LAB MANUAL

OF

ELECTRICAL MACHINE-1

(EE-215-F)

IN

ELECTRICAL ENGINEERING

RPS GROUP OF INSTITUTIONS

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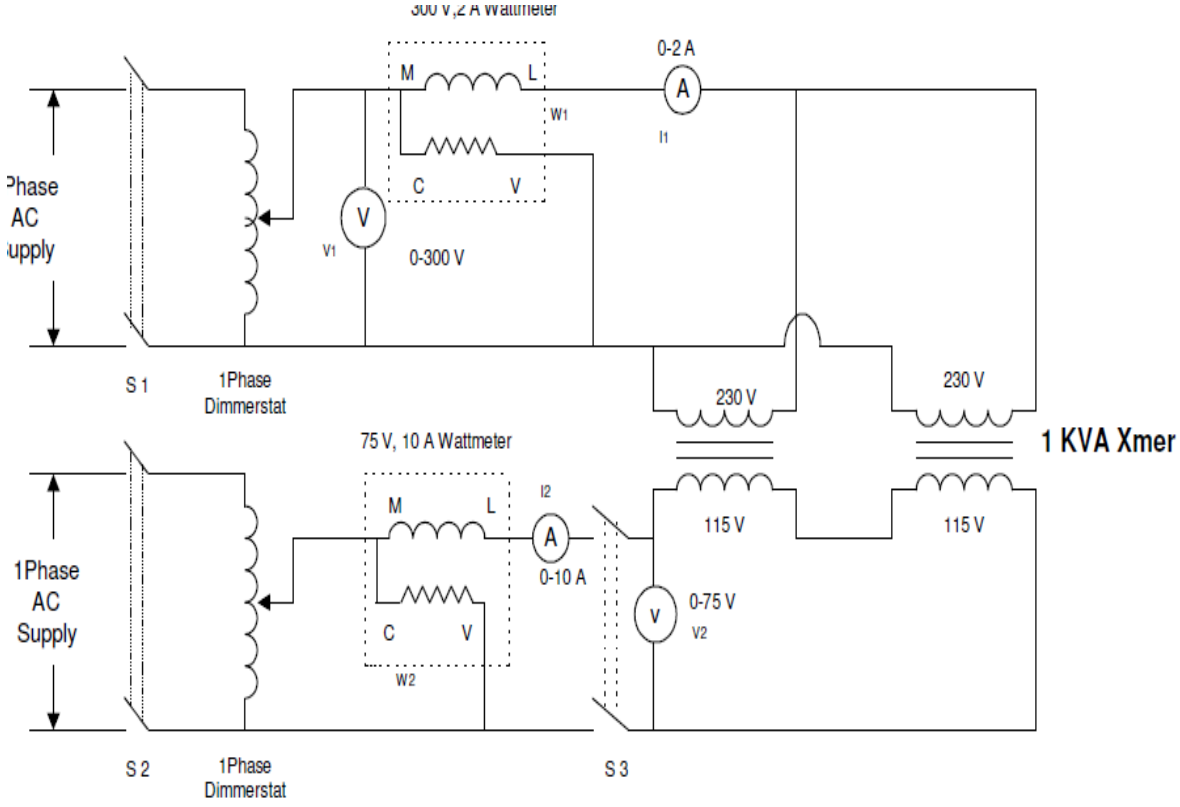
Experiment -1

Aim: TO PERFORM BACK TO BACK TEST ON SINGLE PHASE TRANSFORMERS.

Apparatus: 1) Two transformers, (1- phase, 1 kVA, 220 /115 V,)
2) Two dimmer stats, (0-270 V, 1- phase, 5 A)
3) Voltmeter, (0-300 V),(0-75 V)
4) Ammeter, (0-2 A), (0-10 A)
5) Wattmeter (0-300 V, 2 A),(0-75 V, 10 A)
6) Connecting wires

Circuit Diagram:



Procedure: 1) Make the connections as shown in circuit diagram.

2) Keep secondary windings.

3) Switch ON the supply and check the correctness of polarities of the two transformers. If V2 = 0 then polarities of connected transformers are correct i.e. connections are back to back and emf induced in secondaries are in phase opposition but if V2 = 2xKxV1, then secondary emfs are in phase, in that case change the polarities of any one secondary winding.

4) Note down the readings of V1, I1 and W1

5) Now close switch S2, S3 and increase dimmerstat output voltage gradually so that full load current flows through deviate from their earlier readings.

6) Note down V2 , I2 and W2. While doing so , the values shown by V1, I1 and W1 should not switches S2 & S3 open and the dimmerstats at zero position.

Observation Table:

Calculations:

Iron loss per transformer Wi = W1 / 2

Copper loss per transformer Wcu = W2 / 2

$$\% \text{ Efficiency} = \frac{\text{Output Power}}{\text{Output Power + Losses}} \times 100$$

$$\% _ = \frac{kVA \times \cos _}{kVA \times \cos _ + \text{Iron loss} + \text{Cu. Loss}} \times 100$$

With the help of above equation, calculate efficiency at

1. Full load, UPF

2. Half full load and 0.8 p.f. lagging.

Results: It is found that,

i) % Efficiency at F.L. & unity power factor =

ii) % Efficiency at half full load & 0.8 power factor (lag.) =

Viva Questions:

1. What is the condition to be satisfied by the two transformers to be tested using this method?

2. What is the main advantage of this test?

3. Other than losses and efficiency, what else can be determined from this test?

4. How are the full load conditions simulated?

5. How are the losses separated?

Experiment -2

D.C SHUNT MOTOR

OBJECT:

To study the variation of speed of a. d. c. shunt motor.

i) With armature voltage under constant field excitation, and

ii) With field excitation under constant armature voltage.

CIRCUIT DIAGRAM:

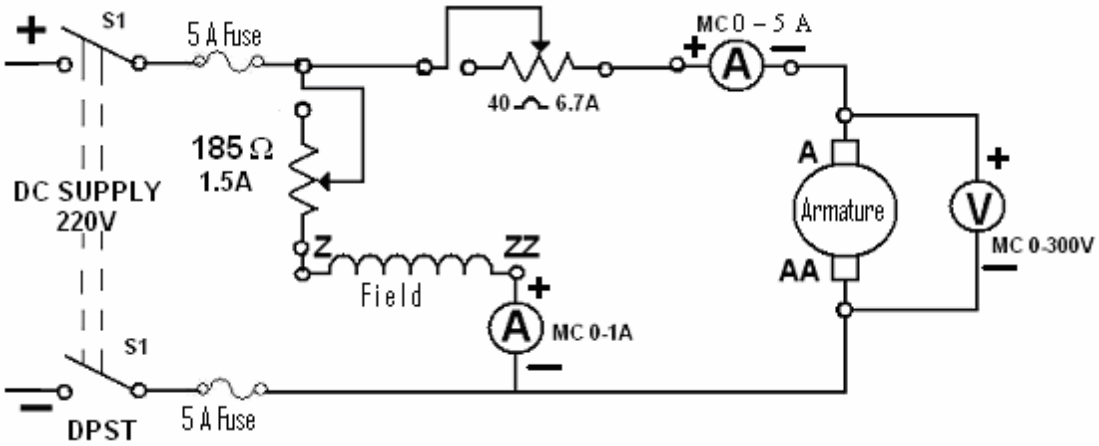


Fig. 1 Speed Control of D.C. Shunt Motor

PROCEDURE:

i) Connect the circuit as shown in figure – 1.

ii) Start the motor with maximum resistance in the armature circuit and minimum resistance in the field circuit.

iii) Bring the motor to the rated speed, first by decreasing the resistance in the armature circuit and then by increasing the resistance in the field circuit.

iv) Vary the resistance in the field circuit and take readings of speed and field current, keeping the armature voltage constant at a particular value.

v) Change armature voltage to another value and repeat the procedure given in – (iv)

vi) Then change the resistance in the armature circuit and take reading of speed and armature voltage, keeping the field current constant at a particular value.

vii) Change the field current to another value, repeat the procedure given in (vi).

viii) Take three sets of readings for each method of variation.

OBSERVATION :

Table I: Variation of speed with field excitation

S.NO	Field current(A)	Speed(rpm)	Constant Armature Voltage (V)

Table II : Variation of speed with armature voltage.

Sl. No.	Armature voltage (V)	Speed(rpm)	Constant field Current (A)

RESULTS :

i) Plot speed against field current for different sets of constant armature voltage on a graph paper.

ii) Plot speed against armature voltage for different sets of constant field current on another graph paper.

DISCUSSION :

i) Discuss and explain about the nature of the plots with relevant equations.

ii) Discuss about the limitations and merits of the two methods of speed control.

iii) Why do you keep the resistance in the armature circuit at a maximum, and resistance in the field circuit a minimum at start?

iv) What will happen when the field circuit gets opened, while the machine is running

v) At steady state condition, draw an equivalent circuit diagram for the DC shunt Motor and express it with a mathematical model.

Experiment -3

SWINBURN'S TEST

AIM **To predetermine the efficiency o the D.C. machine as**

(i) Motor

(ii) Generator

APPARATUS REQUIRED:-

Sl.No.	Name of the apparatus	Range	Type	Quantity
1.	Ammeter	(0 -10A)	MC	1
2.	Ammeter	(0 - 2 A)	MC	1
3.	Voltmeter	(0 - 300 V)	MC	1
4.	Rheostat	200, 2AΩ	-	1
5.	Tachometer	(0 - 10000rpm)	Analog	1

PROCEDURE

- **The connections are made as per the circuit diagram.**
- **The DPST switch is closed.**
- **The motor is started using three point starter.**
- **The field rheostat of the motor is adjusted to bring the motor speed to the rated value.**
- **The no load current, voltage and shunt field current are noted.**

PRECAUTION

- **The field rheostat should be kept at minimum resistance position.**
- **There should be no load at the time of starting the experiment.**

TABULAR COLOUMN

Sl. No.	Voltage, V (volts)	Field current, I_r (A)	No load current, I_0 (A)

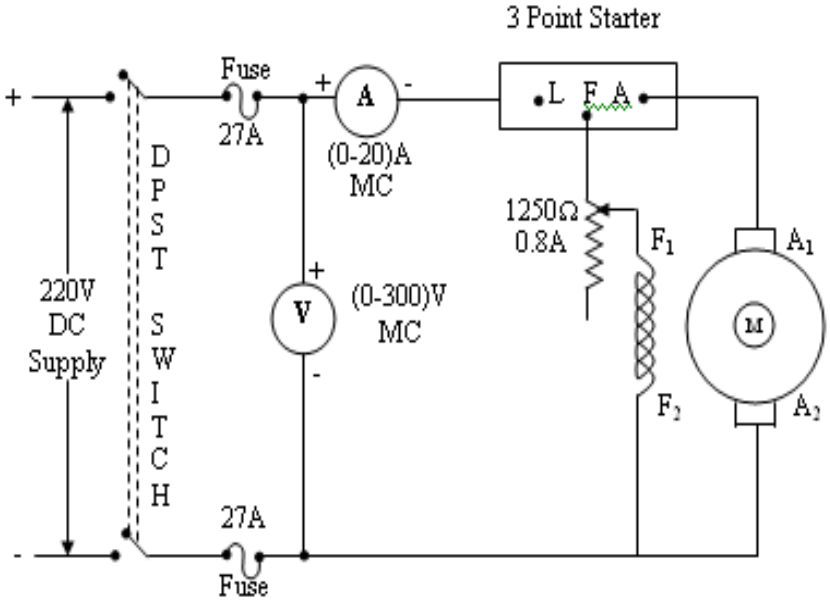
For generator

Sl. No.	Voltage (volts)	Load Current, I_L (A)	$I_a = I_L + I_f$ (A)	$I_a^2 R_a$	Total Loss (watts)	Input Power (watts)	Output Power (watts)	Efficiency %η

For motor

Sl. No.	Voltage (volts)	Load Current, I_L (A)	$I_a = I_L + I_f$ (A)	$I_a^2 R_a$	Total Loss (watts)	Input Power (watts)	Output Power (watts)	Efficiency %η

CIRCUIT DIAGRAM:



FUSE RATING:

125% of rated current

$$\frac{125 \times 21}{100} = 26.25A$$

NAME PLATE DETAILS:

Rated Voltage : 220V
Rated Current : 21A
Rated Power : 3.5KW
Rated Speed : 1500 RPM

RESULT

Thus the efficiency of the DC machine has been predetermined and characteristic were drawn.

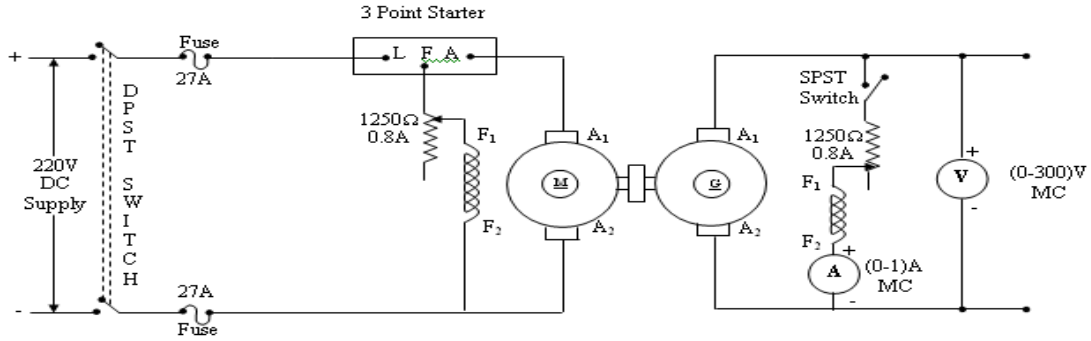
Experiment -4

AIM To draw the open circuit characteristics of self excited D.C. shunt generator

APPARATUS REQUIRED:-

Sl. No.	Name of the apparatus	Range	Type	Quantity
1.	Ammeter	(0 - 20A)	MC	1
2.	Ammeter	(0 - 2A)	MC	1
3.	Voltmeter	(0 - 300V)	MC	1
4.	Rheostat	200 Ω, 2A	-	1
5.	Tachometer	(0 - 10000rpm)	Analog	1

CIRCUIT DIAGRAM:



FUSE RATING:

125% of rated current

$$\frac{125 \times 21}{100} = 26.25A$$

NAME PLATE DETAILS:

	Motor	Generator
Rated Voltage :	220V	220V
Rated Current :	21A	21A
Rated Power :	3.5KW	7.5KW
Rated Speed :	1500 RPM	1500 RPM

Open Circuit Characteristics:-

PROCEDURE

- **The connections are made as per the circuit diagram.**
- **The DPST switch is closed.**
- **The motor is started using three point starters.**
- **By varying the field rheostat of the motor, the speed of the motor, is adjusted to the rated speed of the generator.**
- **The initial voltage due to residual magnetism in noted & The SPST switch should be closed.**
- **The field rheostat of the generator is varied in steps.**
- **In each step the ammeter and voltmeter readings are noted.**

PRECAUTION

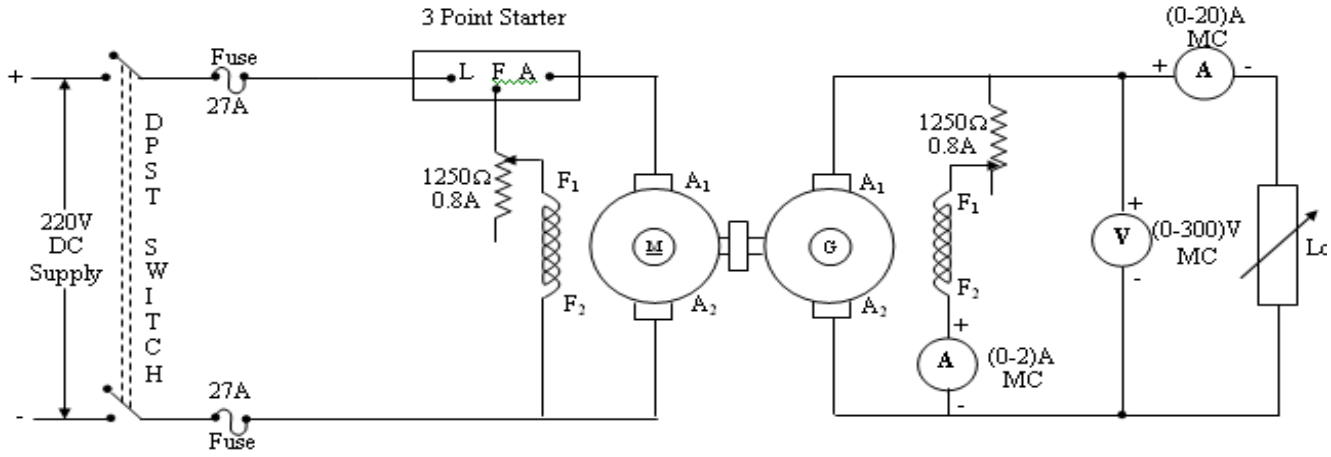
- **All the switches are kept open initially.**
- **The motor field rheostat is kept at minimum resistance position.**
- **The generator field rheostat is kept at maximum resistance position.**
- **The SPST should be kept open at the time of starting to find the residual voltage.**

TABULAR COLOUMN

Sl. No.	Field current, I_f Amperes	Generated EMF, E_g volts
1.		
2.		
3.		
4.		
5.		
6.		

Load test

CIRCUIT DIAGRAM:



FUSE RATING:

125% of rated current

$$\frac{125 \times 21}{100} = 26.25A$$

NAME PLATE DETAILS:

	Motor	Generator
Rated Voltage :	220V	220V
Rated Current :	21A	21A
Rated Power :	3.5KW	7.5KW
Rated Speed :	1500 RPM	1500 RPM

PROCEDURE

- **The connections are given as per the circuit diagram.**
- **The DPST of the motor side is closed.**
- **The motor is started using the 3- point starter.**
- **By varying the field rheostat of the motor, the speed of the motor is adjusted to the rated speed of the generator.**
- **The DPST switch of the generator side is closed.**
- **The load on the generator is applied in steps.**
- **At each step of loading the meter readings are noted.**
- **The procedure is repeated till the ammeter reads the rated current of the generator.**

PRECAUTION

- **All the switches are kept open initially.**
- **The motor field rheostat is kept at minimum resistance position.**
- **The generator field rheostat is kept at maximum resistance position.**
- **There should not be any load on the generator when start and stop the motor.**

TABULAR COLOUMN FOR LOAD TEST

Sl. No.	Voltage, V (Volts)	Current, I_L (Amperes)	Field current, I_f (Amperes)	Armature Current, I_a (Amperes)	Generated EMF, E_g (Volts)

MODEL CALCULATION:-

Armature current, $I_a = I_L = I_f$

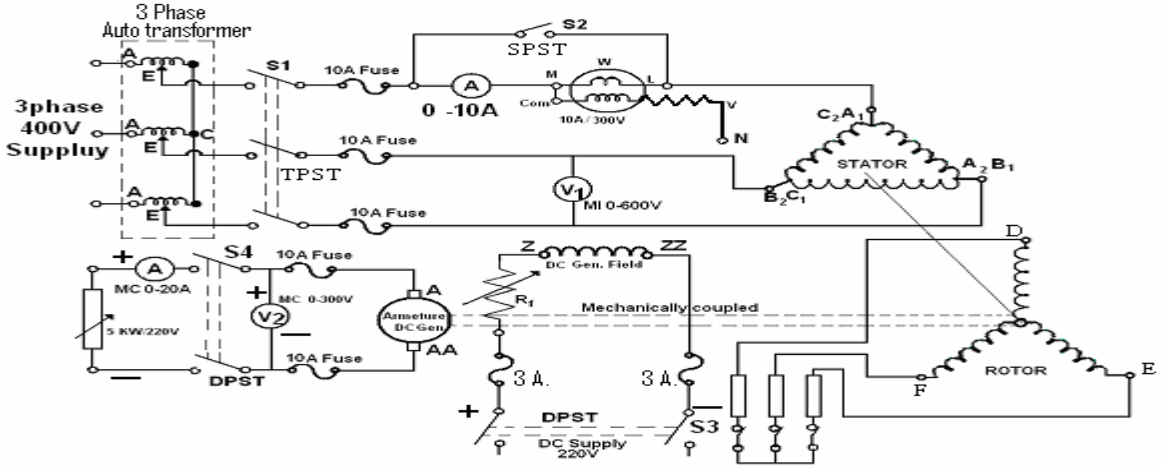
Generated EMF, $E_g = (V + I_a R_a)$

Experiment -5

INDUCTION MOTOR

1. OBJECT: i) To study the constructional features of three phase induction motor.
ii) To plot torque Vs slip characteristic of the motor over the operating range.
iii) To plot power factor and efficiency of the motor against the shaft load.
2. CIRCUIT DIAGRAM :

Figure 1.



2.1 Procedure:

Following steps are to be followed to carry out the experiment.

1. **Choose the appropriate ranges of various meters and connect the circuit as shown in Figure 1**
2. **Keep S_1, S_3 and S_4 open but S_2 closed.**
3. **Keeps the autotransformer setting to get zero output voltage.**
4. **Now close S_1 and gradually increase the applied voltage to the rated value of the induction machine.**
5. **The motor starts running at no load. Open the switch S_2 and note down all the readings as per Table 1. below.**
6. **Keep R*f* at its maximum value and close the switch S_3 to energise the field winding of the generator.**
7. **Adjust R*f* such that rated voltage is generated across the armature of the D.C. generator, V_2 indicates the generated voltage.**
8. **Ensuring that all the switches of the loading rheostat are open, close the switch S_4.**

9. Now start closing the switches of the loading rheostat in steps and record all the meter readings, including speed at the appropriate places in table. Note that the rated current of the induction motor should not be exceeded while closing the loading rheostat switches.

2.2 Computation & plots

1. Output power of generator = $P_{e\ output} = V_2A_2$

2. Shaft power of the induction motor, $P_{sh} = V_2A_2$ + Po, where Po is the constant rotational loss comprising of the frictional loss and core loss of the D.C. generator. (Note: Psh ignores small amount of D.C. armature copper loss)

3. Estimated shaft torque of the induction motor 602*shshPTnr*π= where *nr* is in rpm.

4. Calculated slip *rsnnsn*−

5. Total input power to the induction motor, P_{in} = 3W.

6. Operating power factor of the induction motor, 113*inPCosVA*θ=

7. Estimated efficiency of the induction motor, in*shPP*η=

Supply frequency = 50 Hz Recorded values						Calculated values				
Sl. No.	V1 (V)	A1 (A)	V2 (V)	A2 (A)	W (W)	Speed (rpm)	Slip %	T_{sh}	Cos θ	η_m
1.										
2.										
3.										
4.										

Table 1

Draw the following graphs:

1. Torque vs. slip.

2. Power factor vs slip.

3. Efficiency vs. slip

Experiment -6

HOPKINSON'S TEST

AIM: To conduct Hopkinson's test on a pair of identical DC machines to pre-determine the efficiency of the machine as generator and as motor.

APPARATUS REQUIRED:

S.No.	Apparatus	Range	Type	Quantity
1	Ammeter	(0-1)A (0-20) A	MC MC	1 2
2	Voltmeter	(0-300) V (0-600)V	MC MC	1 1
3	Rheostats	1250Ω, 0.8A	Wire Wound	2
4	Tachometer	(0-3000) rpm	Digital	1
5	Resistive Load	5KW,230V	-	1
6	Connecting Wires	2.5sq.mm.	Copper	Few

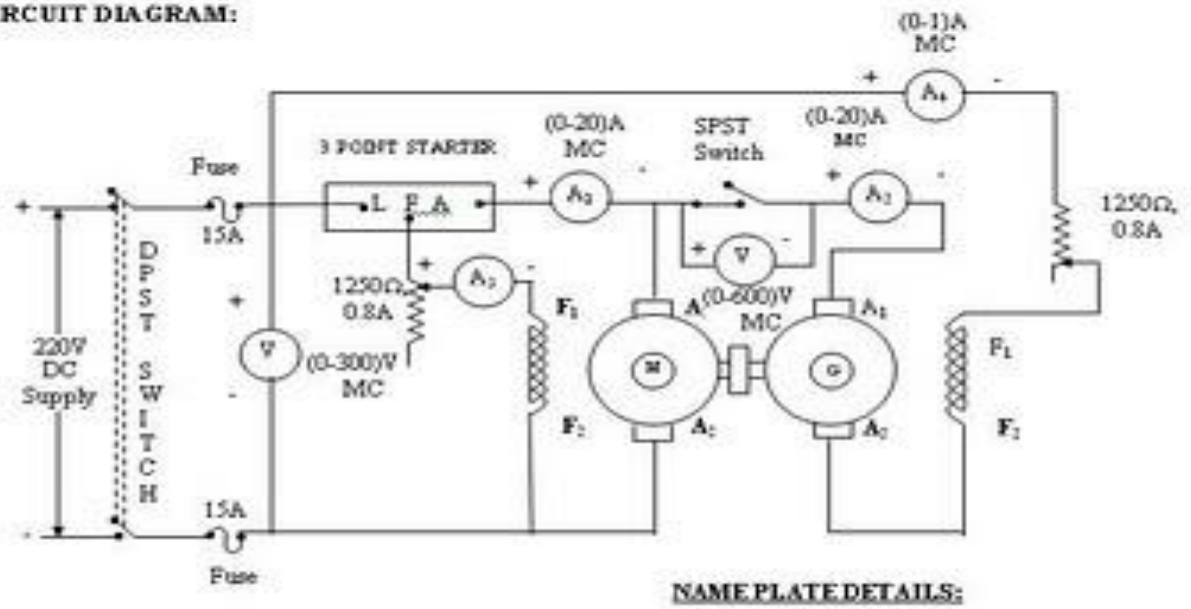
PRECATUIONS:

1. **The field rheostat of the motor should be in the minimum position at the time of starting and stopping the machine.**
2. **The field rheostat of the generator should be in the maximum position at the time of starting and stopping the machine.**
3. **SPST switch should be kept open at the time of starting and stopping the machine.**

PROCEDURE:

1. **Connections are made as per the circuit diagram.**
2. **After checking the minimum position of field rheostat of motor, maximum position of field rheostat of generator, opening of SPST switch, DPST switch is closed and starting resistance is gradually removed.**
3. **The motor is brought to its rated speed by adjusting the field rheostat of the motor.**
4. **The voltmeter V_1 is made to read zero by adjusting field rheostat of generator and SPST switch is closed.**
5. **By adjusting field rheostats of motor and generator, various Ammeter readings, voltmeter readings are noted.**
6. **The rheostats and SPST switch are brought to their original positions and DPST switch is opened.**

CIRCUIT DIAGRAM:



NAME PLATE DETAILS:

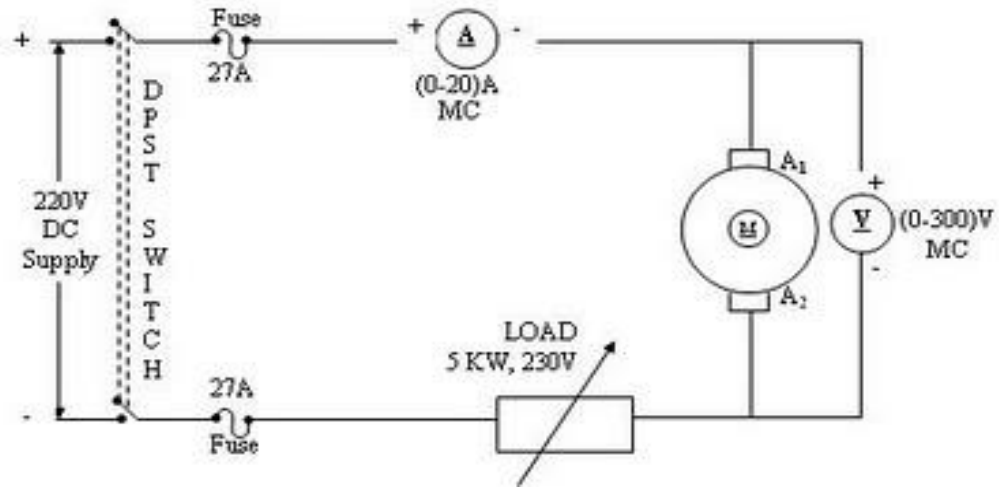
	SHUNT MOTOR	SHUNT GENERATOR
Rated Voltage :	220V	220V
Rated Current :	21A	21A
Rated Power :	3.5KW	7.5KW
Rated Speed :	1500 rpm.	1500rpm.

TABULAR COLUMN: AS MOTOR:

S.No.	Supply Voltage V(Volts)	I_1 (Amps)	I_2 (Amps)	I_3 (Amps)	I_4 (Amps)	$I_1 + I_2$ (Amps)	Motor Armature Cu Loss W (watts)	Generator Armature Cu Loss W(watts)	Total Stray losses W (watts)	Stray Loss Per M/c w/2 (watts)

AS GENERATOR:

DETERMINATION OF ARMATURE RESISTANCE:



PROCEDURE:

1. Connections are made as per the circuit diagram.

2. Supply is given by closing the DPST switch.

3. Readings of Ammeter and Voltmeter are noted.

4. Armature resistance in Ohms is calculated as R_a = (Vx1.5) /I

TABULAR COLUMN:

S.No.	Voltage V (Volts)	Current I (Amps)	Armature Resistance R_a (Ohms)

FORMULAE:

Input Power = VI_1 watts
Motor armature cu loss = $(I_1+ I_2)^2$ Ra watts
Generator armature cu loss = I_2^2 Ra watts
Total Stray losses W = $V I_1 - (I_1+I_2)^2 Ra + I_2^2 Ra$ watts.
Stray loss per machine = W/2 watts.

AS MOTOR:

Input Power = Armature input + Shunt field input

= $(I_1+ I_2) V + I_3V = (I_1+I_2+I_3) V$

Total Losses = Armature Cu loss + Field loss + stray loss

= $(I_1 + I_2)^2$ Ra + VI_3 + W/2 watts

$$\text{Efficiency } \eta\% = \frac{\text{Input power – Total Losses}}{\text{Input Power}} \times 100\%$$

AS GENERATOR:Output Power = VI_2 watts

Total Losses = Armature Cu loss+ Field Loss + Stray loss
= I_2^2 Ra + VI_4 + W/2 watts

$$\text{Efficiency } \eta\% = \frac{\text{Output power}}{\text{Output Power+ Total Losses}} \times 100\%$$

RESULT:

Thus Hopkinson's test is conducted on a pair of identical DC machines the efficiency of the machine as generator and as motor are pre-determined

Experiment -7

LOAD TEST ON DC SHUNT MOTOR

AIM: To conduct a load test on DC shunt motor and to find its efficiency

APPARATUS REQUIRED:

S.No.	Apparatus	Range	Type	Quantity
1	Ammeter	(0-20)A	MC	1
2	Voltmeter	(0-300)V	MC	1
3	Rheostat	1250□, 0.8A	Wire Wound	1
4	Tachometer	(0-1500) rpm	Digital	1
5	Connecting Wires	2.5sq.mm.	Copper	Few

PRECAUTIONS:

1. DC shunt motor should be started and stopped under no load condition.
2. Field rheostat should be kept in the minimum position.
3. Brake drum should be cooled with water when it is under load.

PROCEDURE:

1. Connections are made as per the circuit diagram. Circumference of the Brake drum = cm.
2. After checking the no load condition, and minimum field rheostat position, DPST switch is closed and starter resistance is gradually removed.
3. The motor is brought to its rated speed by adjusting the field rheostat.
4. Ammeter, Voltmeter readings, speed and spring balance readings are noted under no load condition.
5. The load is then added to the motor gradually and for each load, voltmeter, ammeter, spring balance readings and speed of the motor are noted.

The motor is then brought to no load condition and field rheostat to minimum position, then DPST switchis opened

FORMULAE:

$$R = \frac{\text{Circumference}}{} \text{ m}$$

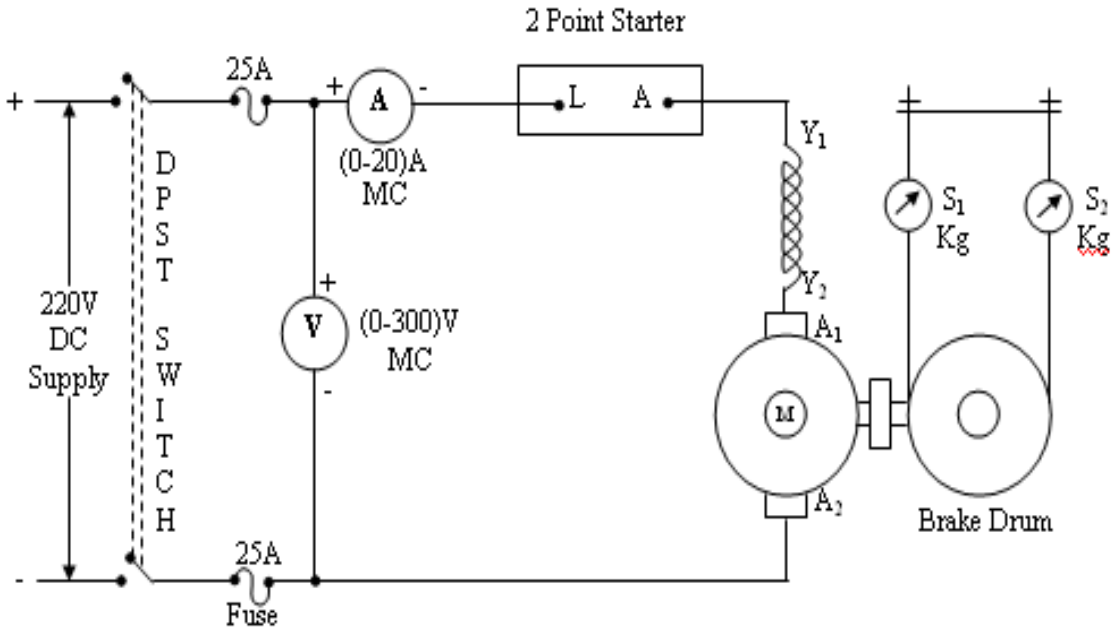
$$\text{Torque } T = (S1 - S2) \times R \times 9.81 \text{ Nm}$$

$$\text{Input Power } Pi = VI \text{ Watts}$$

$$\text{Output Power } Pm = \frac{2\pi NT}{60} \text{ Watts}$$

$$\text{Efficiency } \eta\% = \frac{\text{Output Power}}{\text{Input Power}} \times 100\%$$

CIRCUIT DIAGRAM:



FUSE RATING:

125% of rated current

$$\frac{125 \times 20}{100} = 25A$$

NAME PLATE DETAILS:

Rated Voltage : 220V
Rated Current : 20A
Rated Power : 5KW
Rated Speed : 1500 RPM

Experiment -8

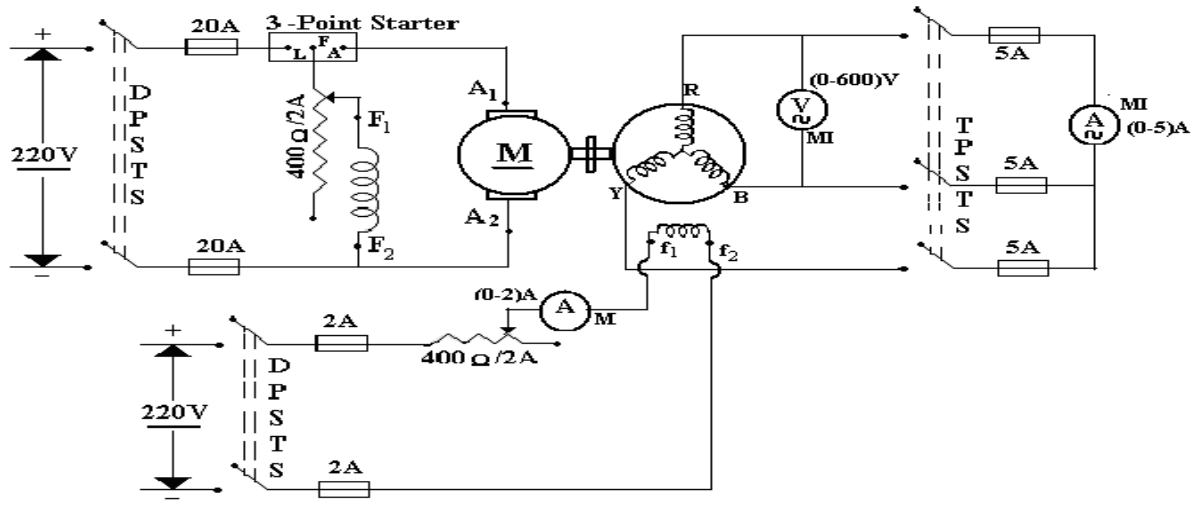
V AND INVERTED V CURVES OF THREE PHASE SYNCHRONOUS MOTOR

AIM:To draw the V-Curves and inverted v-curves of the given three phase synchronous motor by constant output.

APPARATUS REQUIRED:

S. No. Name of the Equipment Range Type Qty

Circuit diagram for OC & SC Test



PRECAUTIONS:

1. The field rheostat of motor should be in minimum resistance position initially.

2. The field rheostat of alternator should be in maximum resistance position while starting.

PROCEDURE:

OC Test:

1. Connections are made as per the circuit diagram

2. DPST – I is closed and the motor is started using a 3 point starter

3. The field rheostat of motor is adjusted to give rated speed of alternator.

4. DPST – 2 is closed and the field rheostat of alternator is adjusted to get various voltages and corresponding field currents are noted. This procedure is repeated up to rated field current.

SC Test:

1. Connections are made as per the circuit diagram.

2. DPST – I is closed and the motor is started using a 3 point starter.

3. The field rheostat of motor is adjusted to get rated speed of the alternator.

4. The field rheostat of alternator is adjusted to get rated current in the armature of alternator.

5. This value of Isc and the corresponding If are noted.

6. The field rheostat of alternator is brought back to maximum resistance Position and the field rheostat of the motor is brought back to minimumResistance position.
7. Open the DPSTS.
Determination of Ra:
1. Connections are made as per the circuit diagram
2. DPSTS is closed and the rheostat is adjusted
3. For various values of voltages the value of current is noted
4. The rheostat is brought back to maximum position

Open Circuit Test
S.No. No load voltage V0 No Load Field Current

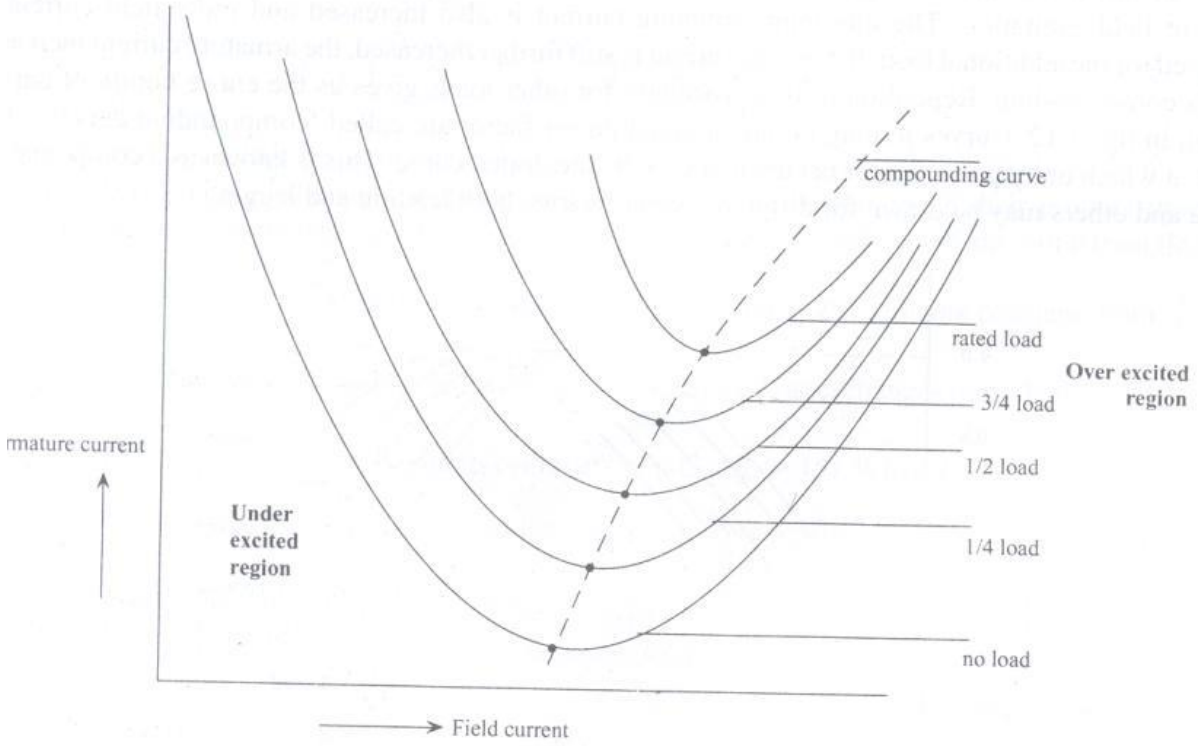
Short Circuit Test:

S.No. Rated I(A) If (A)

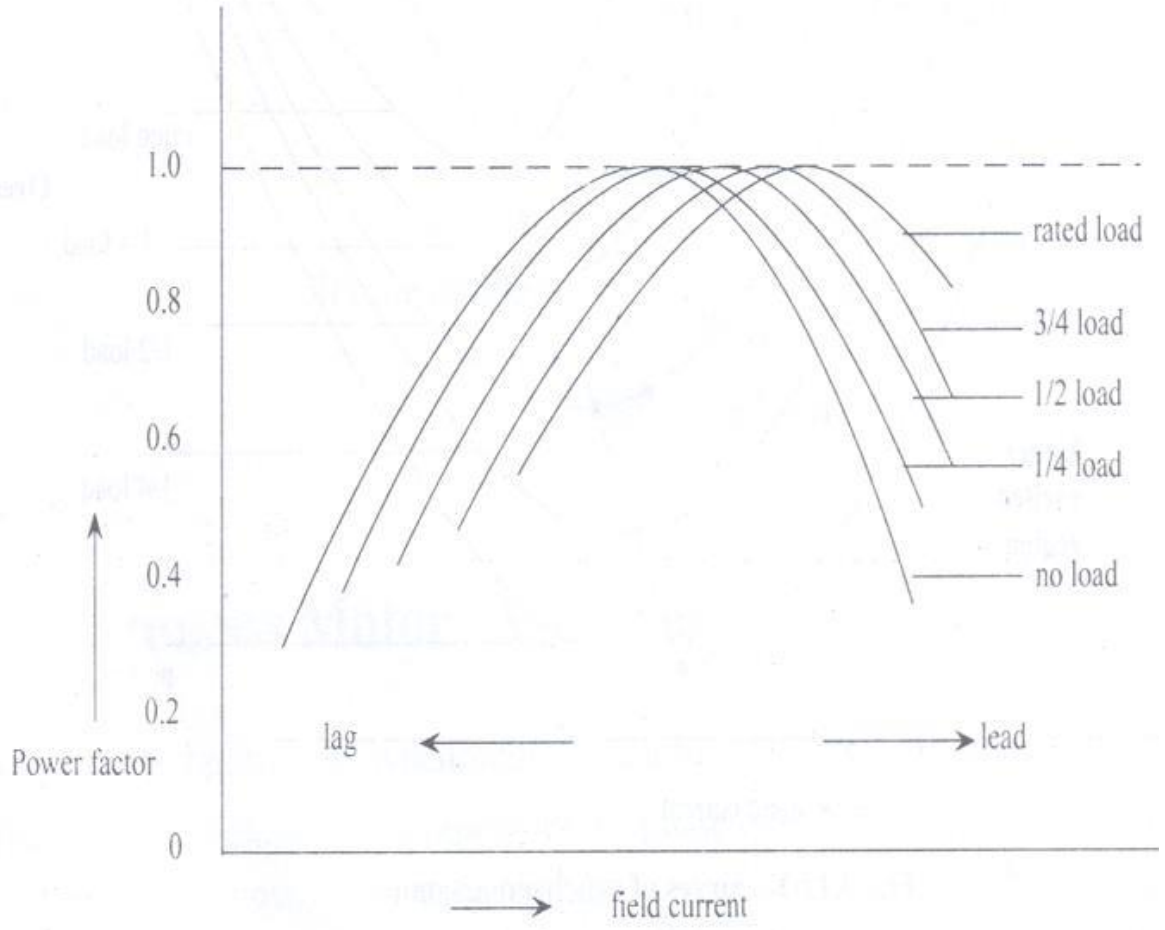
FORMULAE USED:
Ra= Rdc* 1.3
Zs= Vph/Isc
Xs= □((Zs
2-Ra
2)
□=tan-1(Xs/Ra)
Iphcos□= P/□3VL
SYNCHRONOUS REACTANCE:
OCC and SC characteristic are drawn as shown. The field current OA gives the rated voltage per phase RV.
The same field current RA given as armature current OB on short circuit.
Therefore Synchronous Impedance, ZS=OV/OB
Therefore Synchronous Reactance, XS=√ZS
2 –RS
2
CONSTANT INPUT POWER LINE:
Let P be the constant total input to the synchronous motor. Therefore constant input power per phase equals
P/3. Therefore Vph*Iph*cosΦ=P/3
Iph* cosΦ=P/3Vph
Since P & V are constant Iph*cosΦ is also a constant.
The reference OV1 is drawn to represent V as shown in the figure.

The vector OR is equal to Vph/ZS is drawn lagging OV1 by an angle

MODEL GRAPH:
V Curves.



Where α = tan-1(XS/Rac) OS is made equal to IphcosΦ. At □□a line STU is drawn perpendicular to the reference
vector OV1. This line represents the constant input power line.
CONSTANT EXCITATION CIRCLES:
OR=Vph/Zph represents 100% excitation with R as centre and OR as radius a circle is drawn. This circle is known as 100% excitation circle. Similarly constant excitation circle cuts the constant input power line at T.



RESULT: Thus V-curves and inverted V curves of synchronous motor were drawn.

Experiment -9

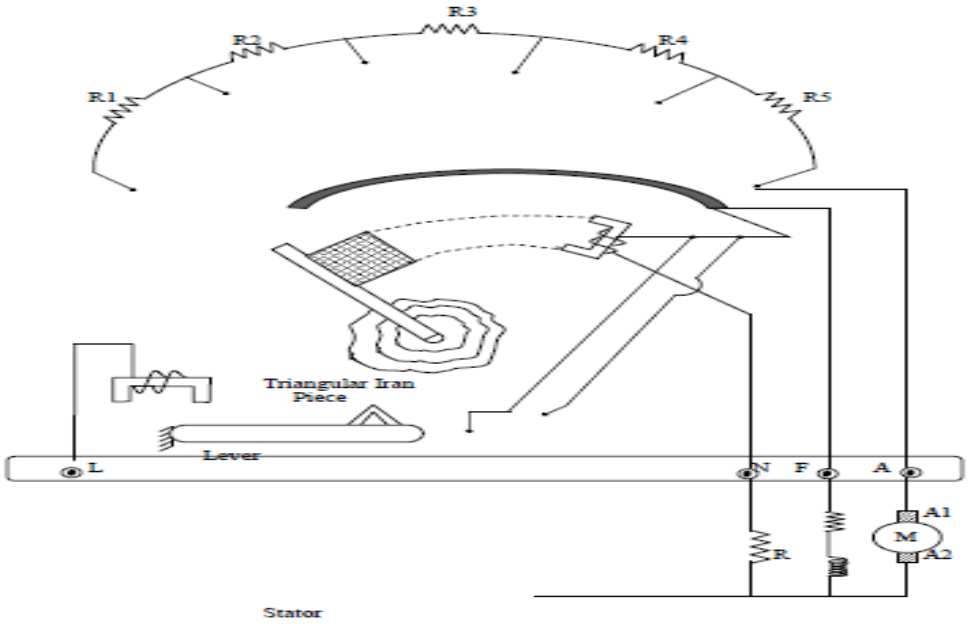
SYUDY OF DC MOTOR STARTERS

AIM: To study about the DC motor starter.

TWO POINT STARTER:

A two point starter is used for switching a series motor which has the problem of over spreading due to loss at
the load from the shaft. Here for starting the motor, the control on in moved clockwise from its position against
the spring tension. The control arm is held in the 'ON' position by an electromagnet. This held on electro magnet connected in series with the armature circuit. If the motor losses it load current and hence the strength of the electromagnet also decreases. The control arm return to the DFF position due to a spring tension, thus the preventing motor from over spreading the starter which are connected with the supply
and motor terminals.

THREE POINT STARTER:

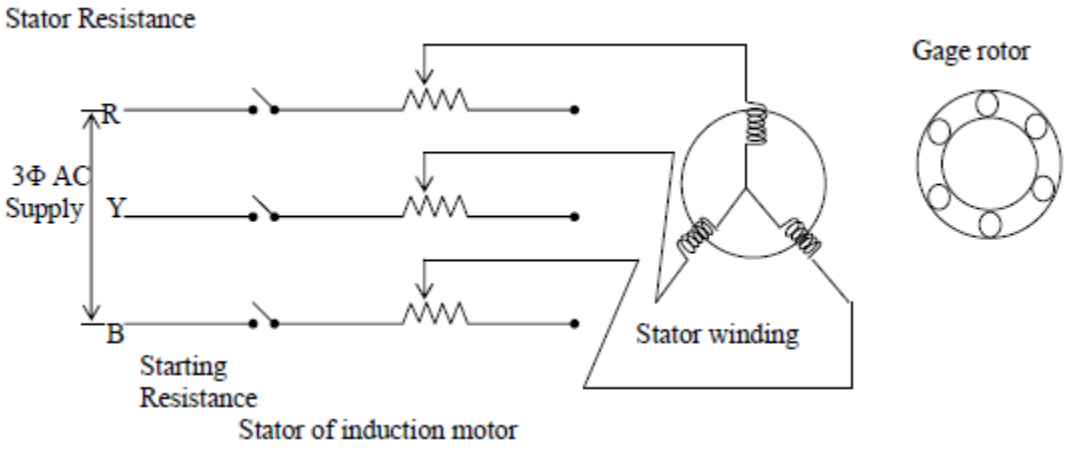


THREE PHASE INDUCTION MOTOR STARTERS:

1. AUTO TRANSFORMERS:

It is also known as autotransformers or compensator. It consists of an autotransformers with necessaryswitches or three phase transformers reduced voltage is applied to the motor when the motor pick up 80%. So,

that the transformer is out-out and full voltage is given to the motor most of the autotransformer are provided
with 3 sets of tops so as to reduce the voltage to 85, 60 up to 50% of the line voltage. Again the autotransformer
starter may also be provided with stop overload protection and interlocks. The completer scheme of the starter
also included.
(a) Interlocks to ensure reduced voltage starting.
(b) Protection against over load etc..,
2. STAR – DELTA STARTER:
The three phase induction motor to be started with the help of the star delta starter must hae its six terminals of
the stator winding available. (A1 – A2), (B1 – B2), (C1 – C2). Thus for a 415v across each phase of the stator
winding during running.The stator winding is connected in star during starting. Thus for a 415v each winding
phase gets 415/_3 = 230V. The starting current is thus reduced in the same proportion (1 : _3) and the starting
torque isreduce to 1 : 1/_3 compared with the values with full starting. Thus a reduced voltage is applied to the
motor during starting.After the motor starts and attains speed. The connections are changed to delta with the
help of the stator and the motor operations at full voltage and hence runs under normal conditions. The star
delta starters has the reconnecting arrangement and in addition it has the following features.
1. An interlock to prevent direct switching to delta position.
2. A push button (or) knob to stop from running condition. After operating this, the switch isbrought to the OFF position.
3. An over load protection



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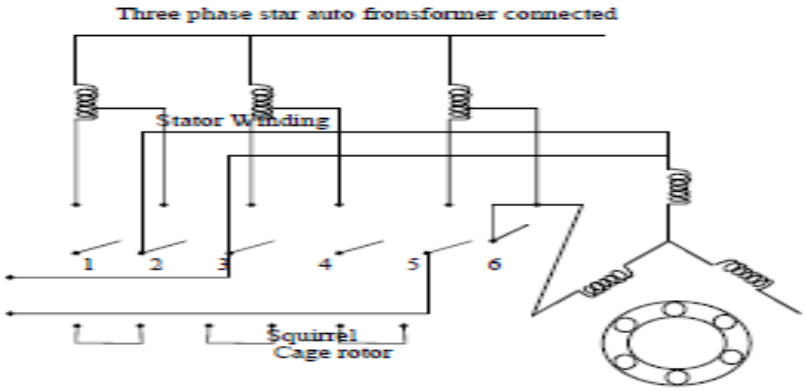
.This method is used in the case of the motor which one built t run normally with a delta connected starter
winding. It consists of two way switch connect the motor in star for starting and then delta for normal running. The star connected applied voltage by a factor of 1/_3 and hence the torque developed
because 1/_3 of that of which would have been developed if the motor war directly connected in the delta. The three types of star delta starters are:

1. Hand Operated
2. Semi Automatic
3. Fully Automatic

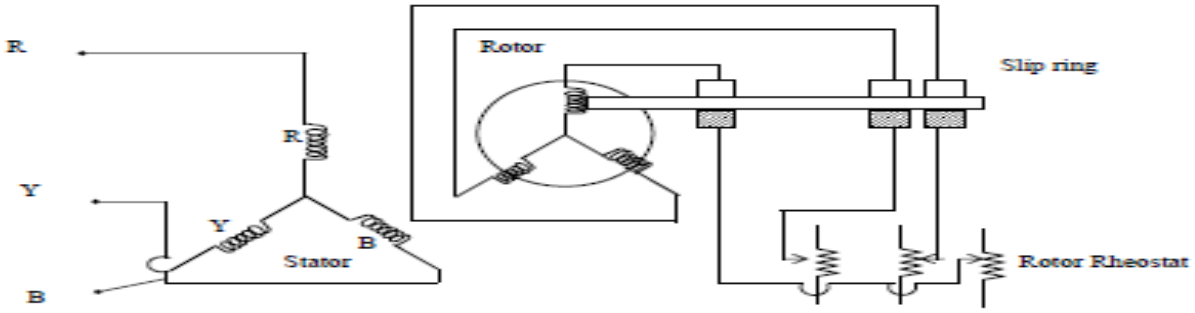
3. DIRECT ON LINE STARTER (or) D.O.L. STARTER:

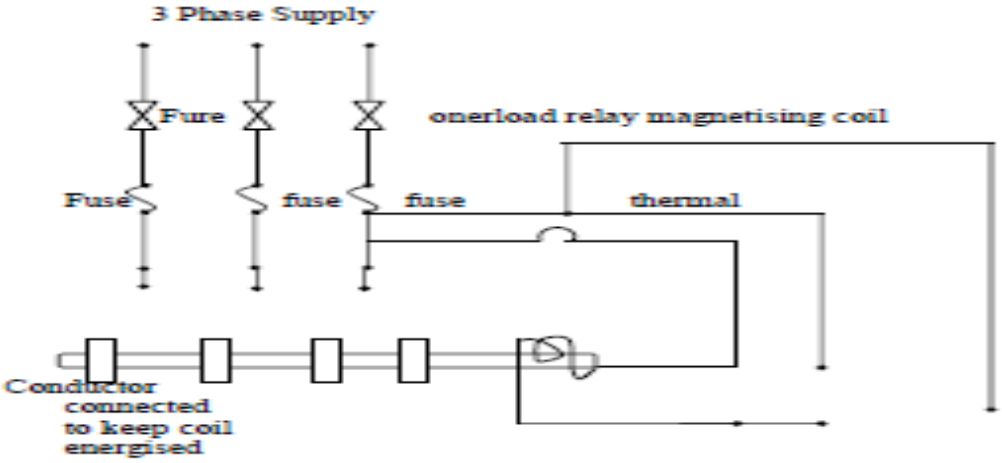
When fully voltage is supplied across the starters of indction motor, lot of current in drawn by the winding. This is because at the time of starting the induction motor are started using direct on line starter on heavy starting curent will flow through the winding such as heavy starting current of short duration may not cause to the motor. Since the construction of induction motor are rugged. More over it takes time for temperature rise to endanger the utilization of motor windings. But this heavy impression current will cause large voltage drop with the linear during the period of motor A direct alternate method at starting of induction motor is application up to starting of induction motor. The ON push button is pressed coil A becomes energized and if open contacts are closed when OFF button push button is pressed in a will get energized and main contacts of the conductor open when the motor starts, in case of overload on the motor the contact of over load may be opened and sub sequently the motor will stop. In case of over load the overload relay also opens the circuit of the coil and the contactor opens. In case of a supply failure while the motor is running, the coil is deenergized and the motor is isolated from the supply lines. After the supply is resumed the operator has to operate the start push button for running the motor

ROTOR RESISTANCE STARTER

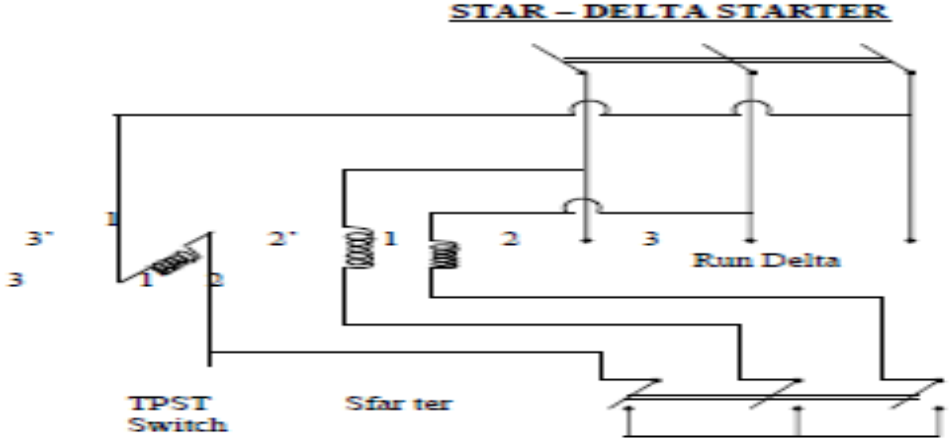


ROTOR RESISTANCE STATOR





STAR – DELTA STARTER



If is used for starting a shunt on compound motor will at the load held on electromagnet is connected in series with the shunt field coil. In case at disconnection in the field circuit due to the internal feature (or) field rheostat failure. The control arm will retain to its OFF position due to spring tension. It is necessary because the shunt motor will over speed is it losses the field ecitation. The starter also retains to the OFF position in case of low supply using no volt release over load protection for the motor can be interrupted by connecting another electromagnetic coils. This coil falls on iron piece upwards within short circuit the coil ab hold down electromagnet. The electromagnet gets reenergized and three force the starter arm return to 'OFF' position. Thus protecting the motor against overload. If should be noted that (L, F, A) are three terminals of a three point starter use at a grass strip as shown in fig enables can't of the field circuit directly with the supply is stead of via the starter resistance.

FOUR POINT STARTER:

When compared tot three point starter it will be noticed that one important change has been taken at the shunt field circuit and has been connected directly access the time through a protecting resistance. When the arm touches stud no. I the line current divides into three parts.

1. One part posses through the starting resistance Rs series field and motor armature.

2. The second part posses through the shunt field and its field.It should be particularly noted that this

arrangement any change at current is the shunt field doesn't offer the current passing through the motion coil. It means the electromagnet full excited by the hold on coil.

DIRECT ON LINE STARTER (or) D.O.L. STARTER:

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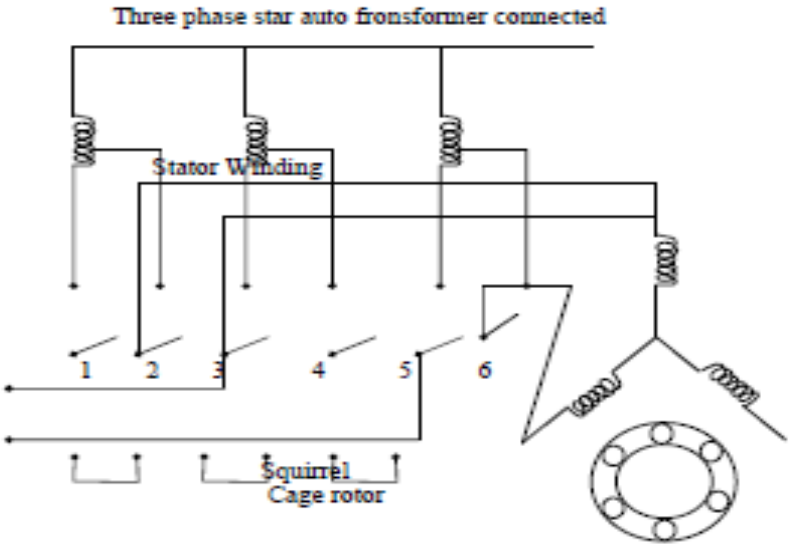
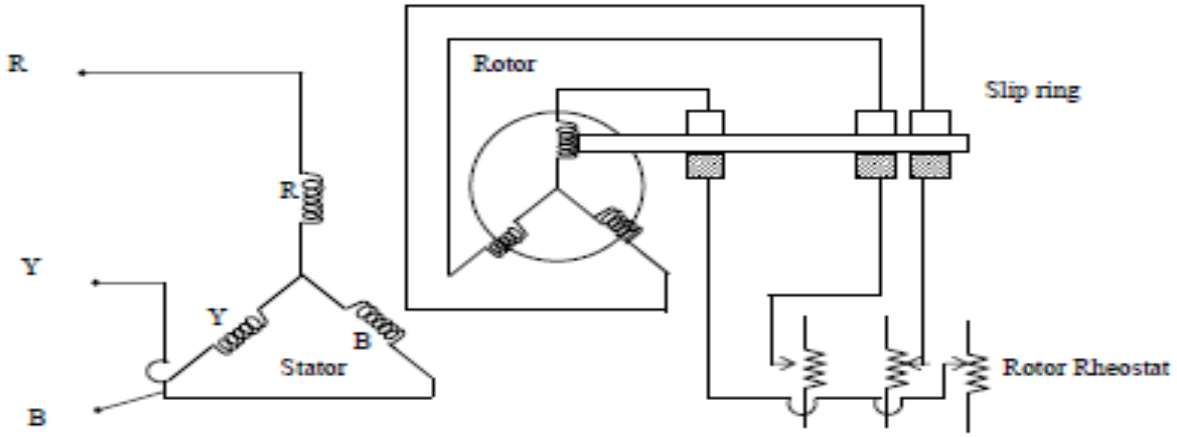
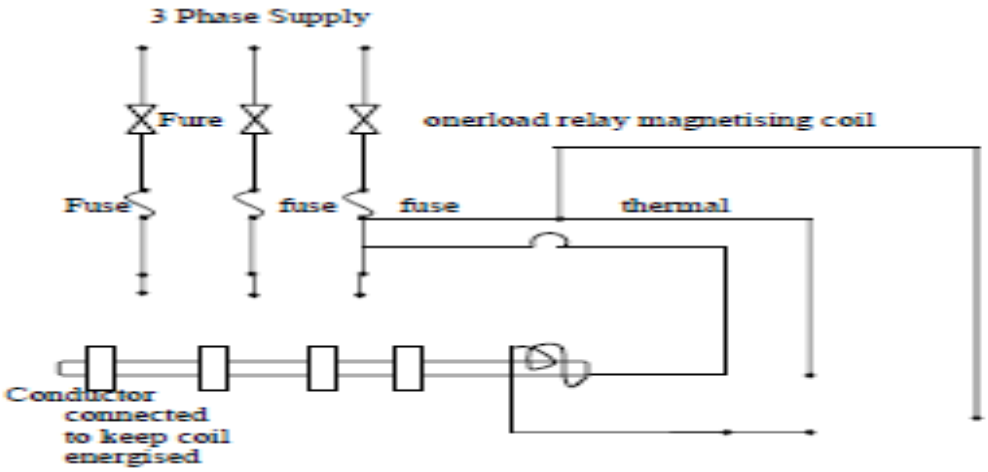
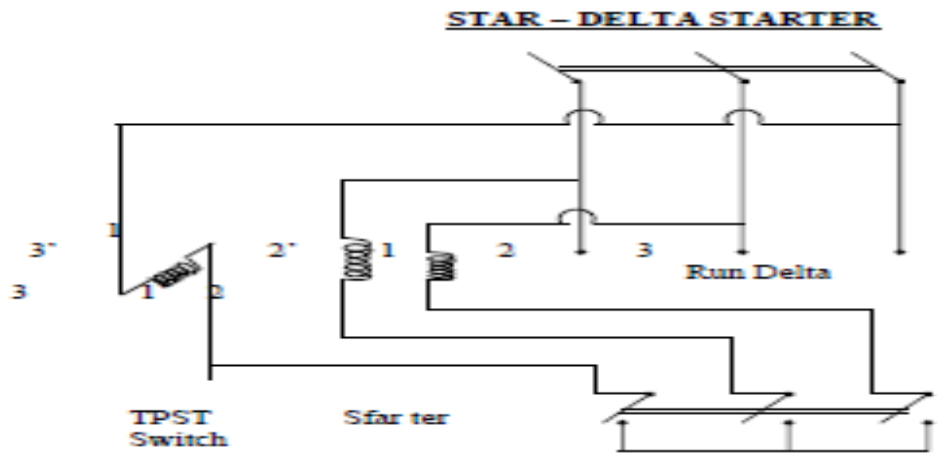
ROTOR RESISTANCE STARTER



ROTOR RESISTANCE STATOR







RESULT:

Thus the DC and AC Motor starters were studied