



TECHNICAL INFORMATION

TITLE: MULTIPLE RTD'S

Many proponents of motor-protection equipment with multiple-RTD inputs are simply adhering to the adage "MORE IS BETTER". In actual fact, the use of multiple RTD's cannot be justified by either engineering or economic considerations. The one-RTD design implemented by the MPU-16A was based on the following information:

- The response of temperature sensors embedded in stator windings is too slow to protect a motor against most overload conditions; however, they will indicate steady-state temperature and provide protection against loss of ventilation and high ambient temperature. If ambient temperature remains below 40°C and if there is no loss of ventilation, an accurate thermal model can provide protection against overloads. If an embedded RTD temperature sensor is used to provide hot-motor compensation by adding a bias to the thermal model, then protection is extended to include overloads initiated when the stator temperature is high. Only one sensor is required since the variation among sensors in the same motor is small compared to the temperature rise of the motor.
- Multiple RTD's would be beneficial if temperature varied around the periphery of a motor. In 1974, Nailen measured an average temperature variation of 6°C from the lowest to the highest embedded detector readings in the same machine. These tests were performed on 10 motors of various speeds and enclosures rated from 500 hp to 2500 hp. There was no pattern to the variation.
- Multiple RTD's would be beneficial if phase-unbalance protection was not available and if phase unbalance created a significant differential between the hottest phase and the coolest phase. In 1959, Gafford measured a maximum temperature differential of 7°C at 120% load and approximately 60% current unbalance. The biggest problem associated with unbalance is heating caused by negative-sequence currents and this will not be detected by multiple RTD's.
- Multiple RTD's should be installed when a motor is rewound. Since RTD's occasionally fail, it is a good idea to have spares already installed.
- Multiple RTD's should be used in motors over 2500 hp or 7000 V. In these motors, the thermal resistance between phases can be sufficient to allow the temperature of the most heavily loaded phase to exceed the average phase temperature. Since such motors are expensive, a multiple-RTD relay is recommended as back-up protection that is independent of the overload protection.

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