'V' AND 'INVERTED V' CURVES OF SYNCHRONOUS MOTOR

AIM:

To plot the 'v' and 'inverted v' curves of Synchronous motor.

APPARATUS REQUIRED:

Sl. No.	Equipment	Type	Range	Quantity
1	Voltmeter	MI	(0-600)V	1 no
2	Ammeter	MC MI	(0-2.5)A (0-10)A	1 no 1 no
3	Rheostat	Wire-wound	400 Ω /1.7A	1 no
4	Tachometer	Digital	*****	1 no
5	Wattmeter	Electrodynamometer	10A, 600V UPF 10A , 600V LPF	1 no 1 no
6	Connecting Wires	*****	*****	Required

NAME PLATE DETAILS

3- ϕ Synchronous motor	
Power Rating:	
PF	
Line voltage:	
Speed	

Freq.	
Rated Current :	
Field current (I_f)	
Field Voltage (V_f)	

3- ϕ Auto transformer details

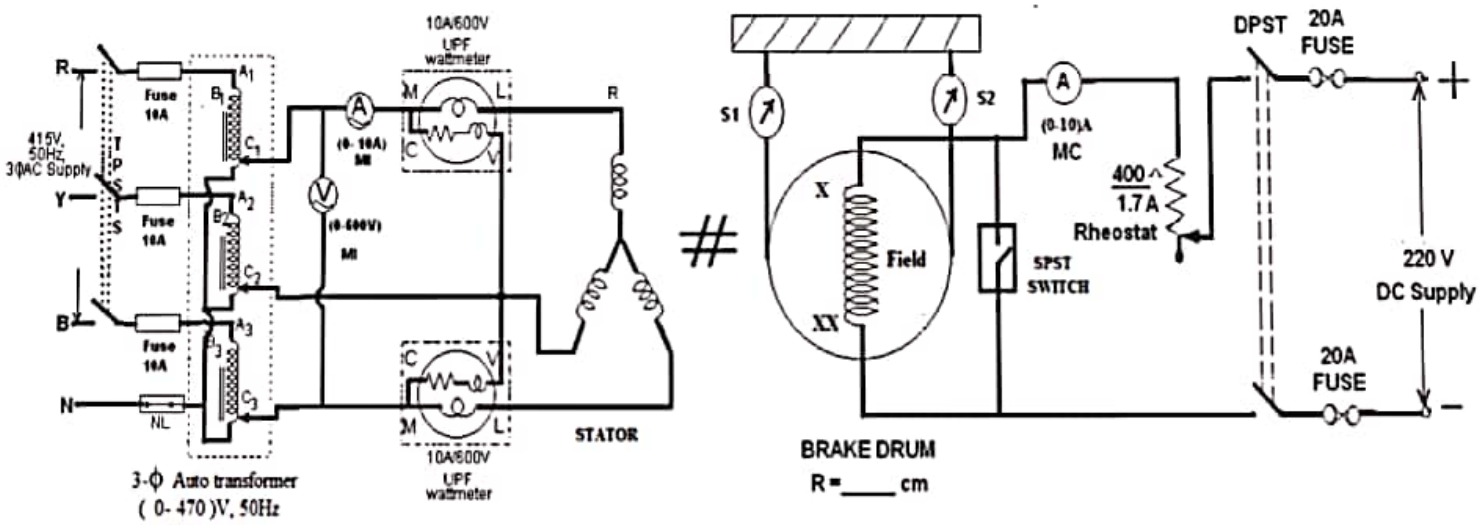
Input voltage: _____(Volt)

Output Voltage : _____(Volt)

Frequency. :_____(Hz)

Current: _____(Amp)

CIRCUIT DIAGRAM:



PROCEDURE:

1. Connections are made as per the circuit diagram.

2. Opening the SPST switch connected across the field DC supply is given to the field and field current is adjusted to 0.3A (20% of rated field current)
3. The DC supply to the field is removed and SPST switch is connected across the field by closing the switch
4. As 3- ϕ , 440V, 50Hz AC supply is applied to 3- ϕ dimmer stator keeping it in minimum output position, keeping it prior to that motor is kept in no load state.
5. Gradually supply voltage to synchronous motor is increased and then motor starts running as squirrel cage induction motor. The direction of rotation is observed. if it is not proper then supply phase sequence is altered.
6. Observing I_a, the voltage is gradually increased. It will reach a high value and suddenly falls to a low value.
7. At that instant, open SPST switch connected across the field. The DC supply is then given to the field. Then the motor is pulled into synchronism and motor now works as a synchronous motor.
8. Gradually the supply voltage to stator is increased by observing the armature current. If I_a, increases above the rated value then increase If such that I_a will be within limits and thus full rated supply voltage is gradually given to the motor. Now motor will work as synchronous motor with full rated voltage.
9. By varying If in steps, armature currents are recorded at no-load.
10. By applying half of full load on motor, If and I_a are recorded again. The same experiment is repeated at $3/4^{th}$ load, full load and corresponding readings are recorded.
11. Completely removing the load on motor, the 3- ϕ supply to stator and then the DC supply to the field are switched OFF

OBSERVATION TABLE:

Sl no.	Supply voltage	Wattmeter W1	Wattmeter W2	Field current If(Amp)	Armature current I_a(Amp)	Cos ϕ

Load 1 : 18.1% FL N = 1500 rpm V_L = 415V S_1 = 2.2 kg S_2 = 5.2 lg

I_f (A)	I_a (A)	W_1 (W)	W_2 (W)	$Tan\phi = \frac{\sqrt{3}(W_1 - W_2)}{(W_1 + W_2)}$	ϕ	Cosϕ

Load 2 : 39.2% FL N = 1500 rpm V_L = 415V S_1 = 3.5 kg S_2 = 9 kg

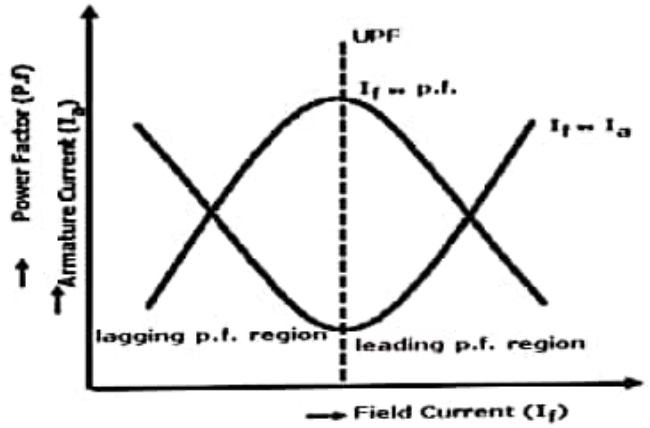
I_f (A)	I_a (A)	W_1 (W)	W_2 (W)	$Tan\phi = \frac{\sqrt{3}(W_1 - W_2)}{(W_1 + W_2)}$	ϕ	Cosϕ

CALCULATIONS:

Power factor = Cos $[\tan^{-1}(\frac{\sqrt{3}(W1-W2)}{W1+W2})]$

$$\phi = Tan^{-1}\left[\frac{\sqrt{3}(W_1 - W_2)}{(W_1 + W_2)}\right]$$

MODEL GRAPHS:



RESULT:

VIVA Questions:

1. What are the difficulties in starting a synchronous motor?
2. What are the commonly employed methods of starting a synchronous motor?
3. What are the applications of synchronous motor?
4. What is synchronous condenser?
5. What do you understand by hunting?