

# ASCEND ELECTRONICS INC.

## XFRM DESIGN EXPRESSIONS

PN004006

<a href="https://ascendelec.com/">https://ascendelec.com/</a>	SIZE A4	FSCM NO 5HYK7	DWG NO 004006-230718	REV 1.02
DEPARTMENT: Engineering	SCALE non	DESIGN REFERENCE		SHEET 1 OF 2

## Brief Explaining Transformer Design Expressions

### Transformer Efficiency

The ratio of a transformer's output power to its input power is known as transformer efficiency. The effect of transformer losses is measured by transformer efficiency, typically expressed as a percentage.

### What is the Efficiency of Transformer?

$$\eta = \frac{\text{output power}}{\text{input power}} = \frac{\text{output power}}{\text{output power} + \text{losses}}$$

$$\eta = \frac{\text{output power}}{\text{output power} + \text{iron losses} + \text{copper losses}}$$

$$\eta = \frac{V_2 I_2 \cos \phi_2}{V_2 I_2 \cos \phi_2 + P_1 + P_c}$$

Output power versus efficiency

### Transformer Voltage Regulation

Transformer voltage regulation is the ratio or percentage value by which a transformer's output terminal voltage varies either up or down from its no-load value due to variations in the connected load current.

$$\text{Regulation} = \frac{\text{Change in Actual Output Voltage}}{\text{The No-load Output Voltage}}$$

$$\therefore \text{Regulation} = \frac{V_{(\text{no-load})} - V_{(\text{full-load})}}{V_{(\text{no-load})}}$$

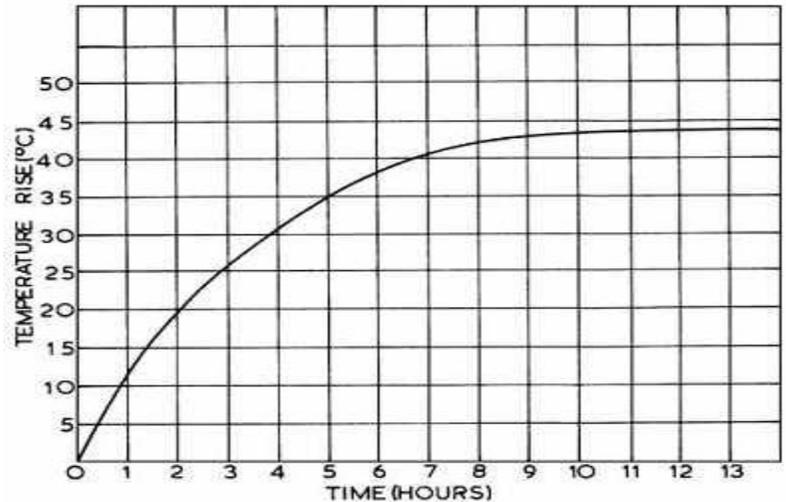
### Ambient Operating Temperature

The ambient temperature is the temperature at a location not affected by the heat generated by the transformer itself.

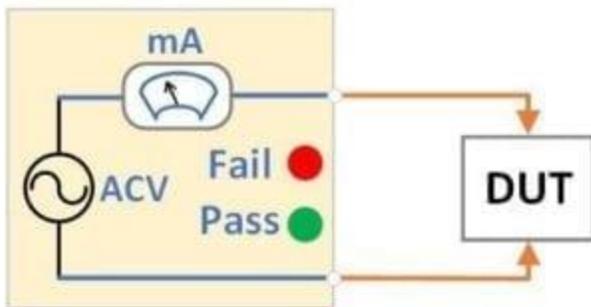


## Transformer Temperature Rise

Transformer temperature rise is defined as the average temperature rise of the windings above the constant ambient (surrounding) temperature when the transformer is loaded at its nameplate rating.



## Hipot Tester



## High Voltage Isolation Class

The high-voltage isolation class is used during the transformers' high-pot tests. High-pot (High Potential) tests, also known as dielectric withstand tests, are used to apply high voltage to assets to determine the adequacy of the electrical insulation to withstand voltage transients and ensure the insulation is not marginal. In addition, the voltage class is used to define high-voltage potential differential operation between primary and secondary.

## Input Waveforms

The transformer induces power or signal voltage waveforms for each secondary output. The resulting output waveform will be the same shape and frequency as its input waveform. Note that all transformers have bandpass characteristics, meaning they have a low-end and high-end frequency roll-off. Therefore for transformers outside the standard AC power line (50Hz to 400Hz), such as audio (20Hz-20kHz) and switching (1kHz to 10MHz), the minimum and maximum frequency of the bandwidth must be specified, in addition to the input waveform, such as pulse (square) or sinus.

