LS-Titan includes positive-opening contacts

Introduction

A key feature of Eaton's new LS-Titan™ series of mechanical limit switches is their use of "positive opening" normally closed contacts. This application note is intended to explain the definition of "positive opening" and provide examples of where such a switch would be applied.

Positive-opening vs. spring-force contacts

"Positive opening" or "positive break" is a term used for many years to describe a particular type of electrical contact used in electrical switching devices. In association with mechanical limit switches as described in IEC directive EN 60204-1, positive opening is defined as "contact separation as direct result of a determined movement of the operating part of the switch via nonflexible parts."

In order to have a better understanding of that definition, it's important to understand how most switch contacts that are not "positive opening" operate. The most common form of electrical switching employed in mechanical limit switches is "snap action."

In these switches, force is applied to a spring. When the spring has compressed beyond a critical point, it changes shape rapidly and "snaps" to a new position, taking with it one or more electrical contacts. When the force is removed from the spring, it snaps back to the original position, restoring the contacts to their original state.

Snap-action contacts are usually quite reliable and remain the industry standard. However, under fault conditions, snap-action contacts can weld together. This may be caused by arcing from highly inductive loads or excessive load current beyond the ratings of the switch contacts. When the force is applied to the actuating spring, the deflection of the spring provides insufficient force to break the welded contacts apart.

A switch with positive-opening action will provide a "nonflexible" mechanical linkage that will rip the contacts apart even when welded. It is possible to have contacts that are both snap action and positive break. There are significant advantages to having a snap action that will quickly separate the contacts, reducing the duration of any arc, which in turn extends the life of the contacts. In such switches, they have both a spring and a nonflexible linkage to ensure that the contacts are pulled apart.

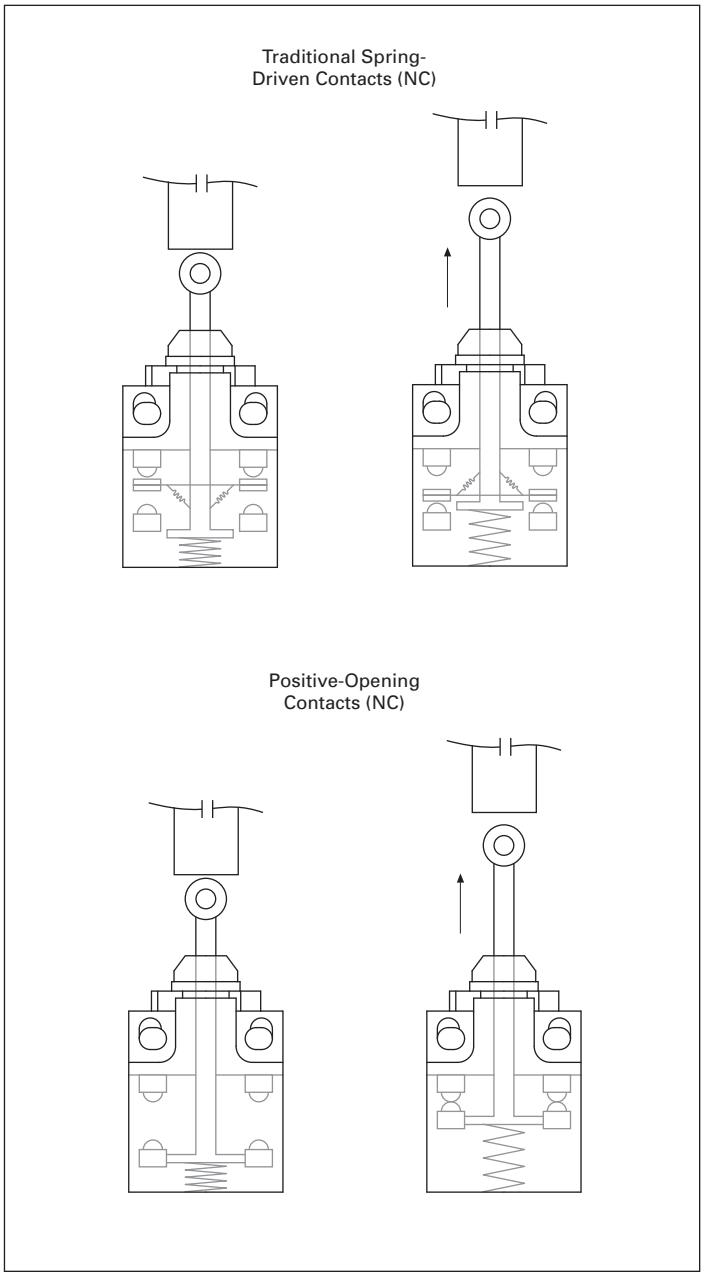

Figure 1. Conventional vs. Positive-Opening Contacts

Application

When are positive-opening contacts required? The choice of positive-opening contacts is determined by the machine designer. There are a number of domestic and international standards that specify the use of positive-opening contacts in machine design. If designing a machine for export to any of the European Union (EU) member countries, the machine builder must ensure that the machine conforms to all applicable EU directives. Even if positive-opening contacts are not specifically required, using a limit switch with such contacts positions the design so that conformance will be made easier if it ever becomes a future requirement.

What kind of application would use a limit switch with positive-opening contacts? The possibilities are many. In general, a typical application could be where a switch is providing feedback about the status of a machine part. Is the door closed? Is the vent open? Has the target reached the top limit of travel? Is the tank cover in place? All of these applications could be accomplished with limit switches that do not have positive-opening contacts. The key difference will be the safety requirements of the machine design. To know for sure, one begins with the safety standards and works from there. When in doubt, err on the side of caution and specify positive-opening contacts.

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