Safeguarding machines with hard guards

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Hard guarding is a common approach to protecting both the visible and invisible hazardous areas of a machine. It can involve a variety of materials, including metal screening, or clear plastic to allow visibility. The only limiting factor is that the material must be strong enough to contain the impact from any debris or potential broken parts that could be ejected during the manufacturing process.

Hard guarding challenges

Fixed hard guarding is generally preferred due to its simplicity. However, since this prevents access to the machinery for maintenance, repairs, adjustments or product manipulation, other alternatives may need to be considered.

Figure 1. PLEASE PROVIDE CAPTION. Source: Altech Corp.

Incorporating a door or removable access panel can eliminate this problem, as long as the door or access panel remains closed when the dangerous condition is present. Incorporating interlock switches is a common approach, as they monitor the position of the guard. There are several different types of interlock switches available, including keyed safety switches, non-contact safety switches and hinged safety switches. Standard switches provide one or two closed contacts when the door or panel is in place, thereby blocking the hazardous condition. Usually these are connected in series, forming a one- or two-looped safety circuit that is monitored by a safety relay or safety programmable logic controller (PLC). Typically these monitoring devices shut off the power, stopping the dangerous moving parts and preventing the start of the machine when the guard is opened or removed.

Due to inertia, some machines may continue to run after power is disconnected. This can create a dangerous situation where it is possible to access moving, hazardous areas of the machine. Examples of these machines are saws, flywheel devices or K presses.

To eliminate this possibility, the guards must be placed at a sufficient distance for the process to stop completely before the operator is able to access it. This safety distance can be calculated based on the time it takes to open the guard, the response time of the safety relay and an average hand speed constant.

Locking vs. unlocked

Another approach is to simply lock the guard or gate closed, allowing the machine enough time to safely wind down. This can be easily accomplished using solenoid-locking, keyed-interlock switches. These switches use a solenoid mechanism to lock a door-mounted activation key into the switch, preventing the guard, gate or door from being opened. Solenoid switches are available in two configurations: normally locked, in which the keys are locked into the switches automatically and the solenoid must be powered to remove

Figure 2. A normally locked and normally unlocked solenoid switch. Source: Altech Corp.

them; or normally unlocked, with switches that require power to the solenoid to lock the keys into the switch.

Typically, the power to the locking solenoid is controlled using a zero-speed device to sense that all the dangerous motion has stopped, or a PLC or timer to ensure that enough time is provided for the machine to come to a complete stop.

Most normally locked solenoid locking switches include an emergency override that allows the locking actuator key to be removed manually in the event of a power failure. These are designed for emergency use only and usually require the use of a separate tool like a hex key to open. If quick access to the override is required, some switches offer an optional hand-operated manual override, which can only be reset with a special tool.

Many solenoid locking switches are available with multiple contacts that offer separate outputs to indicate when the key has been properly inserted into the switch and if the key has been locked. Older generations of switches sometimes required the key contacts and locking contacts to run in series to reach the highest safety levels. Newer switches feature a fail-safe locking design integrating both functions into one contact, indicating that the key is both in place and locked. There is a new symbol, according to ISO 14119, to designate these fail-safe contacts.

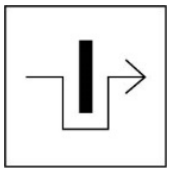

Figure 3. Symbol for a two-function fail safe locking solenoid. Source: Altech Corp.

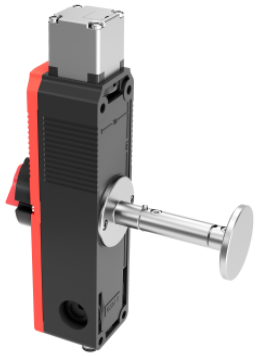

Figure 4. Solenoid with reverse override. Source: Altech Corp.

Locking a door or gate closed to guard an area large enough to allow full-body access (e.g., a robotic manufacturing cell) could accidentally trap an operator inside the hazardous area. Since the locking control and switch override would be outside of the cell, the operator would have no means of accessing them and no means of escape. Some solenoid locking switches are available with optional emergency escape override accessible from the back of the switch. When mounted, the escape override extends through the guard, giving the operator access to unlock the switch from within the cell.

Non-locking and locking keyed interlock switches are not designed for use as physical stops for the doors or gates. This is especially true with large, heavy, door and gate designs. Many switches offer separate hardware that can be used in conjunction with the switches, to support the weight and forces required to secure the gate. These units, which are typically referred to as slide bolts or shock bolts, are equipped with a handle to allow the operator to open and close the gate by hand when unlocked.

Figure 5. Slide bolt solenoid. Source: Altech Corp.

Many solenoid locking switches are now vertically designed to make them much easier to mount on extruded aluminum rail systems, which are popular for hard guarding applications. Some also feature a combination of plastic and metal in their construction components to make them both durable and cost effective.

Conclusion

Since 1984, Altech Corporation has grown to become a leading supplier of automation and industrial control and safety components. Headquartered in Flemington, NJ, Altech has an experienced staff of engineering, manufacturing and sales personnel to provide the highest quality products with superior service. With the Bernstein line of safety products, Altech offers electrical and electronic switching, sensing and enclosure systems. The Bernstein range offers over 25,000 high quality, durable and innovative switches, sensors and enclosure products. Our well trained technical experts welcome the opportunity to answer your technical questions and provide solutions to your automation and control needs. Visit www.altechcorp.com to learn more or reach out to us directly: morgan@altechcorp.com.