

EEE 270

(Electrical Drives and Instrumentation Sessional)

EXPT. NO.

03

NAME OF THE EXPERIMENT:

CHARACTERISTICS OF A DC SHUNT GENERATOR.

<u>Group No.</u>	05
<u>Student Name</u>	SAEM HASAN
<u>Student ID</u>	1705027
<u>Section</u>	A-1
<u>Department</u>	CSE
<u>Date of Performance:</u>	20-10-2020
<u>Date of Submission:</u>	10-11-2020

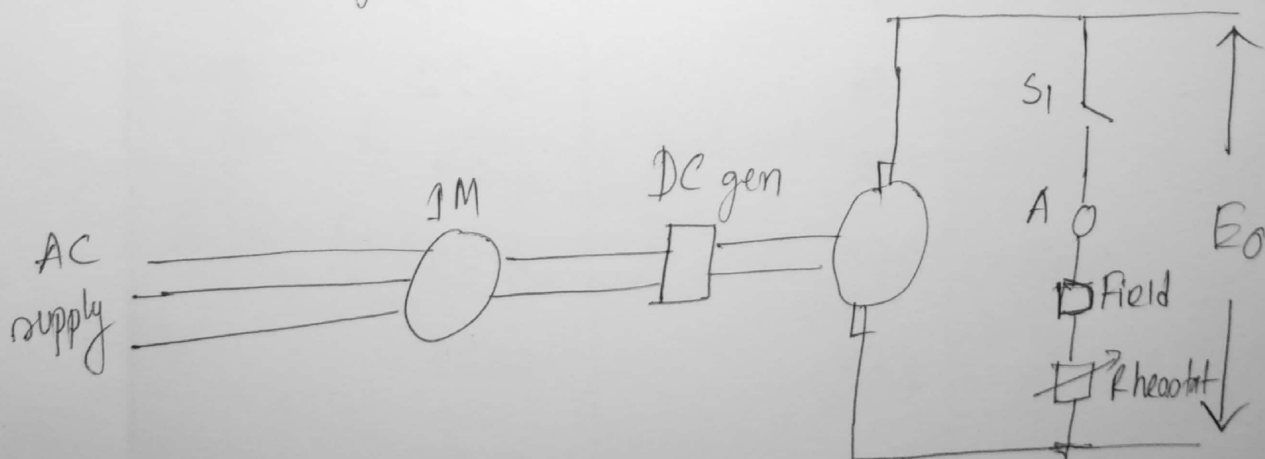
Objective

This experiment is conducted to draw the O.C.C. curve (E_o vs I_f) of a D.C. shunt generator for two different speeds.

Apparatus:

1. One D.C. voltmeter (0-300V)
2. Two D.C. ammeters (0-5A, 0-50A)
3. Tachometer
4. One SPST switch
5. Rheostat (0-360 Ω , 1.1A)
6. One AC surge motor generator couple

Circuit Diagram

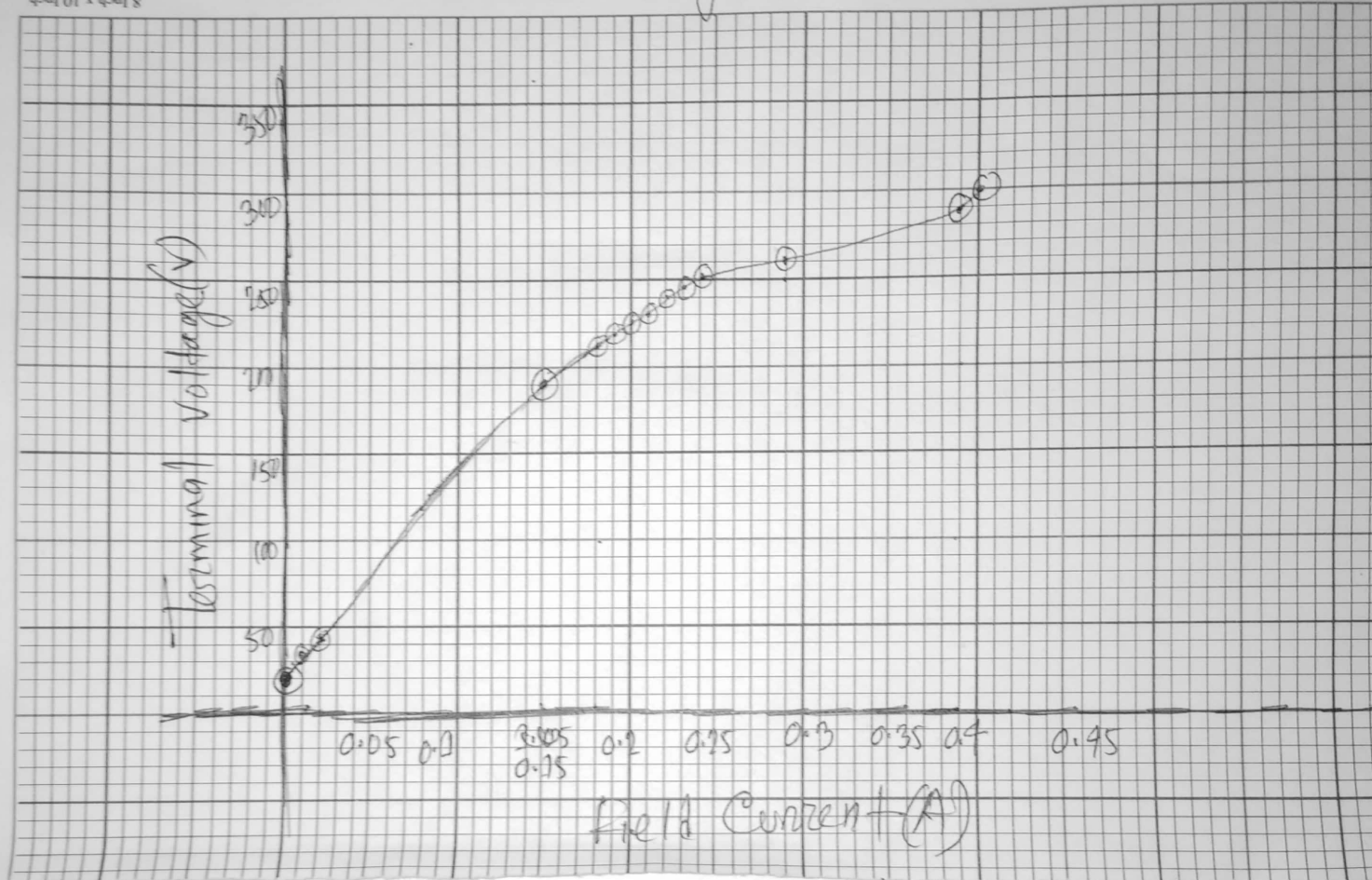


Experimental Data:

Here the motor speed is 1500rpm. And when the field current is zero, the terminal voltage is 17V. From the experiment, the achieved data are:

Rheostat (ohm)	V_T (V)	I_f (A)
1000 (disconnected)	17	0
1000	34	0.01
750	40	0.02
500	191	0.15
-	212	0.18
-	217	0.19
-	225	0.20
-	232	0.21
-	244	0.22
-	246	0.23
-	250	0.24
-	259	0.29
-	288	0.39
-	297	0.40

Terminal Voltage vs Field current



③ ~~2~~ Calculate field resistance from o.c.c. curve.

Answer:

from the graph the saturation point is (0.25, 250).

So the field resistance is, $V_F = I_F R_F$

$$\Rightarrow R_F = \frac{V_F}{I_F}$$

$$= \frac{250 \text{ V}}{0.25 \text{ A}}$$

$$\boxed{R_F = 1000 \Omega}$$

Questions:

① What could be the reasons when the shunt generator doesn't build up voltage?

Answer:

Causes of failure of ~~v~~ voltage build-up:

① No residual magnetism

without any residual magnetism, voltage build-up cannot start. Due to again, in transportation, the machine may lose residual ~~mag~~ magnetism. This difficulty can be overcome by excitation of the field winding from a separate DC source for some time. After this voltage build up takes place.

② High field circuit resistances

If field resistance is more critical resistance then the voltage will not build up. Field resistance will be more than critical resistance due to.

- ① open circuit winding
- ② large external resistance in the field circuit
- ③ Dirty commutator

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(iii) Speed less than the critical speed

The voltage will not build up if armature speed less than critical speed.

(2) Why don't you get sufficient reading of voltage in step 7 and step 8?

Answer

In both steps, the residual flux produces an internally generated voltage E_A . The voltage E_A produces a field current that produces a flux opposing the residual flux, instead of adding it. In these circumstances, the flux actually decreases below Φ_{res} and no voltage can be build up.

⑦ ⑥
③ What are the conditions for a voltage build up in a self-excited shunt generator?

Answer

There are six conditions that must be fulfilled:

- The generator must be on load
- Brushes must have proper contact with commutators
- The speed of the prime mover of the generator must be above critical speed
- The resistance of field windings must be less than critical resistance.
- Poles should contain some residual flux
- Field and armature winding must be correctly connected so that initial emf adds residual flux.

Discussion

In this experiment, OCC curve is plotted only for 1500 rpm speed. From the graph it can be noticed that terminal voltage is proportion to field current. But this relation has different effect before and after terminal voltage is 250V. The increase rate of field current before 250V is less than that of after 250V. In the generator, used in the experiment, the voltage doesn't build up in discrete steps; instead both E_A and I_f increases simultaneously until steady state conditions are reached. In this graph, the steady state point is reached when the terminal voltage is 250V. and field current is 0.25A. After 250V the curve becomes flat towards the x-axis.