MGM TRANSFORMER COMPANY

DID YOU KNOW ?

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… what does transformer "insulation class" refers to?

One of the key specifications in an electrical machine (transformer, motor, etc.) is the "winding temperature rise" which is the average temperature increase of the winding above the ambient temperature when the winding is under load. The maximum value of the temperature rise in any machine is determined by the temperature class of the insulation in that machine. The electrical insulation system for materials used in generators, electric motors, transformers, and other electrical components is divided into different classes by temperature rating which is often referred to as *insulation class* or *thermal classification*. The different classes are defined by NEMA, IEEE, Underwriters Laboratories (UL) and IEC standards.

This insulation class is one of the many key components of the transformer design and manufacturing. The insulation class, or rating, of any insulation system is defined as the maximum allowable temperature at any point in the winding (the "hot spot") that will still give adequate life (usually 20 years) before degradation of the insulation system occurs. A "hot spot" is a single point of high temperature in the transformer. The "hot spot differential" is the difference between the hot spot temperature and the average temperature of the winding. So, putting all of these definitions together in the terms normally used in specifying a transformer we get: Hot Spot Differential = Maximum Ambient Temperature + Hot Spot Rise + Average Winding Rise. To get typical life from a transformer the Hot Spot Temperature should be less than or equal to the Insulation System Rating. The table on the right summarizes the different insulation systems available for 40 °C ambient max.

Insulation Rating	Insulation Class	Avg. Winding Temp Rise	Hot Spot Temp Rise	Max Winding Temp (Hot Spot Temp)
Class 105	A	45 degree C	65 degree C	105 degree C
Class 130	B	75 degree C	90 degree C	130 degree C
Class 155	F	95 degree C	115 degree C	155 degree C
Class 180	H	115 degree C	140 degree C	180 degree C
Class 220	R	150 degree C	180 degree C	220 degree C

** Note: Maximum acceptable temperature rise based on an average ambient of 30 degree C during any 24 hour period and a maximum ambient of 40 degree C at any time.

The maximum hot-spot operating temperature is reached by adding the rated ambient temperature of the machine (usually 40 °C), a temperature rise, and typically a 10 °C- 30 °C hot-spot allowance. Electrical machines including transformers are usually designed with an average temperature below the rated hot-spot temperature to allow for acceptable life. Insulation does not suddenly fail if the hot-spot temperature is reached, but useful operating life declines rapidly; the rule of thumb in the industry is a halving of the useful life of the unit for every consistent 10 °C temperature increase. MGM Transformer Company uses Nomex insulation rated at 220 °C regardless of winding temperature rise of 150, 115 or 80 °C rise to allow for overloading capacity of 15 %, 33 % for 115, 80 °C respectively. This temperature protection costs more in the manufacturing process, but ensures a much longer life out of your transformer. This is another one of the many ways that MGM Transformer is making customer service our priority. When you buy a transformer from MGM, you can rest assured that no corners were cut and you are getting a product as good if not better than anything else in the industry.