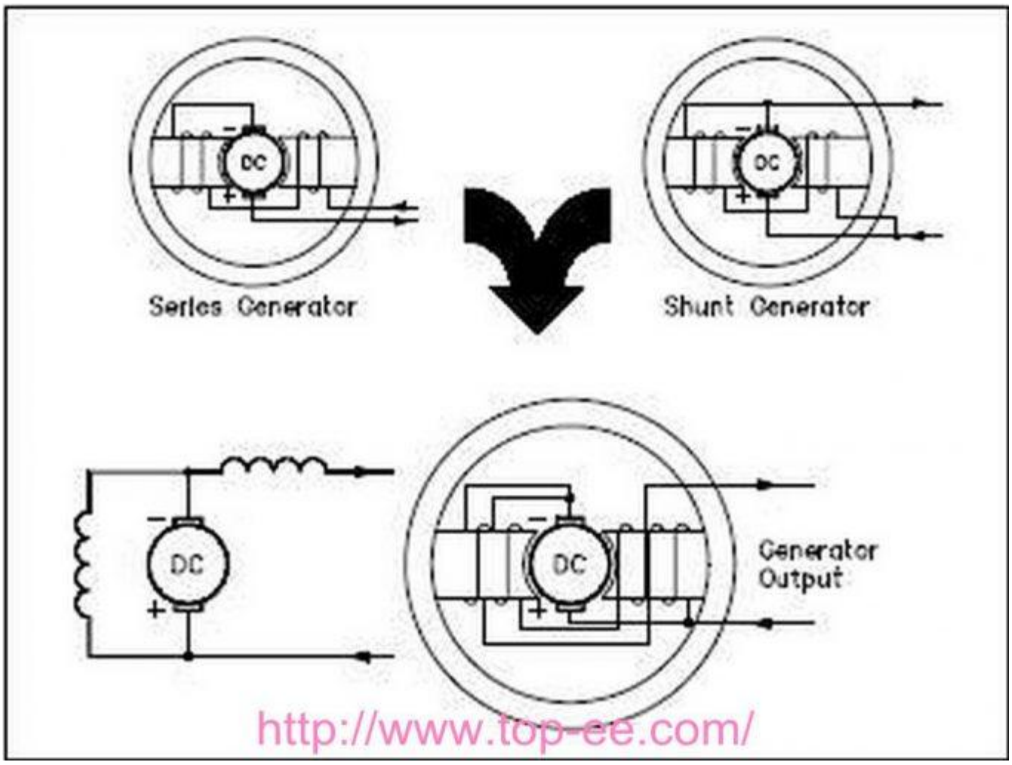
Self-Excited DC Compound wound Generator

In **self-excited generator** field coils are energized by the current produced by the generator, the field winding is also connected to the armature winding in varying ways to achieve a wide range of performance characteristics.

In this generator, there are two connections of the field winding one connected in series with the armature winding and the other connected in parallel with the armature winding. And it supplies a stable output voltage.



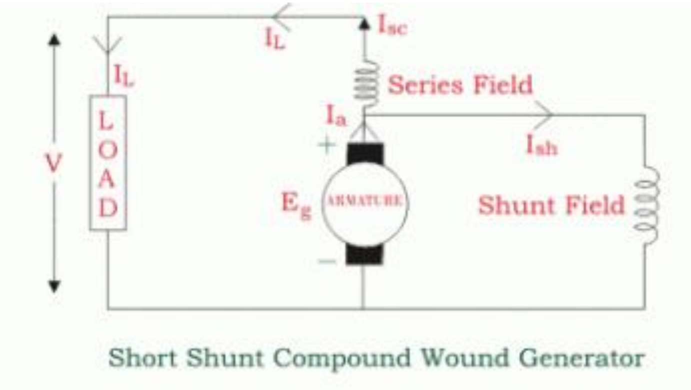
Among various types of DC generators, the compound wound DC generators are most widely used because of its compensating property. Depending upon number of series field turns, the cumulatively compounded generators may be over compounded, flat compounded and under compounded. We can get desired terminal voltage by compensating the drop due to armature reaction and ohmic drop in the in the line. Such generators have various applications.

1. Cumulative compound wound generators are generally used for lighting, power supply purpose and for heavy power services because of their constant voltage property. They are mainly made over compounded.
2. Cumulative compound wound generators are also used for driving a motor.
3. For small distance operation, such as power supply for hotels, offices, homes and lodges, the flat compounded generators are generally used.
4. The differential compound wound generators, because of their large demagnetization armature reaction, are used for arc welding where huge voltage drop and constant current is required.

Compound Wound DC generators can be further classified based on their winding configurations, being:

i. Short Shunt
ii. Long shunt

Equations for self-excited short shunt compound-wound DC generator:



Short Shunt Compound Wound Generator

The series field current:

$$I_{sc}=I_L.$$

The shunt field current:

$$I_{sh} = (V + I_{sc}R_{sc})/R_{sh}.$$

The armature current:

$$I_a = I_{sc} + I_L.$$

The load voltage:

$$V = E_g - I_aR_a - I_{sc}R_{sc}.$$

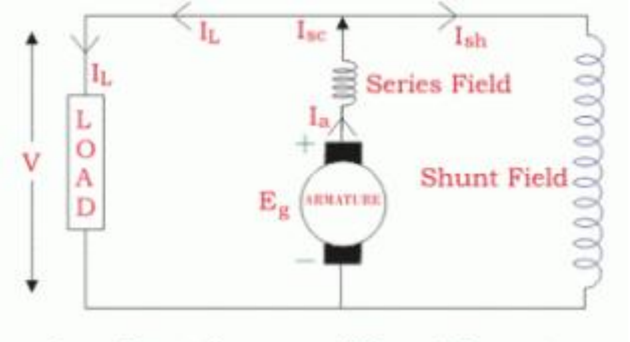
The generated power:

$$P_g=E_g*I_a.$$

So, the load power:

$$P_L=V*I_L.$$

Equations for self-excited long shunt compound-wound DC generator:



Long Shunt Compound Wound Generator

The shunt field current

$$I_{sh} = V/R_{sh}.$$

The armature current equals the series field current:

$$I_a=I_{sc}=I_L+I_{sh}.$$

So, the load voltage:

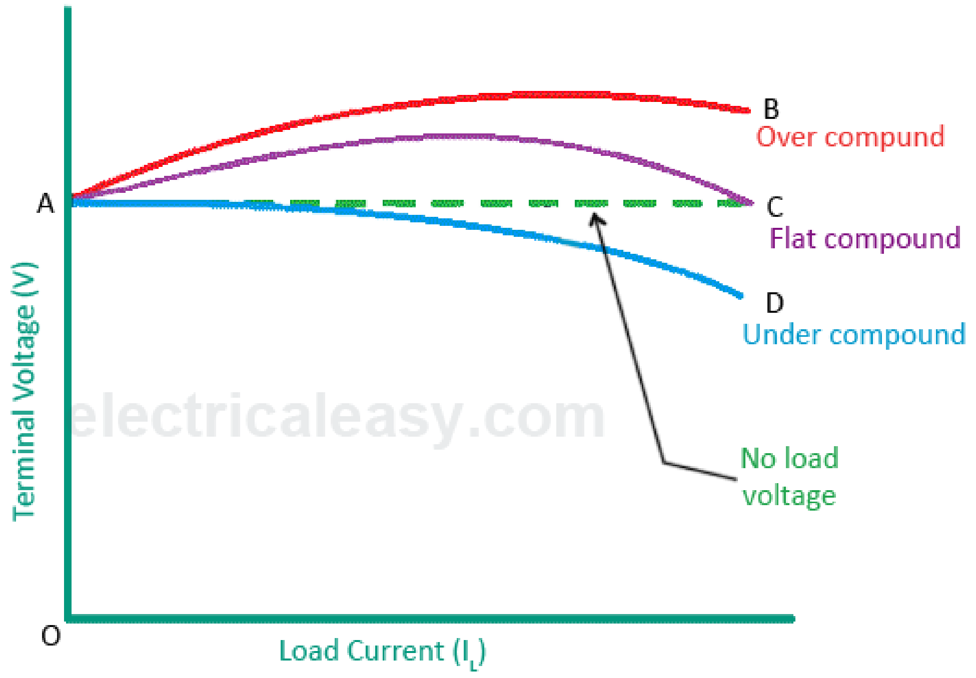
$$V = E_g - I_aR_a - I_{sc}R_{sc} = E_g - I_a(R_a + R_{sc}).$$

The generated power:

$$P_g=E_g*I_a.$$

So, the load delivered power:

$$P_L = V*I_L.$$



External characteristic of DC compound generator

The above figure shows the external characteristics of DC compound generators. If series winding amp-turns are adjusted so that, increase in load current causes increase in terminal voltage then the generator is called to be over compounded. The external characteristic for over compounded generator is shown by the curve AB in above figure.

If series winding amp-turns are adjusted so that, the terminal voltage remains constant even the load current is increased, then the generator is called to be flat compounded. The external characteristic for a flat compounded generator is shown by the curve AC.

If the series winding has lesser number of turns than that would be required to be flat compounded, then the generator is called to be under compounded. The external characteristics for an under compounded generator are shown by the curve AD.