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DC Series Motor Formulas

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List of 16 DC Series Motor Formulas

DC Series Motor

Current

1) Armature Current of Series DC Motor

Open Calculator

fx $$I_a = \sqrt{\frac{\tau}{K_f \cdot \Phi}}$$

ex $$0.724925\text{A} = \sqrt{\frac{0.708\text{N*m}}{1.135 \cdot 1.187\text{Wb}}}$$

2) Armature Current of Series DC Motor given Input Power

Open Calculator

fx $$I_a = \frac{P_{in}}{V_s}$$

ex $$0.720833\text{A} = \frac{173\text{W}}{240\text{V}}$$

3) Armature Current of Series DC Motor given Speed

Open Calculator

fx $$I_a = \frac{V_s - \Phi \cdot K_f \cdot N}{R_a + R_{sf}}$$

ex $$0.710992\text{A} = \frac{240\text{V} - 1.187\text{Wb} \cdot 1.135 \cdot 1290\text{rev/min}}{80\Omega + 1.58\Omega}$$

4) Armature Current of Series DC Motor using Voltage

Open Calculator

fx $$I_a = \frac{V_s - V_a}{R_a + R_{sf}}$$

ex $$0.735474\text{A} = \frac{240\text{V} - 180\text{V}}{80\Omega + 1.58\Omega}$$

Mechanical Specifications

5) Machine Construction Constant of Series DC Motor using Armature Induced Voltage

Open Calculator

fx $$K_f = \frac{V_a}{\Phi \cdot \omega_s \cdot I_a}$$

ex $$4.237333 = \frac{180\text{V}}{1.187\text{Wb} \cdot 49.43\text{rad/s} \cdot 0.724\text{A}}$$

6) Machine Construction Constant of Series DC Motor using Speed

Open Calculator

fx $$K_f = \frac{V_s - I_a \cdot (R_a + R_{sf})}{\Phi \cdot N}$$

ex $$1.128382 = \frac{240\text{V} - 0.724\text{A} \cdot (80\Omega + 1.58\Omega)}{1.187\text{Wb} \cdot 1290\text{rev/min}}$$

7) Magnetic Flux of Series DC Motor given Speed

Open Calculator

$$\Phi = \frac{V_s - I_a \cdot (R_a + R_{sf})}{K_f \cdot N}$$

$$1.180079\text{Wb} = \frac{240\text{V} - 0.724\text{A} \cdot (80\Omega + 1.58\Omega)}{1.135 \cdot 1290\text{rev/min}}$$

Resistance

8) Armature Resistance of Series DC Motor given Voltage

Open Calculator

$$R_a = \left(\frac{V_s - V_a}{I_a}\right) - R_{sf}$$

$$81.29293\Omega = \left(\frac{240\text{V} - 180\text{V}}{0.724\text{A}}\right) - 1.58\Omega$$

9) Series Field Resistance of Series DC Motor given Speed

Open Calculator

$$R_{sh} = \left(\frac{V_s - N \cdot K_f \cdot \Phi}{I_a}\right) - R_a$$

$$0.114248\Omega = \left(\frac{240\text{V} - 1290\text{rev/min} \cdot 1.135 \cdot 1.187\text{Wb}}{0.724\text{A}}\right) - 80\Omega$$

10) Series Field Resistance of Series DC Motor given Voltage

Open Calculator

fx $$R_{sf} = \left(\frac{V_s - V_a}{I_a} \right) - R_a$$

ex $$2.872928\Omega = \left(\frac{240V - 180V}{0.724A} \right) - 80\Omega$$

Speed

11) Angular Speed of DC Motor given Output Power

Open Calculator

fx $$\omega_s = \frac{P_{out}}{\tau}$$

ex $$49.43503rad/s = \frac{35W}{0.708N*m}$$

12) Speed of Series DC Motor

Open Calculator

fx $$N = \frac{V_s - I_a \cdot (R_a + R_{sh})}{K_f \cdot \Phi}$$

ex $$1290.022rev/min = \frac{240V - 0.724A \cdot (80\Omega + 0.11\Omega)}{1.135 \cdot 1.187Wb}$$

Voltage

13) Armature Induced Voltage of Series DC motor given Voltage

Open Calculator

fx $V_a = V_s - I_a \cdot (R_a + R_{sf})$

ex $180.9361\text{V} = 240\text{V} - 0.724\text{A} \cdot (80\Omega + 1.58\Omega)$

14) Input Power of Series DC Motor

Open Calculator

fx $P_{in} = V_s \cdot I_a$

ex $173.76\text{W} = 240\text{V} \cdot 0.724\text{A}$

15) Voltage Equation of Series DC Motor

Open Calculator

fx $V_s = V_a + I_a \cdot (R_a + R_{sf})$

ex $239.0639\text{V} = 180\text{V} + 0.724\text{A} \cdot (80\Omega + 1.58\Omega)$

16) Voltage of Series DC Motor given Input Power

Open Calculator

fx $V_s = \frac{P_{in}}{I_a}$

ex $238.9503\text{V} = \frac{173\text{W}}{0.724\text{A}}$

Variables Used

- I_a Armature Current *(Ampere)*
- K_f Constant of Machine Construction
- **N** Motor Speed *(Revolution per Minute)*
- P_{in} Input Power *(Watt)*
- P_{out} Output Power *(Watt)*
- R_a Armature Resistance *(Ohm)*
- R_{sf} Series Field Resistance *(Ohm)*
- R_{sh} Shunt Field Resistance *(Ohm)*
- V_a Armature Voltage *(Volt)*
- V_s Supply Voltage *(Volt)*
- **τ** Torque *(Newton Meter)*
- **Φ** Magnetic Flux *(Weber)*
- ω_s Angular Speed *(Radian per Second)*

Constants, Functions, Measurements used

- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Electric Current** in Ampere (A)
  Electric Current Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Magnetic Flux** in Weber (Wb)
  Magnetic Flux 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 Revolution per Minute (rev/min), Radian per Second (rad/s)
  Angular Velocity Unit Conversion
- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion

Check other formula lists

- **DC Motor Characteristics Formulas**
- **DC Series Motor Formulas**
- **DC Shunt Motor Formulas**

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