Important Dynamometer Formulas PDF

Formulas
Examples
with Units

List of 19
Important Dynamometer Formulas

1) Constant for Particular Shaft for Torsion Dynamometer Formula

Evaluate Formula

Formula

$$k = \frac{G \cdot J}{L_{shaft}}$$

Example with Units

$$8.5714 = \frac{40\,\text{N/m}^2 \cdot 0.09\,\text{m}^4}{0.42\,\text{m}}$$

2) Distance Moved in One Revolution by Rope Brake Dynamometer Formula

Evaluate Formula

Formula

$$d = \pi \cdot \left(D_{wheel} + d_{rope} \right)$$

Example with Units

$$5.3407\,\text{m} = 3.1416 \cdot \left(1.6\,\text{m} + 0.1\,\text{m} \right)$$

3) Load on Brake for Rope Brake Dynamometer Formula

Evaluate Formula

Formula

$$W = W_{dead} - S$$

Example with Units

$$12.5\,\text{N} = 14.5\,\text{N} - 2\,\text{N}$$

4) Polar Moment of Inertia of Shaft for Hollow Shaft for Torsion Dynamometer Formula

Evaluate Formula

Formula

$$J = \frac{\pi}{32} \cdot \left(d_o^{\,4} - d_i^{\,4} \right)$$

Example with Units

$$0.0909\,\text{m}^4 = \frac{3.1416}{32} \cdot \left(1.85\,\text{m}^{\,4} - 1.8123\,\text{m}^{\,4} \right)$$

5) Polar Moment of Inertia of Shaft for Solid Shaft for Torsion Dynamometer Formula

Evaluate Formula

Formula

$$J = \frac{\pi}{32} \cdot D_{shaft}^{\,4}$$

Example with Units

$$0.0906\,\text{m}^4 = \frac{3.1416}{32} \cdot 0.98\,\text{m}^{\,4}$$

6) Polar Moment of Inertia of Shaft for Torsion Dynamometer Formula

Evaluate Formula

Formula

$$J = \frac{T \cdot L_{shaft}}{G \cdot \theta}$$

Example with Units

$$0.09\,\text{m}^4 = \frac{13\,\text{N*m} \cdot 0.42\,\text{m}}{40\,\text{N/m}^2 \cdot 1.517\,\text{rad}}$$

7) Power Transmitted by Torsion Dynamometer Formula

Evaluate Formula

Formula

$$P = \frac{2 \cdot \pi \cdot N \cdot T}{60}$$

Example with Units

$$680.6784\,\text{W} = \frac{2 \cdot 3.1416 \cdot 500 \cdot 13\,\text{N*m}}{60}$$

8) Power Transmitted for Epicyclic-Train Dynamometer Formula

Evaluate Formula

Formula

$$P = \frac{2 \cdot \pi \cdot N \cdot T}{60}$$

Example with Units

$$680.6784\,\text{W} = \frac{2 \cdot 3.1416 \cdot 500 \cdot 13\,\text{N*m}}{60}$$

9) Power Transmitted for Epicyclic-Train Dynamometer using Tangential Effort Formula

Evaluate Formula

Formula

$$P = \frac{2 \cdot \pi \cdot N \cdot P_t \cdot r_p}{60}$$

Example with Units

$$680.092\,\text{W} = \frac{2 \cdot 3.1416 \cdot 500 \cdot 36.08\,\text{N} \cdot 0.36\,\text{m}}{60}$$

10) Tangential Effort for Epicyclic-Train Dynamometer Formula

Evaluate Formula

Formula

$$P_t = \frac{W_{end} \cdot L_{horizontal}}{2 \cdot a_{gear}}$$

Example with Units

$$36.0898\,\text{N} = \frac{19\,\text{N} \cdot 0.6843\,\text{m}}{2 \cdot 0.18013\,\text{m}}$$

11) Tension in Slack Side of Belt for Belt Transmission Dynamometer Formula

Evaluate Formula

Formula

$$T_2 = T_1 - \frac{W_{end} \cdot L_{horizontal}}{2 \cdot a_{pulley}}$$

Example with Units

$$19.0768\,\text{N} = 26.30\,\text{N} - \frac{19\,\text{N} \cdot 0.6843\,\text{m}}{2 \cdot 0.9\,\text{m}}$$

12) Tension in Tight Side of Belt for Belt Transmission Dynamometer Formula

Evaluate Formula

Formula

$$T_1 = T_2 + \frac{W_{end} \cdot L_{horizontal}}{2 \cdot a_{pulley}}$$

Example with Units

$$26.3\,\text{N} = 19.07683\,\text{N} + \frac{19\,\text{N} \cdot 0.6843\,\text{m}}{2 \cdot 0.9\,\text{m}}$$

13) Torque Acting on Shaft for Torsion Dynamometer Formula

Evaluate Formula

Formula

$$T = \frac{G \cdot \theta \cdot J}{L_{shaft}}$$

Example with Units

$$13.0029\,\text{N*m} = \frac{40\,\text{N/m}^2 \cdot 1.517\,\text{rad} \cdot 0.09\,\text{m}^4}{0.42\,\text{m}}$$

14) Torque on Shaft of Prony Brake Dynamometer Formula

Evaluate Formula

Formula

$$T = W_{end} \cdot L_{horizontal}$$

Example with Units

$$13.0017\,\text{N*m} = 19\,\text{N} \cdot 0.6843\,\text{m}$$

15) Torque on Shaft of Prony Brake Dynamometer using Radius of Pulley Formula

Evaluate Formula

Formula

$$T = F \cdot R$$

Example with Units

$$13\,\text{N*m} = 8\,\text{N} \cdot 1.625\,\text{m}$$

16) Torque Transmitted for Epicyclic Train Dynamometer Formula

Evaluate Formula

Formula

$$T = P_t \cdot r_p$$

Example with Units

$$12.9888\,\text{N*m} = 36.08\,\text{N} \cdot 0.36\,\text{m}$$

17) Torque Transmitted if Power is known for Epicyclic-Train Dynamometer Formula

Evaluate Formula

Formula

$$T = \frac{60 \cdot P}{2 \cdot \pi \cdot N}$$

Example with Units

$$12.9985\,\text{N*m} = \frac{60 \cdot 680.6\,\text{W}}{2 \cdot 3.1416 \cdot 500}$$

18) Torsion Equation for Torsion Dynamometer Formula

Evaluate Formula

Formula

$$T = k \cdot \theta$$

Example with Units

$$13.0029\,\text{N*m} = 8.571429 \cdot 1.517\,\text{rad}$$

19) Torsion Equation for Torsion Dynamometer using Modulus of Rigidity Formula

Evaluate Formula

Formula

$$T = \frac{G \cdot \theta \cdot J}{L_{shaft}}$$

Example with Units

$$13.0029\,\text{N*m} = \frac{40\,\text{N/m}^2 \cdot 1.517\,\text{rad} \cdot 0.09\,\text{m}^4}{0.42\,\text{m}}$$

Variables used in list of Dynamometer Formulas above

- a_{gear} Distance between Center of Gear and Pinion *(Meter)*
- a_{pulley} Distance between Loose Pulleys and T-Frame *(Meter)*
- **d** Distance Moved *(Meter)*
- d_i Shaft Inner Diameter *(Meter)*
- d_o Shaft Outer Diameter *(Meter)*
- d_{rope} Diameter of Rope *(Meter)*
- D_{shaft} Shaft Diameter *(Meter)*
- D_{wheel} Diameter of Wheel *(Meter)*
- **F** Frictional Resistance between Block and Pulley *(Newton)*
- **G** Modulus of Rigidity *(Newton per Square Meter)*
- **J** Polar Moment of Inertia of Shaft *(Meter⁴)*
- **k** Constant for a Particular Shaft
- $L_{horizontal}$ Distance between Weight and Center of Pulley *(Meter)*
- L_{shaft} Shaft Length *(Meter)*
- **N** Speed of Shaft in RPM
- **P** Power *(Watt)*
- P_t Tangential Effort *(Newton)*
- **R** Radius of Pulley *(Meter)*
- r_p Pitch Circle Radius *(Meter)*
- **S** Spring Balance Reading *(Newton)*
- **T** Total Torque *(Newton Meter)*
- T_1 Tension in Tight Side of Belt *(Newton)*
- T_2 Tension in Slack Side of Belt *(Newton)*
- **W** Load Applied *(Newton)*
- W_{dead} Dead Load *(Newton)*
- W_{end} Weight at Outer End of Lever *(Newton)*
- **θ** Angle of Twist *(Radian)*

Constants, Functions, Measurements used in list of Dynamometer Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Pressure** in Newton per Square Meter (N/m²)
  Pressure Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Radian (rad)
  Angle Unit Conversion
- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion
- Measurement: **Second Moment of Area** in Meter⁴ (m⁴)
  Second Moment of Area Unit Conversion

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