NEW ELEC

MOTOR PROTECTION & CONTROL TECHNOLOGY

Motor Life Expectancy

Why overheating of the winding insulation materials decreases motor life expectancy

Heat Losses:

Since the useful power output at the output shaft of a motor is always less than the power input absorbed from the supply side, it implies that the motor efficiency is always less than 100%. The difference between the input and output power is called loss. This power loss is always transformed into heat. This heat warms up the motor windings and must be expelled from the motor to avoid excessive temperature rise.

Heat Dissipation:

The heat generated by internal losses is dissipated to the ambient air through the external surfaces of the frame. In totally enclosed frames this dissipation is usually aided by a shaft mounted fan. Good heat dissipation depends on the efficiency of the ventilating system, the motor frame area and the temperature differences between the frame and the ambient air. An efficient cooling system is one capable of dissipating the largest possible quantity of heat from the smallest dissipation area. The hottest point of the windings is in the centre of the slots where heat is generated as a result of losses in the conductors.

In the past, the temperature of an electric motor was usually measured by touch. Electrical motors were built by empirical design criteria and, often had a high degree of overloading capacity. Modern electric motors are computer-designed machines capable of delivering very little more kW beyond their continuous rating.

A South African Company to be Proud of

Electric Motor Life Expectancy:

The useful life of an electric motor is dependent on a myriad of factors such as vibration, hostility of air environment, humidity and so on. But the most important of all factors is the working temperature of the insulating materials employed. If the normal insulating material working temperature is exceeded by as little as 8 to 10%, the useful life of the motor will be reduced by half.

We are not referring to sudden increases in temperature (a locked rotor condition perhaps) where the insulation burns rapidly with total destruction, but the gradual ageing of the insulating material that becomes brittle losing its insulating properties until it eventually can no longer withstand the applied voltage. Insulating materials have an unlimited life for as long as the temperature is kept within their operating limits but deteriorates rapidly should the threshold be exceeded.

Such temperature limits refer to the hottest spot in the insulation and not necessarily to the whole winding. One weak point in the inner part of the windings will be sufficient to destroy it.

Insulation Classes:

The insulation classes used in electrical machines and their respective temperature limits in accordance with IEC 34 Standard are as follows:

- Class A (105 degrees C)
- Class E (120 degrees C)
- Class B (130 degrees C)
- Class F (155 degrees C)
- Class H (180 degrees C)
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Most standard TEFC motors with a continuous motor rating or S1 rating manufactured in South Africa today have a temperature rise specification for Class B insulation but are insulated with Class F insulating materials. This means that the motor during full load operation will typically have a final temperature rise of 80 degrees C. Considering an ambient temperature of 40 degrees C, the resultant final motor temperature would be in the vicinity of 120 degrees C.

Since the insulation material is Class F, it would initially appear that we have a lot of over capacity available. Typically however, this only permits a safe 10% increase in motor load OR a 5% reduction in rated supply voltage OR 3% unbalanced supply voltage.

This brief introduction emphasises the need to provide good, reliable protection to all electric motors. In so doing, the electric motor life expectancy will be maximised with subsequent cost reductions in down time.

Motor re-winding costs will be minimised. Modern electronic motor protection relays often go beyond just protecting the given motor. They facilitate planned maintenance in plants, provide varied control functions and record and date stamp trip events for future analysis. Modern electronic motor protection relays are of immense benefit in fault diagnostics and an electrician's best friend.

NewElec has built a 25 year reputation in the field of motor protection in South Africa and is perceived as a leading designer and manufacturer of electronic motor protection relays.

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