Thermal Trip Adjustment for Changing Current in Motor Relays

GE Power Management No. GET-8419

DEFINITION

The Thermal Capacity Used value (TC_{used}) is updated every 100 ms with the increments dependent on the current measured at the time and the thermal curve selected (or programmed), specifically the time to trip at that particular current. The relay trips when a value of 100% of TC_{used} is reached.

Thermal Capacity Used is defined as"

$$TC_{used} = TC_{used\ at\ t-100\ ms} + \frac{100\ ms}{Time\ to\ Trip} \times 100\% \quad \text{(EQ 1)}$$

where: $TC_{used\ at\ t-100\ ms}$ = the calculated thermal capacity 100 ms earlier
Time to Trip = the programmed curve trip time at the measured current.

EXAMPLE

Assume that a motor starts (5 seconds) with a current level corresponding to trip time of 10 seconds (selected curve) and then settles (for 40 seconds) at a current level corresponding to a 100 second trip time.

What will be the TC_{used} after this 45 seconds if the pre-start thermal level was 0%? We have:

$$\begin{aligned} TC_{used} &= TC_{used\ at\ t-100\ ms} + \frac{100\ ms}{Time\ to\ Trip} \times 100\% \\ &= 0\ s + \frac{5\ s}{100\ ms} \times \frac{0.1}{10\ s} \times 100\% + \frac{40\ s}{100\ ms} \times \frac{0.1\ s}{100\ s} \times 100\% \\ &= 54\% \end{aligned} \quad \text{(EQ 2)}$$

After the above 5 seconds + 40 seconds = 45 seconds, how long can the motor run at a decreased current corresponding to a 1500 second trip time? In this case, we have

$$100\% - 54\% = \frac{t}{100\ \text{ms}} \times \frac{0.1\ \text{s}}{1500\ \text{s}} \times 100\%$$
$$\Rightarrow t = \frac{48\% \times 100\ \text{ms} \times 1500\ \text{s}}{100\% \times 0.1\ \text{s}} = 690\ \text{s} \quad \text{(EQ 3)}$$

Therefore, the motor can run 690 seconds at the decreased current.