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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

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

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2_img.jpg\)](#)

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

2) Armature Current of Series DC Motor given Input Power

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

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa_img.jpg\)](#)

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

3) Armature Current of Series DC Motor given Speed

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

[Open Calculator !\[\]\(f1c5da15572e3e09d343161be98f508d_img.jpg\)](#)

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



4) Armature Current of Series DC Motor using Voltage

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

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

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

Mechanical Specifications

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

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

[Open Calculator !\[\]\(5361750c22c4e047a52f4eac1ec2d4cc_img.jpg\)](#)

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

6) Machine Construction Constant of Series DC Motor using Speed

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

[Open Calculator !\[\]\(b792654f2cef9719eabeb6c5be00811e_img.jpg\)](#)

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



7) Magnetic Flux of Series DC Motor given Speed

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

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

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

Resistance

8) Armature Resistance of Series DC Motor given Voltage

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

[Open Calculator !\[\]\(aa53ad6fea213b8b2226d3077e30533a_img.jpg\)](#)

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


9) Series Field Resistance of Series DC Motor given Speed

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

[Open Calculator !\[\]\(626ce8ac21792b9405bfddfea8e0c96a_img.jpg\)](#)

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



10) Series Field Resistance of Series DC Motor given Voltage 

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

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

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

Speed 11) Angular Speed of DC Motor given Output Power 

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

[Open Calculator !\[\]\(8bba887393ca45b761e5cb49e755e762_img.jpg\)](#)

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

12) Speed of Series DC Motor 

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

[Open Calculator !\[\]\(0fb13ad0bfa3d86868cdd3883e5665b3_img.jpg\)](#)

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



Voltage

13) Armature Induced Voltage of Series DC motor given Voltage

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

[Open Calculator !\[\]\(950a62bbddad88d64435fd35607dfc42_img.jpg\)](#)

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

14) Input Power of Series DC Motor

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

[Open Calculator !\[\]\(73002692dd5e7a64e60946be3158e719_img.jpg\)](#)

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

15) Voltage Equation of Series DC Motor

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

[Open Calculator !\[\]\(104fbf564e2e5a8fbd84f31656d114c7_img.jpg\)](#)

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

16) Voltage of Series DC Motor given Input Power

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

[Open Calculator !\[\]\(21226b58c700e5231ab98d27101bac58_img.jpg\)](#)

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










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)
- T 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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