Safety Lockout System (SLS)

An alternative isolation method for LOTO

PackExpo
Innovation Stage
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Objectives

- The challenges with manual disconnects
- The challenges with using a contactor as an isolator
- Solution: UL 6420 Equipment Used for System Isolation and Rated as a Single Unit
- OSHA acceptance for System Isolation Equipment use
Traditional isolating device challenges

- Larger sizes rated only 2,000 operations, most are rated at 8,000 operations
- “Frequent use” AC23A rating provides 20,000 operations
  - 1 isolation cycle = 2 operations
  - Over a 20 year mission life = 1.3 operations per day
- Changing out disconnects is expensive and inherently an unsafe job
- Disconnects can fail unsafe
  - The operator is required to stand in front of the door to throw the lever, putting him in harms way if there is a fault
  - Phases may remain energized even when locked out
Traditional isolating device challenges

- Clearance of 36” in front of the disconnect enclosure is required
- Series connected disconnects for multiple access points can lead to false zero voltage verification because a disconnect upstream may be off
- Wash down in food-grade environments are especially dangerous when high power disconnects are at machine access in wet locations
- After power failure, a manual disconnect stays on – leaving the potential for hazardous energy to be present when power is reapplied
Contactor as an isolator?

- A contactor system is optimal for high cycle rates but is not an isolating device, unless AC23A rated as a unit.

- Normal contactor testing per IEC 60947-4-1 for SSCR (Short Circuit Current Rating) type 2 coordination with the protection device (fuse, CB) allows the contacts to tack weld closed if it can be broken free easily.

- Common cause failure – In a dual contactor arrangement both contactors can weld on same phase when subjected to a fault current:
  - This inhibits motion in a typical guard door interlock but does not isolate energy.
  - To meet ISO 13849, dual channel requires the system must be tested for this common cause failure to qualify for safety of energy isolation.

- Normal contactor endurance testing per IEC 60947-4-1 uses 6x rated current; AC23A requires 10x rated current and almost twice the cycle count.
UL 6420 covers controls/contactor as an isolator

“Equipment Used for System Isolation and Rated as a Single Unit”

1.1.1.1 This standard applies to isolating equipment incorporating electromechanical contactors remotely controlled and monitored to provide remote isolation status indication with a defined integrity level. …

1.1.1.2 The system isolation equipment is expected to be used both as a means for removal of power for prevention of unexpected start-up of a stopped machine and as an isolator to provide protection from electric shock by ensuring the removal of electrical energy.

1.1.1.3 This equipment is intended for installation in accordance with the National Electrical Code, NFPA 70 and the Electrical Standard for Industrial Machinery, NFPA 79:2012.
UL 6420 covers controls/contactor as an isolator

“Equipment Used for System Isolation and Rated as a Single Unit”

1.1.2.1.1 The system isolation equipment is principally intended for industrial machine applications where, isolation of power is so frequently required that the mechanical life of a typical disconnecting means is unacceptably short or where there are multiple entry points on the machine where disconnection is required, or both.

Note – Multiple entry points are a function of access needs and the layout of the machine.

In 2015, OSHA added the ANSI/UL 6420 for product approvals by a Nationally Recognized Testing Laboratory (NRTL). (Ref OSHA 1910.7)
Additional SLS machine control interfaces

- UL 6420, 4.8.1 provides the system isolation equipment can be configured to meet additional machine control interface applications such as:
  - Safety related interface signal and feedback channels for:
    - Guard door locked status
    - Release signal for guard locks
    - Signal to and feedback from safety pneumatic control valve
    - Signal from E-stop devices to and feedback from E-stop systems
    - Run permissive to machine drive control system
    - Zero speed signals from drive
    - Signal to machine stop
  - Information related interface channels
    - Lockout switch positions (open or closed)
    - Isolation system component status and troubleshooting aids
    - Isolation system equipment status
Safety Lockout System – SLS description

The Safety Lockout System SLS is a system to safely disconnect machines and facilities from electrical, hydraulic and pneumatic power, provide automatic zero energy verification in order to protect personnel and comply with industry standards to prevent unexpected start-up.

The power isolation is a control reliable design and uses dual channel circuitry in the disconnect path.

The concept is the same as a lockout tagout procedure with automatic verification - No light, No enter.

UL 6420 System Isolation Equipment approved, the Pilz SLS system may be used as an isolation disconnect means for electrical servicing per NEC 430.109(A)(7) and NFPA79 2012 section 5.5.4(3).
SLS – Characteristics

- The energy isolation systems are modular in design

- Pilz integrated systems consist of:
  - Main SLS Panel
  - Optional Interface Panel or Remote Interface Subpanel
  - PSS Safety PLC Panel
  - RLS Remote Lockout Switch
  - Optional Pneumatic Exhaust Dump Valve Interface
  - Optional Hydraulic Exhaust Dump Valve Interface

- OEM versions supplied with equipment or for retrofit consist of
  - Main SLS Panel w/ PNOZmulti Controller
  - Optional Marshalling Boxes for expansion
  - Optional Pneumatic Exhaust Dump Valve Interface
  - Optional Hydraulic Exhaust Dump Valve Interface
SLS design principle

RLS 1

RLS 2

RLS 3

Pilz SLS

PSS or PNOZmulti Controller

Redundant Isolation Contactors and Voltage Monitor

Redundant Valve(s) and Dual PS Feedback

Optional C-Stop(s) or E-Stop(s)
SLS Multi system

- 480Vac Line Power
- Isolated 480Vac Load Power
- SRP/CS Interface
- E-Stop, Interlock Interface and Dual Contact “System Isolated” Feedback
- Ethernet Communication for fault and system status

More Marshalling Panels
Optional Marshalling Panel
8 Remote Lockout Stations per main panel
8 more RLS

Power and Control Panel

Pneumatic Isolation Panel
Hydraulic Isolation Panel
Wall and floor mount systems

Wall mount systems:
60A, 100A, 200A

Floor mount systems:
200A, 400A, 600A
Adding fluid power to the standard

- Hydraulic and pneumatic isolation will be added to the standard in 2017
- A plug-in pneumatic panel with inlet pressure switch and dual, calibrated zero pressure, factory tested, verification switches is provided for isolation to ISO 13849-1 category 4, PL e
- For now, OSHA will allow operator tasks and minor servicing exceptions for prevention of unexpected startup until a standard update is released and OSHA adds to 1910.7
System isolation equipment – Advantages

- Safe disconnect (isolation) of machine or zone hazardous energy
- Prevention of unintended start-up
- Zero energy verification and visual acknowledgement of the safe state (no need to suit up for zero voltage verification)
- Long lifetime, compared to traditional disconnect switches – designed for high cycle frequency and 20 year mission life
- Remote operation removes operator from power switching elements
- Electrical and fluid power isolation with a single remote lockout station (just one lock)
System isolation equipment – Advantages

- Economical placement of lockout points at each access promotes using proper procedures
- Flexible configuration for large and diverse machines and facilities
- Clearance of 36” in front of the Remote Lockout Station is not needed because it is 24VDC low current
- Removes the operator from hazards associated with wash down environments by removing the presence of 480VAC at the access point
NEC accepts SLS use for electrical energy isolation

The National Electrical Code (NFPA 70:2005)

430.2 Definitions
System isolation equipment: A redundant monitored, remotely operated contactor isolation system, packaged to provide the disconnection/isolation function, capable of verifiable operation from multiple remote locations, each having the capability of being padlocked in the ‘off’ (open) position.

430.109 (A)(7)
System isolation equipment shall be listed for disconnection purposes. SIE shall be installed on the load side of the current protection and it’s disconnecting means.
NFPA 79-2015

5.5 Devices for disconnecting (isolating) electrical equipment

5.5.4 The following devices shall be permitted to fulfill the isolating function of 5.5.3:

1. Devices described in 5.3.2
2. A manual motor starter marked suitable for motor disconnect and compliance with UL508 where located on the supply side of the last short circuit protection device (in the branch)
3. System isolation equipment that incorporates control lockout stations and is listed for disconnection purposes where located on the load side of the main supply circuit disconnecting means and over-current protection
OSHA 29 CFR Subpart S

OSHA 29 CFR, Subpart S, Electrical
1910.399, Definitions applicable to this subpart

Acceptable. An installation or equipment is acceptable to the Assistant Secretary of Labor, and approved within the meaning of this Subpart S:
(1) If it is accepted, or certified, or listed, or labeled, or otherwise determined to be safe by a nationally recognized testing laboratory recognized pursuant to § 1910.7; or
(2) ...

Accepted. An installation is "accepted" if it has been inspected and found by a nationally recognized testing laboratory to conform to specified plans or to procedures of applicable codes.
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