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DC Shunt Motor Formulas

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List of 23 DC Shunt Motor Formulas

DC Shunt Motor

Current

1) Armature Current of Shunt DC Motor given Input Power

Open Calculator

fx $$I_a = \frac{P_{in}}{V_{sp}}$$

ex $$3.715481\text{A} = \frac{888\text{W}}{239\text{V}}$$

2) Armature Current of Shunt DC Motor given Torque

Open Calculator

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

ex $$3.72807\text{A} = \frac{0.85\text{N*m}}{2 \cdot 0.114\text{Wb}}$$

3) Armature Current of Shunt DC Motor given Voltage

Open Calculator

fx $$I_a = \frac{V_{sp} - E_b}{R_a}$$

ex $$3.703704\text{A} = \frac{239\text{V} - 231\text{V}}{2.16\Omega}$$

4) Field Current of DC Shunt Motor

Open Calculator

fx $$I_f = \frac{V_{sp}}{R_{sh}}$$

ex $$1.503145\text{A} = \frac{239\text{V}}{159\Omega}$$

Flux

5) Magnetic Flux of DC Shunt Motor given Kf

Open Calculator

fx $$\Phi = \frac{E_b}{\omega_s \cdot K_f}$$

ex $$0.114176\text{Wb} = \frac{231\text{V}}{161\text{rev/s} \cdot 2}$$

6) Magnetic Flux of DC Shunt Motor given Torque

Open Calculator

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

ex $$0.114865\text{Wb} = \frac{0.85\text{N*m}}{2 \cdot 3.7\text{A}}$$

Mechanical Specifications

7) Machine Constant of DC Shunt Motor given Torque

Open Calculator

fx $$K = \frac{\tau}{\Phi \cdot I_a}$$

ex $$2.015173 = \frac{0.85\text{N*m}}{0.114\text{Wb} \cdot 3.7\text{A}}$$

8) Machine Construction Constant of DC Shunt Motor given Angular Speed

Open Calculator

fx $$K_f = \frac{E_b}{\Phi \cdot \omega_s}$$

ex $$2.003094 = \frac{231\text{V}}{0.114\text{Wb} \cdot 161\text{rev/s}}$$

9) Machine Construction Constant of Shunt DC Motor

Open Calculator

fx $$K_f = \frac{60 \cdot n_{||}}{n \cdot Z}$$

ex $$2.015226 = \frac{60 \cdot 6}{4 \cdot 44.66}$$

10) Machine Construction Constant using Speed of Shunt DC Motor

Open Calculator

fx $$K_f = \frac{V_t - I_a \cdot R_a}{N \cdot \Phi}$$

ex $$2.175589 = \frac{75V - 3.7A \cdot 2.16\Omega}{2579.98rev/min \cdot 0.114Wb}$$

11) Number of Armature Conductors of DC Shunt Motor using K

Open Calculator

fx $$Z = \frac{60 \cdot n_{||}}{K \cdot n}$$

ex $$44.66501 = \frac{60 \cdot 6}{2.015 \cdot 4}$$

12) Number of Parallel Paths of Shunt DC Motor

Open Calculator

fx $$n_{||} = \frac{K \cdot Z \cdot n}{60}$$

ex $$6 = \frac{2.015 \cdot 44.66 \cdot 4}{60}$$

13) Number of Poles of Shunt DC Motor

Open Calculator

fx $$n = \frac{60 \cdot n_{||}}{K \cdot Z}$$

ex $$4.000449 = \frac{60 \cdot 6}{2.015 \cdot 44.66}$$

Resistance

14) Armature Resistance of Shunt DC Motor given Voltage

Open Calculator

fx $$R_a = \frac{V_{sp} - E_b}{I_a}$$

ex $$2.162162\Omega = \frac{239V - 231V}{3.7A}$$

15) Shunt Field Resistance of Shunt DC Motor given Shunt Field Current

Open Calculator

fx $$R_{sh} = \frac{V_{sp}}{I_{sh}}$$

ex $$159.4396\Omega = \frac{239V}{1.499A}$$

Speed

16) Angular Speed of DC Shunt Motor given Kf

Open Calculator

fx $$\omega_s = \frac{E_b}{K_f \cdot \Phi}$$

ex $$161.2491rev/s = \frac{231V}{2 \cdot 0.114Wb}$$

17) Angular Speed of DC Shunt Motor given Output Power

Open Calculator

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

ex $$161.0274\text{rev/s} = \frac{860\text{W}}{0.85\text{N*m}}$$

18) Full Load Speed of Shunt DC Motor

Open Calculator

fx $$N_{fl} = \frac{100 \cdot N_{nl}}{N_{reg} + 100}$$

ex $$0.19\text{rev/min} = \frac{100 \cdot 2.58\text{rev/min}}{12012\text{rev/min} + 100}$$

19) No Load Speed of Shunt DC Motor

Open Calculator

fx $$N_{nl} = \frac{N_{reg} \cdot N_{fl}}{100 + N_{fl}}$$

ex $$2.389523\text{rev/min} = \frac{12012\text{rev/min} \cdot 0.19\text{rev/min}}{100 + 0.19\text{rev/min}}$$

20) Speed Regulation of Shunt DC Motor

Open Calculator

fx $$N_{reg} = \left(\frac{N_{nl} - N_{fl}}{N_{fl}}\right) \cdot 100$$

ex $$12012.01\text{rev/min} = \left(\frac{2.58\text{rev/min} - 0.19\text{rev/min}}{0.19\text{rev/min}}\right) \cdot 100$$

21) Torque of DC Motor given Output Power

Open Calculator

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

ex $$0.850144\text{N*m} = \frac{860\text{W}}{161\text{rev/s}}$$

Voltage & EMF

22) Voltage of Shunt DC Motor

Open Calculator

fx $$V_{sp} = E_b + I_a \cdot R_a$$

ex $$238.992\text{V} = 231\text{V} + 3.7\text{A} \cdot 2.16\Omega$$

23) Voltage of Shunt DC Motor given Shunt Field Current

Open Calculator

fx $$V_{sp} = I_{sh} \cdot R_{sh}$$

ex $$238.341\text{V} = 1.499\text{A} \cdot 159\Omega$$

Variables Used

- E_b Back EMF *(Volt)*
- I_a Armature Current *(Ampere)*
- I_f Field Current *(Ampere)*
- I_{sh} Shunt Field Current *(Ampere)*
- K Machine Constant
- K_f Constant of Machine Construction
- n Number of Poles
- N Motor Speed *(Revolution per Minute)*
- $n_{||}$ Number of Parallel Paths
- N_{fl} Full Load Speed *(Revolution per Minute)*
- N_{nl} No Load Speed *(Revolution per Minute)*
- N_{reg} Speed Regulation *(Revolution per Minute)*
- P_{in} Input Power *(Watt)*
- P_{out} Output Power *(Watt)*
- R_a Armature Resistance *(Ohm)*
- R_{sh} Shunt Field Resistance *(Ohm)*
- V_{sp} Supply Voltage *(Volt)*
- V_t Terminal Voltage *(Volt)*
- Z Number of Conductors
- τ Torque *(Newton Meter)*
- Φ Magnetic Flux *(Weber)*

- ω_S Angular Speed *(Revolution per Second)*

Constants, Functions, Measurements used

- 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 Second (rev/s), Revolution per Minute (rev/min)
  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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