

Important DC Series Generator Formulas PDF



Formulas
Examples
with Units

List of 18 Important DC Series Generator Formulas

1) Current Formulas

1.1) Armature Current of Series DC Generator given Output Power Formula

Formula

$$I_a = \sqrt{\frac{P_{\text{conv}} - P_{\text{out}}}{R_a}}$$

Example with Units

$$0.66 \text{ A} = \sqrt{\frac{165.5 \text{ W} - 150 \text{ W}}{35.58 \Omega}}$$

Evaluate Formula 

1.2) Armature Current of Series DC Generator given Torque Formula

Formula

$$I_a = \frac{\tau \cdot \omega_s}{V_a}$$

Example with Units

$$0.6565 \text{ A} = \frac{1.57 \text{ N}\cdot\text{m} \cdot 115 \text{ rad/s}}{275 \text{ V}}$$

Evaluate Formula 

1.3) Armature Current of Series DC Generator using Terminal Voltage Formula

Formula

$$I_a = \frac{V_a - V_t}{R_{se} + R_a}$$

Example with Units

$$0.66 \text{ A} = \frac{275 \text{ V} - 170 \text{ V}}{123.5 \Omega + 35.58 \Omega}$$

Evaluate Formula 

1.4) Load Current of Series DC Generator given Load Power Formula

Formula

$$I_L = \frac{P_L}{V_t}$$

Example with Units

$$0.8853 \text{ A} = \frac{150.5 \text{ W}}{170 \text{ V}}$$

Evaluate Formula 

1.5) Load Current of Series DC Generator given Output Power Formula

Formula

$$I_L = \frac{P_{\text{out}}}{V_t}$$

Example with Units

$$0.8824 \text{ A} = \frac{150 \text{ W}}{170 \text{ V}}$$

Evaluate Formula 



2) Losses Formulas ↻

2.1) Mechanical Losses of Series DC Generator given Converted Power Formula ↻

Formula

$$P_m = P_{in} - P_{core} - P_{stray} - P_{conv}$$

Example with Units

$$9\text{ w} = 180\text{ w} - 2.8\text{ w} - 2.7\text{ w} - 165.5\text{ w}$$

Evaluate Formula ↻

2.2) Series Field Copper Loss in DC Generator Formula ↻

Formula

$$P_{se} = I_{se}^2 \cdot R_{se}$$

Example with Units

$$85.4897\text{ w} = 0.832\text{ A}^2 \cdot 123.5\Omega$$

Evaluate Formula ↻

3) Mechanical Specifications Formulas ↻

3.1) Angular Speed of Series DC Generator given Torque Formula ↻

Formula

$$\omega_s = \frac{P_{in}}{\tau}$$

Example with Units

$$114.6497\text{ rad/s} = \frac{180\text{ w}}{1.57\text{ N*m}}$$

Evaluate Formula ↻

3.2) Resultant Pitch of DC Series Generator Formula ↻

Formula

$$Y_R = Y_B + Y_F$$

Example

$$100 = 51 + 49$$

Evaluate Formula ↻

3.3) Torque of Series DC Generator given Angular Speed and Armature Current Formula ↻

Formula

$$\tau = \frac{V_a \cdot I_a}{\omega_s}$$

Example with Units

$$1.5783\text{ N*m} = \frac{275\text{ v} \cdot 0.66\text{ A}}{115\text{ rad/s}}$$

Evaluate Formula ↻

4) Power Formulas ↻

4.1) Converted Power of Series DC Generator given Input Power Formula ↻

Formula

$$P_{conv} = P_{in} - P_{stray} - P_m - P_{core}$$

Example with Units

$$165.5\text{ w} = 180\text{ w} - 2.7\text{ w} - 9\text{ w} - 2.8\text{ w}$$

Evaluate Formula ↻

4.2) Converted Power of Series DC Generator given Output Power Formula ↻

Formula

$$P_{conv} = P_{out} + I_a^2 \cdot R_a$$

Example with Units

$$165.4986\text{ w} = 150\text{ w} + 0.66\text{ A}^2 \cdot 35.58\Omega$$

Evaluate Formula ↻



5) Resistance Formulas

5.1) Armature Resistance of Series DC Generator given Output Power Formula

Formula

$$R_a = \frac{P_{\text{conv}} - P_{\text{out}}}{I_a^2}$$

Example with Units

$$35.5831 \Omega = \frac{165.5 \text{ W} - 150 \text{ W}}{0.66 \text{ A}^2}$$

Evaluate Formula 

5.2) Armature Resistance of Series DC Generator using Terminal Voltage Formula

Formula

$$R_a = \left(\frac{V_a - V_t}{I_a} \right) - R_{se}$$

Example with Units

$$35.5909 \Omega = \left(\frac{275 \text{ V} - 170 \text{ V}}{0.66 \text{ A}} \right) - 123.5 \Omega$$

Evaluate Formula 

5.3) Series Field Resistance of Series DC Generator using Terminal Voltage Formula

Formula

$$R_{se} = \left(\frac{V_a - V_t}{I_a} \right) - R_a$$

Example with Units

$$123.5109 \Omega = \left(\frac{275 \text{ V} - 170 \text{ V}}{0.66 \text{ A}} \right) - 35.58 \Omega$$

Evaluate Formula 

6) Voltage & EMF Formulas

6.1) Armature Induced Voltage of Series DC Generator Formula

Formula

$$V_a = V_t + I_a \cdot (R_a + R_{se})$$

Example with Units

$$274.9928 \text{ V} = 170 \text{ V} + 0.66 \text{ A} \cdot (35.58 \Omega + 123.5 \Omega)$$

Evaluate Formula 

6.2) Terminal Voltage of Series DC Generator Formula

Formula

$$V_t = V_a - I_a \cdot (R_a + R_{se})$$

Example with Units

$$170.0072 \text{ V} = 275 \text{ V} - 0.66 \text{ A} \cdot (35.58 \Omega + 123.5 \Omega)$$

Evaluate Formula 

6.3) Terminal Voltage of Series DC Generator given Output Power Formula

Formula

$$V_t = \frac{P_{\text{out}}}{I_L}$$

Example with Units

$$170.4545 \text{ V} = \frac{150 \text{ W}}{0.88 \text{ A}}$$

Evaluate Formula 



Variables used in list of DC Series Generator Formulas above

- I_a Armature Current (Ampere)
- I_L Load Current (Ampere)
- I_{se} Series Field Current (Ampere)
- P_{conv} Converted Power (Watt)
- P_{core} Core Loss (Watt)
- P_{in} Input Power (Watt)
- P_L Load Power (Watt)
- P_m Mechanical Losses (Watt)
- P_{out} Output Power (Watt)
- P_{se} Series Field Loss (Watt)
- P_{stray} Stray Loss (Watt)
- R_a Armature Resistance (Ohm)
- R_{se} Series Field Resistance (Ohm)
- V_a Armature Voltage (Volt)
- V_t Terminal Voltage (Volt)
- Y_B Back Pitch
- Y_F Front Pitch
- Y_R Resultant Pitch
- T Torque (Newton Meter)
- ω_s Angular Speed (Radian per Second)

Constants, Functions, Measurements used in list of DC Series Generator Formulas above

- **Functions:** **sqrt**, sqrt(Number)
A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- **Measurement:** **Electric Current** in Ampere (A)
Electric Current Unit Conversion 
- **Measurement:** **Power** in Watt (W)
Power Unit Conversion 
- **Measurement:** **Electric Resistance** in Ohm (Ω)
Electric Resistance Unit Conversion 
- **Measurement:** **Electric Potential** in Volt (V)
Electric Potential Unit Conversion 
- **Measurement:** **Angular Velocity** in Radian per Second (rad/s)
Angular Velocity Unit Conversion 
- **Measurement:** **Torque** in Newton Meter (N*m)
Torque Unit Conversion 



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