calculatoratoz.com

unitsconverters.com

Transformer Design Formulas

Calculators! Examples! Conversions!

Bookmark **calculatoratoz.com**, **unitsconverters.com**

Widest Coverage of Calculators and Growing - **30,000+ Calculators!**
Calculate With a Different Unit for Each Variable - **In built Unit Conversion!**
Widest Collection of Measurements and Units - **250+ Measurements!**

Feel free to SHARE this document with your friends!

Please leave your feedback here...

List of 19 Transformer Design Formulas

Transformer Design

1) Area of Core given EMF Induced in Primary Winding

Open Calculator

fx $$A_{core} = \frac{E_1}{4.44 \cdot f \cdot N_1 \cdot B_{max}}$$

ex $$2477.477\text{cm}^2 = \frac{13.2\text{V}}{4.44 \cdot 500\text{Hz} \cdot 20 \cdot 0.0012\text{T}}$$

2) Area of Core given EMF Induced in Secondary Winding

Open Calculator

fx $$A_{core} = \frac{E_2}{4.44 \cdot f \cdot N_2 \cdot B_{max}}$$

ex $$2477.477\text{cm}^2 = \frac{15.84\text{V}}{4.44 \cdot 500\text{Hz} \cdot 24 \cdot 0.0012\text{T}}$$

3) Eddy Current Loss

Open Calculator

fx $$P_e = K_e \cdot B_{max}^2 \cdot f^2 \cdot w^2 \cdot V_{core}$$

ex $$0.401063\text{W} = 0.98\text{S/m} \cdot (0.0012\text{T})^2 \cdot (500\text{Hz})^2 \cdot (0.7\text{m})^2 \cdot 2.32\text{m}^3$$

4) EMF Induced in Primary Winding given Input Voltage

Open Calculator

fx $$E_1 = V_1 - I_1 \cdot Z_1$$

ex $$13.2\text{V} = 240\text{V} - 12.6\text{A} \cdot 18\Omega$$

5) Hysteresis Loss

Open Calculator

fx $$P_h = K_h \cdot f \cdot (B_{max}^x) \cdot V_{core}$$

ex $$0.052424W = 2.13J/m^3 \cdot 500Hz \cdot \left(0.0012T^{1.6}\right) \cdot 2.32m^3$$

6) Maximum Core Flux

Open Calculator

fx $$\Phi_{max} = B_{max} \cdot A_{core}$$

ex $$0.3mWb = 0.0012T \cdot 2500cm^2$$

7) Maximum Flux in Core using Primary Winding

Open Calculator

fx $$\Phi_{max} = \frac{E_1}{4.44 \cdot f \cdot N_1}$$

ex $$0.297297mWb = \frac{13.2V}{4.44 \cdot 500Hz \cdot 20}$$

8) Maximum Flux in Core using Secondary Winding

Open Calculator

fx $$\Phi_{max} = \frac{E_2}{4.44 \cdot f \cdot N_2}$$

ex $$0.297297mWb = \frac{15.84V}{4.44 \cdot 500Hz \cdot 24}$$

9) Number of Turns in Primary Winding

Open Calculator

fx $$N_1 = \frac{E_1}{4.44 \cdot f \cdot A_{core} \cdot B_{max}}$$

ex $$20 = \frac{13.2V}{4.44 \cdot 500Hz \cdot 2500cm^2 \cdot 0.0012T}$$

10) Number of Turns in Secondary Winding

Open Calculator

fx $$N_2 = \frac{E_2}{4.44 \cdot f \cdot A_{core} \cdot B_{max}}$$

ex $$24 = \frac{15.84V}{4.44 \cdot 500Hz \cdot 2500cm^2 \cdot 0.0012T}$$

11) Percentage All Day Efficiency of Transformer

Open Calculator

fx $$\%\eta_{all\ day} = \left(\frac{E_{out}}{E_{in}}\right) \cdot 100$$

ex $$89.28571 = \left(\frac{31.25kW*h}{35kW*h}\right) \cdot 100$$

12) Percentage Regulation of Transformer

Open Calculator

fx $$\% = \left(\frac{V_{no\text{-}load} - V_{full\text{-}load}}{V_{no\text{-}load}}\right) \cdot 100$$

ex $$81.15585 = \left(\frac{288.1V - 54.29V}{288.1V}\right) \cdot 100$$

13) Primary Winding Resistance given Impedance of Primary Winding

Open Calculator

fx $$R_1 = \sqrt{Z_1^2 - X_{L1}^2}$$

ex $$17.97848\Omega = \sqrt{(18\Omega)^2 - (0.88\Omega)^2}$$

14) Secondary Winding Resistance given Impedance of Secondary Winding

Open Calculator

fx $$R_2 = \sqrt{Z_2^2 - X_{L2}^2}$$

ex $$25.90258\Omega = \sqrt{(25.92\Omega)^2 - (0.95\Omega)^2}$$

15) Self-Induced EMF in Primary Side

Open Calculator

fx $$E_{self(1)} = X_{L1} \cdot I_1$$

ex $$11.088V = 0.88\Omega \cdot 12.6A$$

16) Self-Induced EMF in Secondary Side

Open Calculator

fx $$E_2 = X_{L2} \cdot I_2$$

ex $$9.975V = 0.95\Omega \cdot 10.5A$$

17) Stacking Factor of Transformer

Open Calculator

fx $$S_f = \frac{A_{net}}{A_{gross}}$$

ex $$0.833333 = \frac{1000\text{cm}^2}{1200\text{cm}^2}$$

18) Transformer Iron loss

Open Calculator

fx $$P_{iron} = P_e + P_h$$

ex $$0.45\text{W} = 0.4\text{W} + 0.05\text{W}$$

19) Utilisation Factor of Transformer Core

Open Calculator

fx $$UF = \frac{A_{net}}{A_{total}}$$

ex $$0.322581 = \frac{1000\text{cm}^2}{3100\text{cm}^2}$$

Variables Used

- **%** Percentage Regulation of Transformer
- **$\%\eta_{all\ day}$** All Day Efficiency
- **A_{core}** Area of Core *(Square Centimeter)*
- **A_{gross}** Gross Cross Sectional Area *(Square Centimeter)*
- **A_{net}** Net Cross Sectional Area *(Square Centimeter)*
- **A_{total}** Total Cross Sectional Area *(Square Centimeter)*
- **B_{max}** Maximum Flux Density *(Tesla)*
- **E_1** EMF Induced in Primary *(Volt)*
- **E_2** EMF Induced in Secondary *(Volt)*
- **E_{in}** Input Energy *(Kilowatt-Hour)*
- **E_{out}** Output Energy *(Kilowatt-Hour)*
- **$E_{self(1)}$** Self Induced EMF in Primary *(Volt)*
- **f** Supply Frequency *(Hertz)*
- **I_1** Primary Current *(Ampere)*
- **I_2** Secondary Current *(Ampere)*
- **K_e** Eddy Current Coefficient *(Siemens per Meter)*
- **K_h** Hysteresis Constant *(Joule per Cubic Meter)*
- **N_1** Number of Turns in Primary
- **N_2** Number of Turns in Secondary
- **P_e** Eddy Current Loss *(Watt)*
- **P_h** Hysteresis Loss *(Watt)*

- P_{iron} Iron Losses *(Watt)*
- R_1 Resistance of Primary *(Ohm)*
- R_2 Resistance of Secondary *(Ohm)*
- S_f Stacking Factor of Transformer
- **UF** Utilisation Factor of Transformer Core
- V_1 Primary Voltage *(Volt)*
- V_{core} Volume of Core *(Cubic Meter)*
- $V_{full\text{-}load}$ Full Load Terminal Voltage *(Volt)*
- $V_{no\text{-}load}$ No Load Terminal Voltage *(Volt)*
- **w** Lamination Thickness *(Meter)*
- **x** Steinmetz Coefficient
- X_{L1} Primary Leakage Reactance *(Ohm)*
- X_{L2} Secondary Leakage Reactance *(Ohm)*
- Z_1 Impedance of Primary *(Ohm)*
- Z_2 Impedance of Secondary *(Ohm)*
- Φ_{max} Maximum Core Flux *(Milliweber)*

Constants, Functions, Measurements used

- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Electric Current** in Ampere (A)
  Electric Current Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Area** in Square Centimeter (cm^2)
  Area Unit Conversion
- Measurement: **Energy** in Kilowatt-Hour (kW*h)
  Energy Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Frequency** in Hertz (Hz)
  Frequency Unit Conversion
- Measurement: **Magnetic Flux** in Milliweber (mWb)
  Magnetic Flux Unit Conversion
- Measurement: **Electric Resistance** in Ohm (Ω)
  Electric Resistance Unit Conversion
- Measurement: **Magnetic Flux Density** in Tesla (T)
  Magnetic Flux Density Unit Conversion
- Measurement: **Electric Potential** in Volt (V)
  Electric Potential Unit Conversion
- Measurement: **Electric Conductivity** in Siemens per Meter (S/m)
  Electric Conductivity Unit Conversion

- Measurement: **Energy Density** in Joule per Cubic Meter (J/m³)
  Energy Density Unit Conversion

Check other formula lists

- Mechanical Specifications Formulas
- Reactance Formulas
- Resistance Formulas
- Transformation Ratio Formulas
- Transformer Circuit Formulas
- Transformer Design Formulas
- Voltage & EMF Formulas

Feel free to SHARE this document with your friends!

PDF Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

12/17/2023 | 12:56:10 PM UTC

Please leave your feedback here...