



Here, we have listed all the important DC Generator Formulas and Equations, DC generator EMF equation, power equation etc.

Parameter	Formula	Where
EMF Equation	$E = \frac{P \Phi Z N}{60 A}$	E = Generated EMF (volts), P = Number of poles, Φ = Flux per pole (Wb), Z = Total armature conductors, N = Armature speed (RPM), A = Number of parallel paths
Terminal Voltage (V)	$V = E - I_a R_a$	V = Terminal voltage (volts), E = Generated EMF (volts), I_a = Armature current (A), R_a = Armature resistance (Ω)
Armature Current (I_a)	$I_a = I_L + I_f$	I_a = Armature current (A), I_L = Load current (A), I_f = Shunt field current (A)
Shunt Field Current (I_f)	$I_f = \frac{V}{R_f}$	I_f = Shunt field current (A), V = Terminal voltage (volts), R_f = Shunt field resistance (Ω)
Power Developed (P_{gen})	$P_{gen} = E I_a$	P_{gen} = Generated power (W), E = Generated EMF (volts), I_a = Armature current (A)



Parameter	Formula	Where
Power Output (P_{out})	$P_{out} = V \times I_L$	P_{out} = Output power (W), V = Terminal voltage (volts), I_L = Load current (A)
Efficiency (η)	$\eta = \frac{P_{out}}{P_{gen}}$	η = Efficiency, P_{out} = Output power (W), P_{gen} = Generated power
Armature Copper Loss	$P_{cu,a} = I_a^2 R_a$	$P_{cu,a}$ = Armature copper loss (W), I_a = Armature current (A), R_a = Armature resistance (Ω)
Shunt Field Copper Loss	$P_{cu,f} = I_f^2 R_f$	$P_{cu,f}$ = Shunt field copper loss (W), I_f = Shunt field current (A), R_f = Shunt field resistance (Ω)
Total Copper Loss	$P_{cu} = I_a^2 R_a + I_f^2 R_f$	P_{cu} = Total copper loss (W), I_a = Armature current (A), R_a = Armature resistance (Ω), I_f = Shunt field current (A), R_f = Shunt field resistance (Ω)
Condition for Self-Excitation	$R_f < R_{critical}$	R_f = Shunt field resistance (Ω), $R_{critical}$ = Critical resistance



Parameter	Formula	Where
Current	$I_f = I_a = I_L$	I_L = Load current (A) I_a = Armature Current (A) I_f = Field Current (A)
Terminal Voltage (V)	$(V = E - I_a \cdot (R_a + R_{se}))$	R_{se} = Series field resistance R_a = Armature resistance
Power Developed (P_g)	$(P_g = E \cdot I_a)$	E = Generated EMF (V), I_a = Armature current (A)
Power Delivered (P_o)	$(P_o = V \cdot I_L)$	V = Terminal voltage (V), I_L = Load current (A)
Copper Loss (P_{cu})	$(P_{cu} = I_a^2 \cdot (R_a + R_{se}))$	I_a = Armature current (A) R_a = Armature resistance R_{se} = Series field resistance
Efficiency (η)	$(\eta = \frac{P_o}{P_g} \times 100)$	P_{gen} = Generated power P_o = Power Delivered
Magnetic Flux (Φ)	$(\Phi \propto I_f)$	I_f = Field Current (A)

Here is the table with key formulas for a DC compound generator, classified separately for **Short Shunt** and **Long Shunt** configurations.

SHORT Shunt Compound Generator

In a short shunt compound generator, the shunt field winding is connected in parallel with the armature winding, while the series field winding is connected in series with the load.

Parameter	Formula	Where
Series Field Current (I_{se})	$I_{se} = I_L$	I_L = Load current (A)
Armature Current (I_a)	$(I_a = I_L + I_{sh})$	I_L = Load current (A), I_{sh} = Shunt field current (A)



Parameter	Formula	Where
Shunt Field Current (I_{sh})	$I_{sh} = \frac{V + I_{se}}{R_{se} + R_{sh}}$	<p>V = Terminal voltage (V), R_{sh} = Shunt field resistance R_{se} = Series field resistance</p>
Terminal Voltage (V)	$V = E - I_a (R_a + R_{se})$	<p>E = Generated EMF (V) I_a = Armature current (A) R_a = Armature resistance R_{se} = Series field resistance</p>
Power Developed (P_g)	$P_g = E \cdot I_a$	<p>E = Generated EMF (V), I_a = Armature current (A)</p>
Power Delivered (P_o)	$P_o = V \cdot I_L$	<p>V = Terminal voltage (V), I_L = Load current (A)</p>

Long Shunt Compound Generator

In a long shunt compound generator, the shunt field winding is connected in parallel with both the armature and the series field winding.

Parameter	Formula	Where
Series Field Current (I_{se})	$I_{se} = I_a$	I_a = Load current (A)
Armature Current (I_a)	$I_a = I_L + I_{sh}$	<p>I_L = Load current (A), I_{sh} = Shunt field current (A)</p>
Shunt Field Current (I_{sh})	$I_{sh} = \frac{V}{R_{sh}}$	<p>V = Terminal voltage (V), R_{sh} = Shunt field resistance</p>
Terminal Voltage (V)	$V = E - I_a R_a - I_{se} R_{se}$	<p>E = Generated EMF (V) I_a = Armature current (A) R_a = Armature resistance R_{se} = Series field resistance</p>
Power Developed (P_g)	$P_g = E \cdot I_a$	<p>E = Generated EMF (V), I_a = Armature current (A)</p>
Power Delivered (P_o)	$P_o = V \cdot I_L$	<p>V = Terminal voltage (V), I_L = Load current (A)</p>