Bi-Metallic vs Expansion

INTRODUCTION

Of the various devices available to protect against short circuits and overloads, thermal circuit protectors have proven to be the designers' choice since they meet the demands of a great majority of applications requiring supplementary protection. The reasons are their ruggedness, simplicity and ability to repeatedly handle overloads and short circuits, at a reasonable cost.

Thermal Circuit Protectors may be divided into two classes:

- the Bi-Metal type and
- the Expansion type

BI-METALLIC CIRCUIT PROTECTORS

This type operates on the principle of a load current flowing through a bi-metal strip. The electrical resistance encountered causes the strip to heat-up, bend, and in doing so opens a set of contacts.

To ensure rapid opening of the circuit protector contacts most manufacturers incorporate a "snap-action" feature as part of the bi-metal strip design configuration. Some of Trimax' manufacturers supplement this feature with a spring mechanism to open the contacts more rapidly to reduce arcing, thereby extending operating life.

Bi-metallic circuit protectors inherently are thermal sensors and as such are affected by ambient temperature. Operation in a temperature environment higher than that for which they are rated, normally 77°F (25°C), will cause the protector to trip prematurely, unless compensated for during the selection process.

Conversely, a bi-metallic circuit protector installed in a temperature environment lower than that for which they are rated will cause the circuit protector to trip too late. This may result in failure of the equipment it is designed to protect, unless also compensated for during the selection process.

Most bi-metallic circuit protector manufacturers publish capacity correction factors to compensate for the difference in temperature between design, e.g. 77°F (25°C), and a variety of ambient temperature conditions, making the task of adjusting for these conditions easy.

The electrical industry offers two kinds of reset capabilities, i.e. automatic and manual reset.

Automatic reset circuit protectors are mainly applied to non-critical situations where space requirements and inaccessibility are prime considerations, e.g. automotive or marine applications, audio equipment, etc.

Manually resettable circuit protectors are mainly used in critical applications where, from an operational point of view, access to the device is available and desirable.

Certain models of manually resettable circuit protectors also feature visual trip indication which makes identification of the circuit involved easier for the operator.

Resetting a manual circuit protector requires moving the bi-metal from its "Open" to its "Closed" position. The procedure to be followed depends on the type of reset mechanism employed.

"Push to Reset" type circuit protectors may be reset by simply pushing a knob. Circuit protectors which combine overload protection with an ON/OFF switching capability such as the Toggle, Rocker, or Push/Pull type, may be reset by switching them to the "ON" position or switching them "OFF" first, then "ON".

All manual reset, bi-metallic circuit protectors offered by Trimax are trip-free, making it impossible to hold the circuit manually closed should an overload exist.

Bi-metallic circuit protectors are extremely suitable for applications where nuisance tripping due to start-up inrush or power surges must be prevented. This is due to its inherent capability to withstand high overload currents with a predictable time lag before interruption.

EXPANSION TYPE CIRCUIT PROTECTORS

Expansion type circuit protectors operate on the principle of a load current flowing through an extremely thin, special alloy wire or strip which is held under tension. Due to its extremely low mass and configuration, the electrical resistance encountered causes it to rapidly expand precisely at its design trip point, and in doing so opens a set of contacts. An integral spring mechanism of the same alloy ensures "snap-action-opening" of contacts, thereby extending operating life.

Due to the extremely low mass of the current carrying wire or strip, coupled with the unique thermal expansion characteristics of the alloy used, this type of circuit protector is insensitive to variations in ambient temperature. No derating or uprating to compensate for ambient temperature is required.

Additionally, due to the rapid heating and expansion characteristics of the sensing element, tripping always takes place consistently and precisely at the design trip point. Since cool-down is also extremely rapid, the circuit protector is immediately resettable.

Resetting the circuit protector activates the spring mechanism causing it to "snap-close" the contacts, thereby extending contact life.

All expansion type circuit protectors offered by Trimax are trip-free, making it impossible to hold the circuit manually closed should an overload exist.

Expansion type circuit protectors are insensitive to frequency variation due to the non-inductive sensing element used. Their voltage drop characteristics are constant up to the trip point.

Expansion type circuit protectors are the ideal choice for applications requiring consistent repeatability, chatter-free interruption and ultra-precise tripping.