Speed Control Of D.C Shunt Motor

Exp. No: **Date:**

Aim: To Study the variation of speed of D.C Shunt motor

i. By varying armature voltage under constant field excitation (Armature voltage control method).

ii. By varying field excitation under constant armature voltage (Field current control method).

Name Plate Details: **Motor**

1. HP/ KW : 2/ 1.3
2. Armature Voltage: 220 V
3. Armature Current: 8A
4. Field Voltage: 220 V
5. Field Current: 0.7A
6. Speed: 1500 RPM
7. Insulation Class: B

Apparatus required:

S No	Name of the equipment	Range/ Specification	Type	Quantity
1	Voltmeter	(0-300) V	MC	1
2	Ammeter	(0-10) A	MC	1
3	Ammeter	(0-1) A	MC	1
4	Rheostat	100Ω, 5A 350Ω, 1.5A	Wire wound	1 1
5	3-Point starter	-	-	1
6	Tachometer	60-1,00,000 RPM	Digital	1
7	Connecting wires	2 Sq.mm	Copper	Adequate

Procedure:

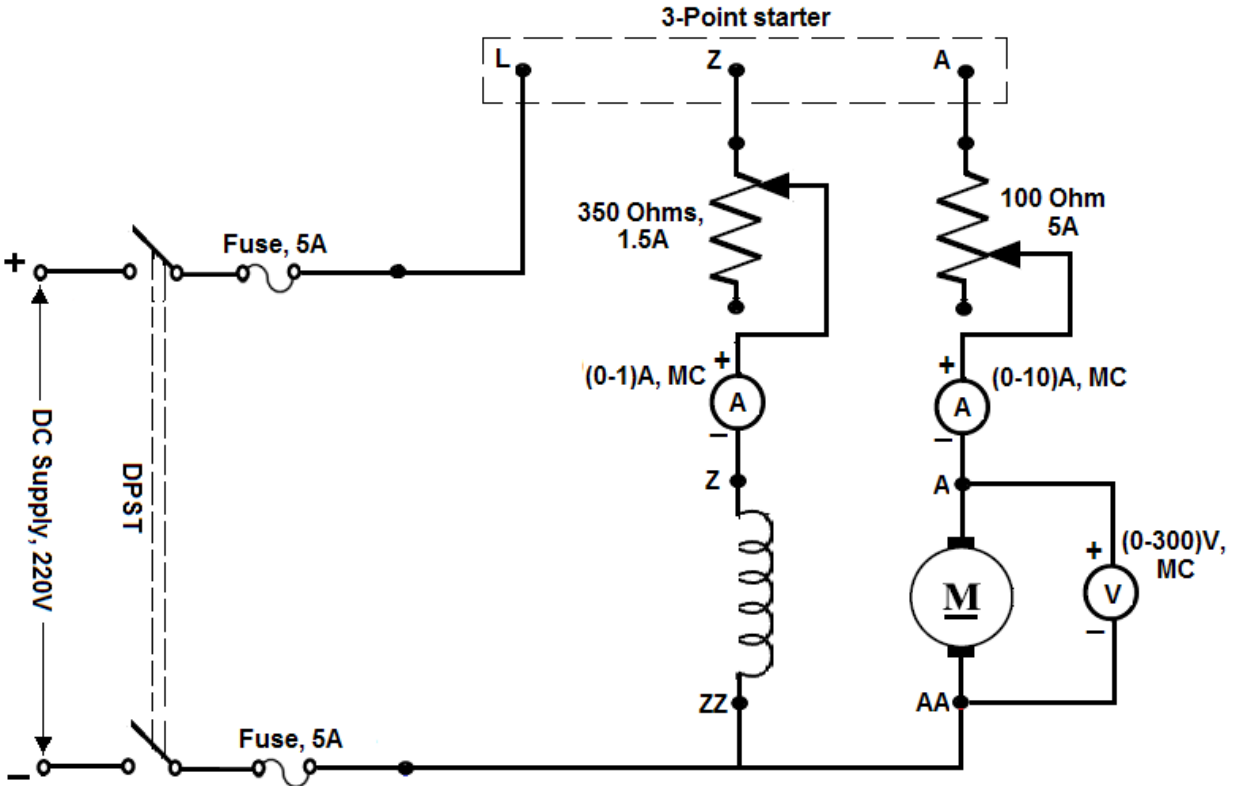
1. Connect the circuit as per the circuit diagram.
2. Initially keep the motor with maximum resistance (rheostat in maximum position) in the armature circuit and minimum resistance (rheostat in minimum position) in the field circuit.
3. Start the motor by closing DPST and move the starting arm of the 3- point starter slowly in clockwise direction.
4. Bring the motor to the rated speed (1500 RPM), first by decreasing the resistance in the armature circuit and then by increasing the resistance in the field circuit.

Field control method:

5. Keeping the armature voltage constant at a particular value i.e (keep the armature rheostat constant), vary the resistance (Increase) in the field circuit and take readings of speed and field current.

Armature control method:

6. Bring the resistance in the armature circuit to maximum and resistance in the field circuit to minimum.
7. Bring the motor to the rated speed (1500 RPM), first by decreasing the resistance in the armature circuit and then by increasing the resistance in the field circuit.
8. Keeping the field current constant at a particular value, change the resistance (Increase) in the armature circuit and take reading of speed and armature voltage.
9. Switch off the power supply after putting all the rheostats in initial positions.



Circuit Diagram for DC Shunt Motor

Tabular column: Field current control

S No	Speed **(N)**	Field current **(I_f)**	Constant armature voltage **(V_a)**

Tabular column: Armature voltage control

S No	Speed **(N)**	Armature voltage **(V_a)**	Constant Field current **(I_f)**

Theoretical calculations:

the EMF equation of DC motor is equal to:

- $E = \frac{N\ P\ \emptyset\ Z}{60A}$

Hence rearranging the equation:

- $N = \frac{60A\ E}{PZ\emptyset}$

With k = PZ/60A, then:

- $N = \frac{E}{k\emptyset}$

Hence with $E = V - I_a R_a$ we derive the speed of the DC motor (N):

V=Supply Voltage

$I_a\ R_a$= Armature Ohmic drop

E= Generated EMF/ Back EMF in the armature

- $\boldsymbol{N} = \frac{V - I_a R_a}{K\emptyset} = \frac{E}{\emptyset}$

From the above speed relations the speed of DC Shunt motor can be varied by changing

1. The applied voltage to the armature
2. Flux/Pole (Field flux control)

Model graph:

1. Plot the graph against speed (Vs) armature voltage for constant field current
2. Plot the graph against speed (Vs) field current for constant armature voltage

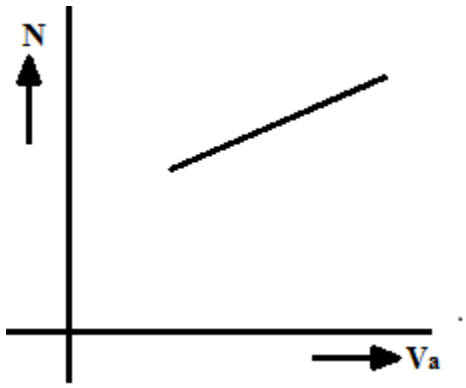


Fig: 1

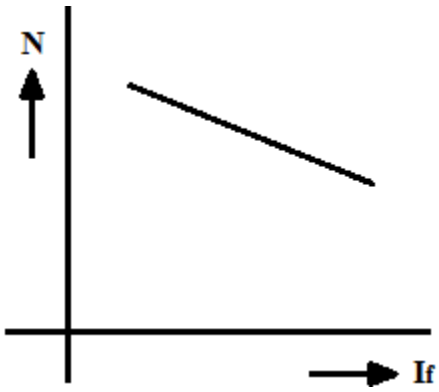


Fig: 2

Precautions:

1. Connections should be tight
2. Check the connections before switching on the supply
3. Readings should be taken without parallax errors.

Result: