

DATE: March 17, 2020
TO: Occupational Safety and Health Standards Board
FROM: Scott Swaaley, CEO, MAKESafe Tools, Inc.
SUBJECT: Petition for Public Notice and Strengthening of CAL/OSHA Requirements Regarding Anti-Restart Devices

Hello Standards Board,

After sharing my thoughts on this issue with CAL/OSHA safety engineers at the Bay Area Safety Symposium on March 4th, 2020 and the San Diego ASSP PDC event on March 11th, 2020, they both encouraged me to bring this issue to the attention of the safety board. At their suggestion, I am submitting this written petition in advance of my public comment at the March 19, 2020 meeting.

Executive Summary *(Why this should matter to CAL/OSHA)*

California businesses are required by standard (and encouraged by local CAL/OSHA engineers) to prevent the unintentional restart of motors and motor operated machinery. Additionally, any engineering control installed by a business for this purpose is required to be listed by a Nationally Recognized Test Lab. Lastly, OSHA is responsible for overseeing all NRTLs. Given these facts, even a well-intentioned and well-informed business is likely to identify any UL Listed anti-restart device as a safe engineering control. However, for the reasons outlined in this petition, that well-intentioned business can be led astray by miscategorized NRTL listings and is put at risk by the unintentional creation of secondary fire and point-of-operation hazards. Now that this has come to our attention, it is imperative that we act to educate businesses, clarify CAL/OSHA requirements, and work with NRTLs and manufacturers to remedy the issue of unsafe motor controls.

Background *(How I discovered the problem)*

This issue first came to my attention when a customer informed me about the high failure rate of their recently purchased anti-restart devices. This particular aerospace customer had purchased approximately 70 commercially available anti-restart devices for pedestal bench grinders and was performing functional tests on a monthly basis. During their monthly tests, between one and three devices were discovered to have failed each month. A few weeks later I mentioned this to a CAL/OSHA safety engineer at the Pacific Coast Safety Fest in July of 2019 who jokingly referred to these types of anti-restart devices as "smoke boxes" (referring to their tendency to fail, smolder, and smoke). Having expertise in both machine guarding and electrical engineering, I decided to investigate further and purchased a few of these devices. As you'll see in the following discussion, my accidental discovery and subsequent investigation of this issue led to the identification of the root cause of these failures. My investigation also suggests a growing industry trend to adopt these seemingly innocuous but ultimately hazardous devices. However, with swift educational and legislative efforts, we can remedy this problem and work to keep machine operators safe across the industry.

Initial Investigation & Improper NRTL Standards

The first thing I noticed when disassembling one of these devices was that the integral switching device (the relay) was extremely undersized for the purpose. Unsure of how this product could have received a Nationally Recognized Test Lab (NRTL) listing, I looked further into their UL listing and discovered that these devices are NRTL Listed as "Appliance Controls" (UL 244A,) by UL. As far as any well-intentioned business can tell from manufacturer literature and specification sheets, these are "UL Listed" anti-restart devices meant for use on industrial machinery yet they are not tested or approved for use on any type of motor. To quote the standard directly, "[Appliance Controls] are not intended for controlling motor-operated appliances...". Further investigation shows that this miscategorization of anti-restart motor controls as "Appliance controls" is prevalent throughout the industry and represents a significant hazard to machine operators.

Proper NRTL Standards

The relevant standard for industrial motor controls is UL508 - "Industrial Control Equipment". This standard takes into account the hazards associated with motor controls and puts into place multiple performance and labeling requirements to mitigate the hazards described above. All switching devices used to control motors and motor-operated machinery should be listed and/or recognized by an NRTL under this standard. However, the devices being discussed here somehow bypassed this standard entirely.

Hazards

By allowing these anti-restart devices to be listed by an NRTL as 'Appliance Controls', well-intentioned business with the intent to comply may be exposed to additional hazards, including:

- **Risk of electrical fire:** excessive starting currents and inductive arcing (described in appendix) on under-rated switching devices can lead to overheating, smoldering, and fire.
- **Failure of engineering controls:** these devices are installed in order to prevent accidental restarts yet excessive starting currents and inductive arcing (described in appendix) can lead to contacts permanently welding into the closed ("ON") position - thereby completely negating the safety function.

Product Examples - Misleading Listing Categories

This petition describes products that are UL Listed as 'Appliance Controls' but marketed and sold for use with motors and motor operated machinery as an industrial control. Examples of these products are available upon request.

Potential Courses of Action

The intent of this petition is for CAL/OSHA to recognize the hazardous conditions described above and to take one or more of the following actions:

- Work with NRTLs to withdraw UL Listings for anti-restart devices currently listed under UL244A (Appliance Controls) and work with manufacturers to transition these products into UL508 compliance.

- Publish a general notice to businesses that such products present a safety hazard and clarify other options for mitigating against unintentional restarts (UL508 listed products, UL508A control panels, etc.).
- Require manufacturers of anti-restart devices that are not NRTL listed for safe use with motors and machinery to explicitly state such on their literature and labeling.
- Clarify the existing CAL/OSHA anti-restart standard (§2530.43) and better align with FED Osha requirement (1910.213(b)(3)) by doing the following:
 - Add current FED OSHA language to Title 8 section 4001 - Machine Power Control: “On applications where injury to the operator might result if motors were to restart after power failures, provision shall be made to prevent machines from automatically restarting upon restoration of power.”

Thank you for your attention to this matter and please let me know if you have any questions.

Sincerely,



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Appendix

Engineering Significance

Motors are a specialized type of electrical load known as an inductive load. This is significant in this analysis for two primary reasons, detailed below.

Startup Currents: Motors have extremely high starting currents. A 1.5 HP single-phase 120V motor, for example, has a full load current rating of 20 amps. During the first few seconds of starting, a motor of this size can pull between 5 and 7 times the full load current - up to 140A. This additional current creates a tremendous amount of heat and devices not designed or rated to handle this current will overheat, smolder, and fail.

Inductive Loads: Every time a motor is switched off, the stored electromagnetic energy in the motor creates a voltage spike in an attempt to maintain current flow. This voltage spike results in an electric arc inside the switching device itself, not unlike the arc created during welding. This arc is highly destructive and its occurrence in underrated devices can lead to the accelerated deterioration of electrical contacts, high resistance connections, high temperatures, smoldering, and failure.

Typical failure modes include: permanent welding of the switching device in the closed (“ON”) position, smoldering, and fire.

Relevant OSHA Standards

Accidental restart refers to the unintentional restarting of a machine after the loss of power. It is sometimes also referred to as “anti-restart” or “low-voltage dropout”. This function is required by multiple standards, including:

- CAL/OSHA §2530.43. Automatic Restarting: “(a) A motor-running overload device that can restart a motor automatically after overload tripping shall not be installed unless approved for use with the motor it protects. (b) A motor that can restart automatically after shutdown shall not be installed if its automatic restarting can result in injury to persons.”
- FED OSHA 1910.213(b)(3): “On applications where injury to the operator might result if motors were to restart after power failures, provision shall be made to prevent machines from automatically restarting upon restoration of power.”
- NFPA 79, 7.5.3 Restarting: “Upon restoration of the voltage or upon switching on the incoming supply, automatic or unintentional restarting of the machine shall be prevented when such a restart causes a hazardous condition”
- NEC 430.43 Automatic Restarting: “A motor overload device that can restart a motor automatically after overload tripping shall not be installed if automatic restarting of the motor can result in injury to persons.”

Additionally, OSHA requires all electrical equipment to be approved for its intended use by a Nationally Recognized Test Lab. Relevant standards include:

- FED OSHA 1910.303(a) Approval. “The conductors and equipment required or permitted by this subpart shall be acceptable only if approved, as defined in §1910.399.”
- FED OSHA 1910.303(b)(2) Installation and use. “Listed or labeled equipment shall be installed and used in accordance with any instructions included in the listing or labeling.”

- FED OSHA, Standard Interpretations (August 24, 1993): “The requirement mandating that electrical equipment be "approved" is set forth at 29 CFR 1910.303(a). Also, OSHA Standard 29 CFR 1910.303(b)(2) requires that "approved" equipment be used in conformance with its approval.”