Insulation Class

A critical factor in the reduced life of electrical equipment is heat. The type of insulation used in a motor depends on the operating temperature that the motor will experience. Average insulation life decreases rapidly with increases in motor internal operating temperatures.

NEMA has established safe maximum operating temperatures for motors based on an average 20,000 hour lifetime. These maximum temperatures are the sum of the ambient and maximum temperature rise ratings of the motor.

There are four NEMA insulation classes based thermal endurance of the system for maximum temperature rating purposes. These are listed on the motor's nameplate and are either A, B, F, or H. These codes indicate the maximum temperature the motor insulation can withstand without failure.

Class A insulation was the standard insulation used on older U Frame motors between 1952 and 1964. Since 1964, T Frame motors use class B insulation as the standard insulation. Most common fractional horsepower motors use either insulation class A or B.

Class B is used on most integral horsepower motors. Classes F and H are generally used for NEMA motor designs which are special applications. Do not confuse the NEMA insulation classes with the NEMA motor designs which are also given by letters.

NEMA insulation ratings assume the motor is operating within its rated ambient temperature. Ambient temperature is the air temperature surrounding the motor and is also indicated on the nameplate.

Motors should be replaced by motors with the same or higher insulation class to avoid reductions in motor life and nuisance tripping of the motor overload device. Each 10 Degree C rise above the motor's rating can reduce motor life by one-half.

CLASS	20,000 HOUR LIFE TEMPERATURE
A	105°C
B	130°C
F	155°C
H	180°C

Class A insulation has a recommended temperature limit of 105 Degrees C or 221 Degrees F. Class B goes to 130 Degrees C or 226 Degrees F, Class F to 155 Degrees C or 311 Degrees F, and Class H to 180 Degrees C or 356 Degrees F. Insulation classes are directly related to motor life.

From this chart, you can compare Class A, B, F, and H insulation systems, all with ambient temperatures of 40 Degrees C. You can see how they differ in the total temperature they can withstand. Based on the ambient temperature of the application and the hours of operation you can select an insulation class that will provide dependable motor life.

For example: A motor operating at 180 Degrees C will have an estimated life of only 300 hours with a Class A insulation system. If Class B insulation is used, estimated life is increased to 1,800 hours. If Class F insulation is used, 8,500 hours of life can be expected from the motor and with Class H insulation motor life will increase to tens of thousands of hours.

IEC insulation winding classes parallel those of NEMA and in all but very rare cases, use the same letter designations.

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