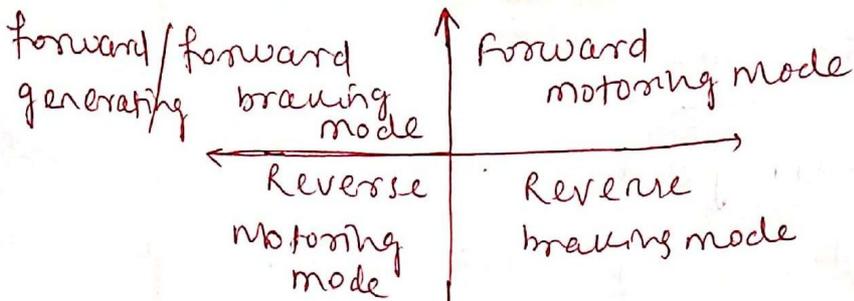


Reverse mode



$T_m \leftarrow w$ (anticlockwise)
 $w \ \& \ T_m = +ve$
 $T_L = +ve$ (clockwise)

reverse mode

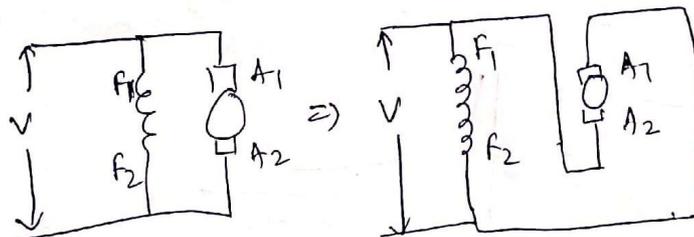


	ω_m	T_m	T_L	$P_2 T_m \cdot \omega$	Name.
I st quadrant	+	+	-	+	F.M
II nd	+	-	+	-	F.B / F.G
III rd	-	-	+	+	R.M
IV th	-	+	-	-	R.B / R.G.

(III) Electrical characteristics of Motor.

- (I) Starting characteristics
- (II) Running characteristics
- (III) Speed control
- (IV) Braking
 - Plugging / Reverse current / Reverse Armature Connection
 - Rheostatic Braking / Dynamic braking
 - Regenerative Braking

→ In DC plugging is applied to series & shunt motor.



(V & E_b are opposite)
(Motoring Mode)

effective voltage ($V - E_b$)

(V & E_b are in same dirⁿ)

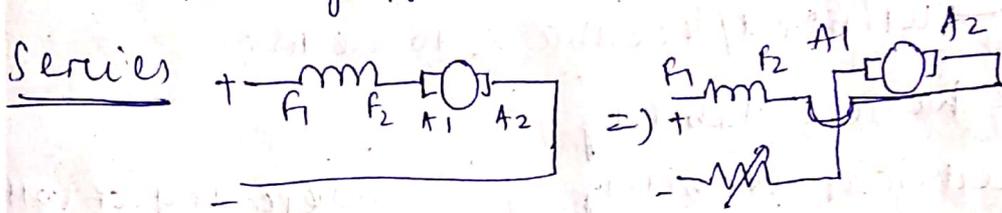
* effective voltage ($V + E_b$)

almost twice of the supply voltage

* high braking torque

* Not effective method.

* med - small scale application like elevator and
 pointing pressure.

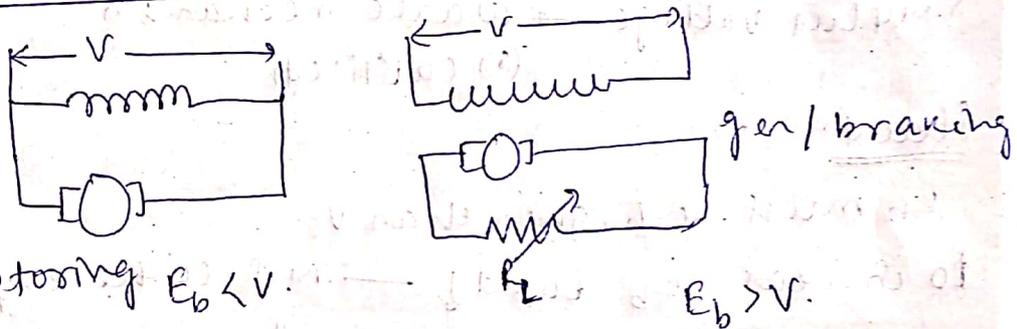


$$T \propto \phi I_a \Rightarrow T = k \phi I_a$$

$$T_B = k \phi I_a$$

in short ϕ const. $T_B = k_f I_a$ ($k \phi = k_f$)

Rheostatic method

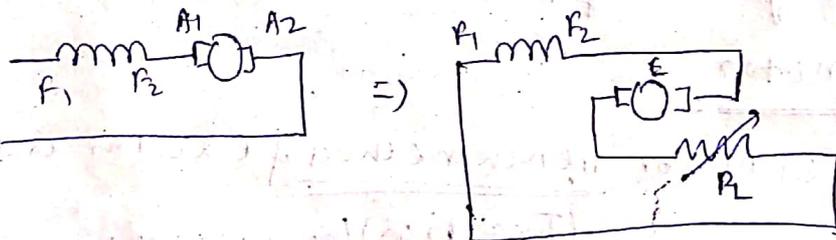


Motoring $E_b < V$.

$E_b > V$.

- cut armature from the supply
- * connect a rheostat across the armature then it becomes separately excited DC gen.

* little bit difficult for series motor



acts as self generated DC gen.

To reduce demagnetising effect, in series motor extra resistance ^{is added} along with field termal should be reverse.

* This method is also inefficient; wastage of power.

Regenerative

Condition:-

1) $E_b > V$ → utilise d/ feedback to the line

2) mechanical stability

3) electrical stability ($T_{braking}$ independent of voltage fluctuation)

Variation in

T_B creates variation in speed hence it

varies the E_b as $(E_b \propto N)$ so you can not feedback a constant supply to the system

4) Surplus voltage → waste mechanism
(not utilised)

Shunt

1) E_b must be higher than V .

to increase E_b load ↓ → N ↑ (where I_f same)

as $N \propto E_b \Rightarrow N \uparrow \rightarrow E \uparrow$

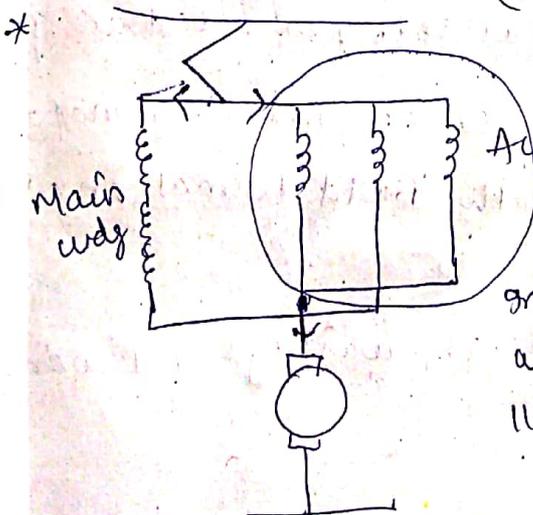
And ~~an~~ Armature (A) → connected to line/ground.

2) 2nd method

I_f change → $I_f \uparrow \rightarrow \phi \uparrow \rightarrow E_b \uparrow$

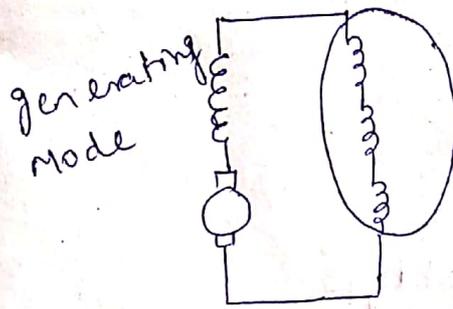
series motor

for series motor French method of Exciter is used.
(Traction)/pentograph



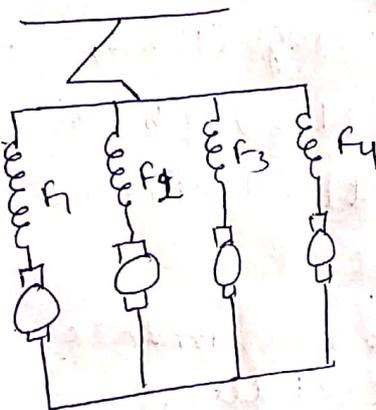
on motoring motor the auxiliary wdg is connected in parallel with the main wdg.

In generating field wdg. connected in series combination. The connection is changed by DPDT Switch before the breaking is applied.

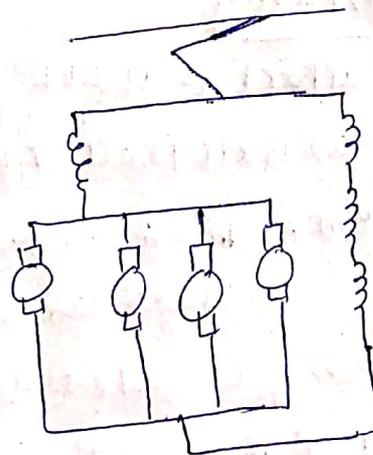


acts like compound ~~motor~~ gen.
4 we get
($E_g > V$)

In a locomotive around 4 to 6 ^{dc series} motors are used.
in motoring mode.



(Motoring mode)



generating
Modes

Mechanical considerations

- (1) Type of enclosure
- (2) Type of bearing
- (3) Transmission of drive
- (4) Noise

enclosure ÷ prevent the entry of dust, dirt into the motor

- safety

* interruption in cooling (create interference in cooling of machines)

Types -> (i) open type
(Priority - cooling)

(ii) Protected type

- (vi) Screen Protected (Transparency screen)
(Removable screen)
- (vii) Drip-Proof type
- (viii) Splash proof type
- (ix) Pipe ventilated
- (x) Totally enclosed
- (xi) Flame Proof
- (xii) Totally enclosed fan cool type

(2) Types of Bearing

Provide support to shaft.

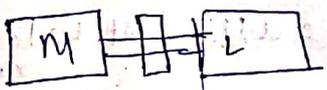
- (cheap) → (a) Ball / roller bearing (15 Kw)
(long life)
- (b) Anti friction / sleeve / bush.
(Rectangular sheet) (less noise)

Ball bearing creates noise.

Material of Bearing → Porous Bronze
Steel alloy.
(Carbide, Ceramic, Aluminium, stainless steel)

2) Type of transmission system

- a) Direct coupling
- b) Belt drive
- c) Rope / V-belt
- d) chain system
- e) Gear
- f) Vertical drive
(used in flour mill)



(Same speed) Distance (↓)
No speed variation.