D.C.GENERATOR CHARACTERISTICS

Objective:

To determine and compare the characteristics of different D.C. generators.

Theory:

A D.C. generator is an energy converter. Mechanical power input received from a prime mover (D.C. motor in this case) is converted electromagnetically into electrical energy. This electrical energy can be changed into heat as is done by connecting load resistors across its armature terminals.

It is essential that the field windings of the generator be excited with D.C. current. The two main fields are the shunt & series. If the shunt field alone is used then the generator is called a shunt generator; while if the series field alone is used, it is called a series generator. When both windings are used, we have the compound generator.

As the name indicates, the shunt field is connected in parallel with the armature, whereas the series field is connected in series with the armature or the load. The shunt field is of larger number of turns and of higher resistance than the series field. The shunt field can be excited either from a separate source (separately excited generator) or from the armature of the same generator (self-excited shunt generator0.

It is possible to have two types of compound generators; one is for the cumulative operation and the other for the differential operation; in the former the series field assists the shunt-field, while in the latter it opposes it. This will be seen from the results of he experiment.

Procedure:

A. Shunt Generator

The connections are shown in FIG.1 (a). The motor is started keeping Ra1 maximum and Rf1 zero. Cut out step by step Ra1 fully and adjust Rf1 to bring the machine to the rated speed of the generator. This speed is held constant throughout. Rf2 is adjusted to bring the voltage Vt to the rated value with no load on the generator. Rf2 is not altered afterwards. Switch SW2 is closed and for various loads $I_{L,}$ Vt and If are noted. (Maximum allowable load current depends on the rating of the generator.)

B. Compound Generator-Cumulative & differential operations

The connections are done as in FIG.1 (b) with series winding connected. The motor is started as before and brought to the rated speed of generator and Rf2 adjusted to get rated voltage on no load. The load is changed and VT, I_L and If a re noted. If this connection gives the cumulative operation, the differential operation is obtained by interchanging the leads S1 and S2. If the original connection gives differential operation, then cumulative operation is obtained by interchanging the leads S1 and S2.The experiment is done both for cumulative as well as differential operations. The extreme load of short circuit should be attempted only *for differential* operation and that too after the voltage is brought to a low value by switching on all the sections of load L.

C. Separately excited generator

The connections are done as in FIG.1 (c)
The motor is started and run up to rated speed of the generator and If is adjusted to the rated voltage of the generator at no load. This current is kept constant and the generator is loaded. Vt and IL are noted.

Report:

(For all graphs the origin should be 0 volt and 0 amp with voltage on the Y-axis and current on the X-axis.)

1. Plots of Vt and I_L are called External Characteristics. Plot all the external characteristics (4 curves) on the same sheet).
2. Note the armature resistance, and calculate the induced e.m.f.

$$E= Vt + Ia\ Ra$$

for each reading of the experiments. Plot E against Ia for all cases.

3. Explain briefly the reasons for the fall of terminal voltage in all the 4 cases.

Figs 1 (a), 1(b), and 1 (c) are given on subsequent pages.

FIG.1 (a) SHUNT GENERATOR

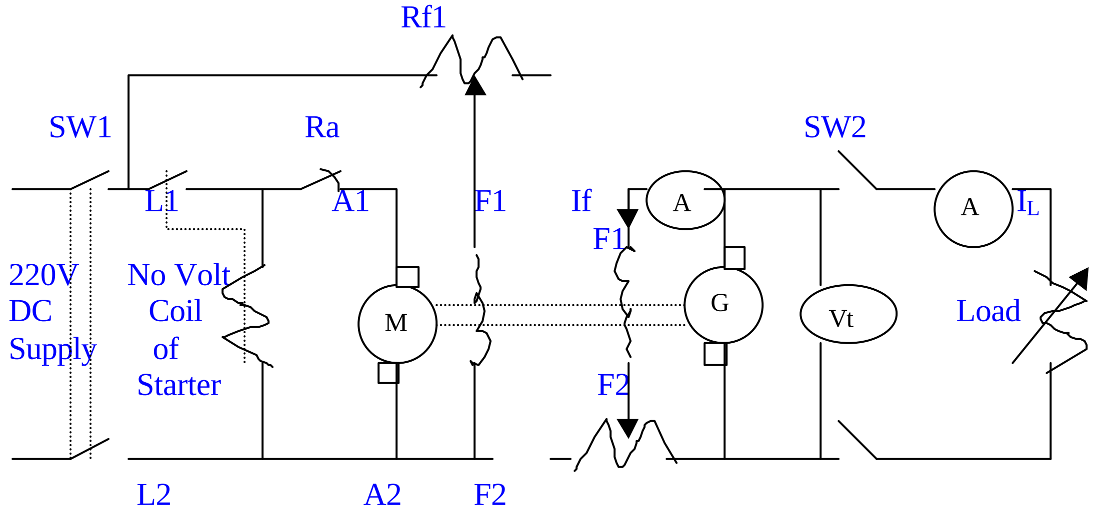

FIG.1 (b) COMPOUND GENERATOR

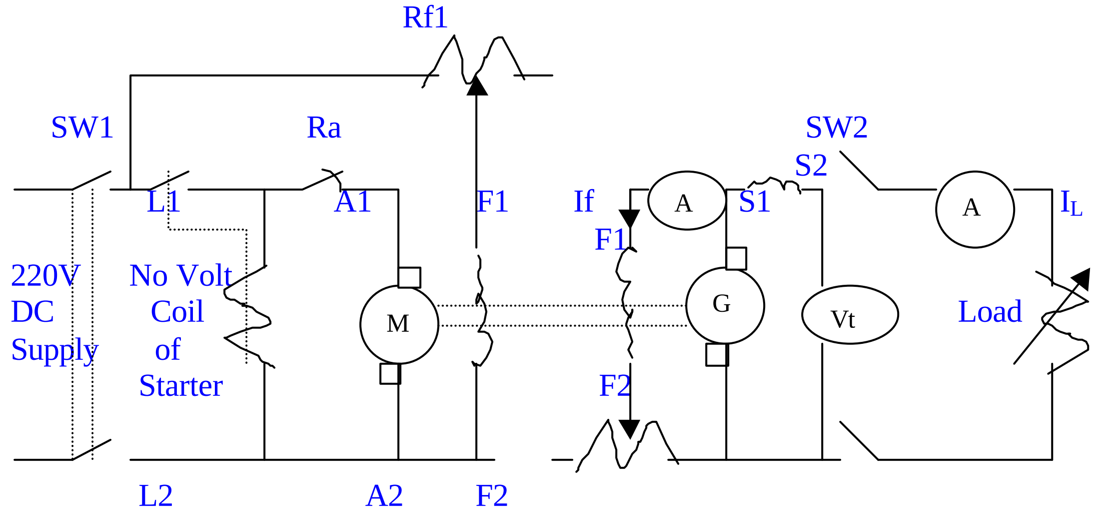

FIG.1 (c) Separately Excited GENERATOR