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DC Machines Formulas

Calculators!

Examples!

Conversions!

List of 19 DC Machines Formulas

DC Machines

1) Area of Damper Winding

Open Calculator

fx $$A_d = \frac{0.2 \cdot q_{av} \cdot Y_p}{\delta_s}$$

ex $$5.652761\text{m}^2 = \frac{0.2 \cdot 187.464\text{Ac/m} \cdot 0.392\text{m}}{2.6\text{A/m}^2}$$

2) Armature Core Length using Specific Magnetic Loading

Open Calculator

fx $$L_a = \frac{n \cdot \Phi}{\pi \cdot D_a \cdot B_{av}}$$

ex $$0.30024\text{m} = \frac{4 \cdot 0.054\text{Wb}}{\pi \cdot 0.5\text{m} \cdot 0.458\text{Wb/m}^2}$$

3) Armature Diameter using Specific Magnetic Loading

Open Calculator

fx $$D_a = \frac{n \cdot \Phi}{\pi \cdot B_{av} \cdot L_a}$$

ex $$0.5004\text{m} = \frac{4 \cdot 0.054\text{Wb}}{\pi \cdot 0.458\text{Wb/m}^2 \cdot 0.3\text{m}}$$

4) Average Gap Density using Limiting Value of Core Length

Open Calculator

$$B_{av} = \frac{7.5}{L_{limit} \cdot V_a \cdot T_c \cdot n_c}$$

$$0.457764 \text{Wb/m}^2 = \frac{7.5}{0.3008 \text{m} \cdot 0.0445 \text{m/s} \cdot 204 \cdot 6}$$

5) Efficiency of DC Machine

Open Calculator

$$\eta = \frac{P_{gen}}{P_o}$$

$$0.666667 = \frac{400 \text{kW}}{600 \text{kW}}$$

6) Flux per Pole using Magnetic Loading

Open Calculator

$$\Phi = \frac{B}{n}$$

$$0.054 \text{Wb} = \frac{0.216 \text{Wb}}{4}$$

7) Flux per Pole using Pole Pitch

Open Calculator

$$\Phi = B_{av} \cdot Y_p \cdot L_{limit}$$

$$0.054004 \text{Wb} = 0.458 \text{Wb/m}^2 \cdot 0.392 \text{m} \cdot 0.3008 \text{m}$$

8) Flux per Pole using Specific Magnetic Loading

Open Calculator

fx $$\Phi = \frac{B_{av} \cdot \pi \cdot D_a \cdot L_a}{n}$$

ex $$0.053957\text{Wb} = \frac{0.458\text{Wb/m}^2 \cdot \pi \cdot 0.5\text{m} \cdot 0.3\text{m}}{4}$$

9) Limiting Value of Core Length

Open Calculator

fx $$L_{limit} = \frac{7.5}{B_{av} \cdot V_a \cdot T_c \cdot n_c}$$

ex $$0.300645\text{m} = \frac{7.5}{0.458\text{Wb/m}^2 \cdot 0.0445\text{m/s} \cdot 204 \cdot 6}$$

10) Number of Poles using Magnetic Loading

Open Calculator

fx $$n = \frac{B}{\Phi}$$

ex $$4 = \frac{0.216\text{Wb}}{0.054\text{Wb}}$$

11) Number of Poles using Pole Pitch

Open Calculator

fx $$n = \frac{\pi \cdot D_a}{Y_p}$$

ex $$4 = \frac{\pi \cdot 0.5\text{m}}{0.392\text{m}}$$

12) Number of Poles using Specific Magnetic Loading

Open Calculator

$$n = \frac{B_{av} \cdot \pi \cdot D_a \cdot L_a}{\Phi}$$

$$4 = \frac{0.458\text{Wb/m}^2 \cdot \pi \cdot 0.5\text{m} \cdot 0.3\text{m}}{0.054\text{Wb}}$$

13) Output Coefficient DC

Open Calculator

$$C_{o(dc)} = \frac{\pi^2 \cdot B_{av} \cdot q_{av}}{1000}$$

$$0.84739 = \frac{\pi^2 \cdot 0.458\text{Wb/m}^2 \cdot 187.464\text{Ac/m}}{1000}$$

14) Output Power of DC Machines

Open Calculator

$$P_o = \frac{P_{gen}}{\eta}$$

$$600.6006\text{kW} = \frac{400\text{kW}}{0.666}$$

15) Peripheral Speed of Armature using Limiting Value of Core Length

Open Calculator

$$V_a = \frac{7.5}{B_{av} \cdot L_{limit} \cdot T_c \cdot n_c}$$

$$0.044477\text{m/s} = \frac{7.5}{0.458\text{Wb/m}^2 \cdot 0.3008\text{m} \cdot 204 \cdot 6}$$

16) Pole Pitch

Open Calculator

fx $$Y_p = \frac{\pi \cdot D_a}{n}$$

ex $$0.392699\text{m} = \frac{\pi \cdot 0.5\text{m}}{4}$$

17) Specific Magnetic Loading using Output Coefficient DC

Open Calculator

fx $$B_{av} = \frac{C_{o(dc)} \cdot 1000}{\pi^2 \cdot q_{av}}$$

ex $$0.457789\text{Wb/m}^2 = \frac{0.847 \cdot 1000}{\pi^2 \cdot 187.464\text{Ac/m}}$$

18) Stator Conductor Cross Section Area

Open Calculator

fx $$\sigma_z = \frac{I_z}{\delta_s}$$

ex $$3.845769\text{m}^2 = \frac{9.999\text{A}}{2.6\text{A/m}^2}$$

19) Stator Conductors per Slot

Open Calculator

fx $$Z_{ss} = \frac{Z}{n_s}$$

ex $$14 = \frac{500}{36}$$

Variables Used

- A_d Area of Damper Winding *(Square Meter)*
- B Magnetic Loading *(Weber)*
- B_{av} Specific Magnetic Loading *(Weber per Square Meter)*
- $C_{o(dc)}$ Output Coefficient DC
- D_a Armature Diameter *(Meter)*
- I_z Current in Conductor *(Ampere)*
- L_a Armature Core Length *(Meter)*
- L_{limit} Limiting Value of Core Length *(Meter)*
- n Number of Poles
- n_c Number of Coils between Adjacent Segments
- n_s Number of Stator Slots
- P_{gen} Generated Power *(Kilowatt)*
- P_o Output Power *(Kilowatt)*
- q_{av} Specific Electric Loading *(Ampere Conductor per Meter)*
- T_c Turns per Coil
- V_a Peripheral Speed of Armature *(Meter per Second)*
- Y_p Pole Pitch *(Meter)*
- Z Number of Conductors
- Z_{ss} Conductors per Slot
- δ_s Current Density in Stator Conductor *(Ampere per Square Meter)*
- η Efficiency

- σ_z Stator Conductor Cross Section Area *(Square Meter)*
- Φ Flux per Pole *(Weber)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Electric Current** in Ampere (A)
  Electric Current Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Power** in Kilowatt (kW)
  Power Unit Conversion
- Measurement: **Magnetic Flux** in Weber (Wb)
  Magnetic Flux Unit Conversion
- Measurement: **Magnetic Flux Density** in Weber per Square Meter (Wb/m²)
  Magnetic Flux Density Unit Conversion
- Measurement: **Surface Current Density** in Ampere per Square Meter (A/m²)
  Surface Current Density Unit Conversion
- Measurement: **Specific Electrical Loading** in Ampere Conductor per Meter (Ac/m)
  Specific Electrical Loading Unit Conversion

Check other formula lists

- **AC Machines Formulas**
- **DC Machines Formulas**

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