STANDARD ISSUE

CSA RELEASES NEW LOCKOUT GUIDELINES FOR CANADIANS

Safeguarding systems have made enormous strides in recent years as machinery designers and manufacturers have developed more reliable systems and new means of safeguarding workers during the normal operation of the equipment.

Yet, problems have arisen when equipment requires maintenance. How are the maintenance mechanics, electricians, millwrights and steamfitters protected? What about the technicians and technologists who are required to service increasingly sophisticated equipment? This is when plants most often require lockout methods.

In 2005, CSA published the first Canadian hazardous energy control standard: CSA Z460-05, Control of Hazardous Energy: lockout and other means. This standard draws on the learning that occurred since ANSI originally released Z244.1 in 1982, and on the learning that has occurred in industry over the last 23 years.

Organizations that choose to apply this standard to the development of Lockout/tagout programs in their plants can expect reductions in workplace injuries to maintenance and service staff.

CSA Z460 is a huge step forward for Canadian manufacturers because while existing regulations dealt with some aspects of lockout, they aren't as comprehensive as the new standard.

The new standard provides clear guidance on lockout requirements and even more importantly, how we can apply other methods to carry out efficient and effective troubleshooting during situations where lockout may not allow work to be completed.

Hazardous energy

Hazardous energy can come in almost any form. It could be from a moving part, a hot surface, a gas, a liquid, electricity, electromagnetic radiation or physical, biological or energy-related phenomena. Learning to identify these hazards is key to developing a useful lockout program. The risk assessment that the equipment manufacturer developed may uncover them. Or you'll find the information in the pre-start health and safety review conducted when the equipment first arrived.

Energy sources

The most common sources of energy in industrial plants are electricity, pneumatics and hydraulics. Many other energy sources may be hazardous, including steam, hot water, gravity, ionizing radiation (e.g. X-rays), non-ionizing radiation (e.g. radiofrequency electromagnetic fields), thermal, and residual sources, such as gravity, trapped air, pressurized accumulators or spinning flywheels.

Means of control

Each source of energy requires control. We can switch off some, such as electricity but we must control others, such as a gravity hazard, by blocking the mechanism so that it cannot fall.

The means of control is called an 'energy isolation device'. Here is how CSA Z460 defines this device:

Energy-isolating device – a mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: a manually operated circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors; a line valve; a block; and other devices used to block or isolate energy (push-button selector switches and other control-type devices are not energy isolating devices).

As you can see from the definition, the standard does not

consider control devices such as selector switches acceptable as a means of control for a source of hazardous energy.

Mechanically, most selector switches aren't robust enough to be considered mechanically reliable for safety-critical applications. The contact blocks on these switches can become loose and drop off the back of the operator device without being noticeable from the front of the panel, or even electrically detectable.

Furthermore, the circuits that these devices are normally connected to are also not reliable enough for lockout. For example, a selector switch connected to a PLC can only be considered to meet the simple degree of reliability (see CSA Z432-04), which is not reliable enough to be used for lockout.

Occasionally, companies may add locking devices to selector switches, emergency-stop buttons or similar devices. They don't necessarily make the device suitable for lockout. The device's ability to fulfill the lockout role depends on the physical construction of the device and the way it is incorporated into the control system.

Companies may use guard-interlocking circuits, but the control circuitry must be highly fault tolerant. The most fault-tolerant control circuit under the current definitions for control reliability in the Canadian standards is 'control reliable'. This definition only mandates single-fault tolerance, which is unlikely to be reliable enough for lockout purposes.

Under the international standards, ISO 13849-1 contains a definition for control reliability that includes multiple fault tolerance (Category 4 control reliability. ISO 13849-1 is also known as EN 954-1, the harmonized version of the international standard used for CE marking machinery under the EU New Approach.)

A well-designed circuit using suitable components that meets the requirements for Category 4 reliability may be adequately reliable for lockout purposes.

Cord-connected equipment can be isolated from electrical power by disconnecting the plug from the power-supply socket. The Canadian Electrical Code (CSA C22.1) and CSA Z432 consider a plug to be an adequate disconnecting and isolating device as long as the worker can maintain direct control of the plug while carrying out the work, say by putting the plug in a pocket. If you add a locking cover to the lug and socket combinations it's a much more positive means of lockout.

A device must be robust and reliable to be usable for energy isolation and you must be able to secure it in the safe position. Section 5 of CSA Z460 lays out the requirements for machine designers and builders. Note that the same requirements apply for equipment that is being rebuilt or modified.

Hazard identification and risk assessment

Risk assessment is basic to all safety engineering. When you design a lockout program, consider not only the machinery hazards that exist in normal conditions, but also the unique hazards that may exist during maintenance operations.

CSA Z460, Section 6 deals specifically with hazard identification from the lockout perspective and Section 6.3 covers hazard identification directly.

Machinery risks

Machinery hazards include all of the normal hazards that exist for the particular machine. These include in-running nip hazards such as those found on belt and chain drives and conveyors, drawing-in hazards like those found where rollers come together, cutting, crushing and stabbing. For a list of mechanical hazards, see CSA Z432-04.

Job hazards

Job or task hazards are those unique hazards that may exist based on the maintenance operator's tasks. Trapped energy hazards may be inside cylinders that are jammed. Gravity hazards may exist where the operator uses vertical rams to operate a die set. There may be hydraulic hazards where the operator uses hydraulic energy to adjust or set-up a piece of equipment.

Hazards also exist related to material waste in the machines, such as beryllium copper dust, fiberglass dust, or other toxic or hazardous materials. Lockouts cannot control these hazards, however the company must consider them and provide suitable training and protective equipment to the workers involved (see the Ontario Occupational Health and Safety Act, 1990, Section 25).

A job hazard analysis (JHA) assesses the hazards faced by a worker performing these tasks. Complete the job hazard analysis as you design the lockout procedure. Find detailed information on JHA on the Canadian Centre for Occupational Health

and Safety (CCOHS) Web site: www.ccohs.ca/. The Industrial Accident Prevention Association (IAPA) also provides a one-day training program in JHA. See their Web site at www.iapa.ca.

Once you've completed the machinery risk assessment and the job hazard analysis, identify the hazards that require lockout and develop the lockout procedure.

It's important to recognize that many troubleshooting tasks require that the equipment's power be on so that technicians can observe the operation of the equipment in order to diagnose the problem. In these situations, we must use other methods of safeguarding the personnel. The machinery designer may include a method in the control system of the machinery, such as the teaching pendant used with robot systems. Some of these means must be provided separately from the equipment.

Lockout versus other methods

- Elements of a lockout program
- Lockout policy versus lockout procedure

It is important to understand the difference between policy and procedure.

A policy is a course or principle of action adopted by an organization. Policies are general documents that define the intended outcome and the principles that an organization will follow. A lockout policy should be part of your management system and should identify the lockout requirements, who is affected and outline specific lockout procedures to be developed and implemented for machinery and work activities where hazardous energy is involved.

On the other hand, a procedure is defined as an established way of doing something, a series of actions conducted in a certain order or manner. A lockout procedure is specific to a particular piece of equipment. It is not possible or reasonable to have a single lockout procedure for an entire facility full of equipment because it cannot be specific enough.

The purpose of the lockout procedure is to ensure that when locking out, operators don't overlook any source of hazardous energy. It also allows you to customize the procedure for different activities, locking out certain energy sources during certain tasks or all sources at other times.

Other methods

Other methods than lockout are suitable under specific circumstances identified in Section 7.4.2 of the standard:

7.4.2 Appropriate Tasks for Other Control Methods

To be considered integral to production, designed tasks shall exhibit most of the following characteristics. They should be

- of short duration;
- relatively minor in nature;
- occurring frequently during the shift or production day;
- usually performed by operators or others functioning as operators;
- present predetermined cyclical activities;
- minimally interrupt the operation of the production process;
- exist even when optimal operating levels are achieved; and
- require task-specific personnel training.

So, this means that significant work, such as a die change on a power press, or the replacement of an air cylinder, must be carried out under lockout. On the other hand, maintainers may do a tip change on a resistance-welding gun, or replace a broken drill bit with a fresh bit, without locking out as long as the situation meets the other requirements for the use of 'other methods'.

Other methods of control include:

- Engineered safeguards such as area scanners, guards, hold-to-run devices, light curtains, single beam light fences, pressure mats, safety rated switches, stop devices and trapped key devices.

and/or

- Warning and alerting techniques including an attendant, automated warning systems, barricades, warning signs, placards and tags.

In addition to the methods above, you may also require administrative controls such as safe work procedures, apparel, illumination, preparation for work, training and personal protective equipment.

Finally, training is always required for hazardous work. A lockout procedure can be very thorough and well written and yet be absolutely worthless if no one knows it exists or knows how to follow it. Section 7.5.2 gives advice on training requirements for lockout.

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