Webinar provided by:

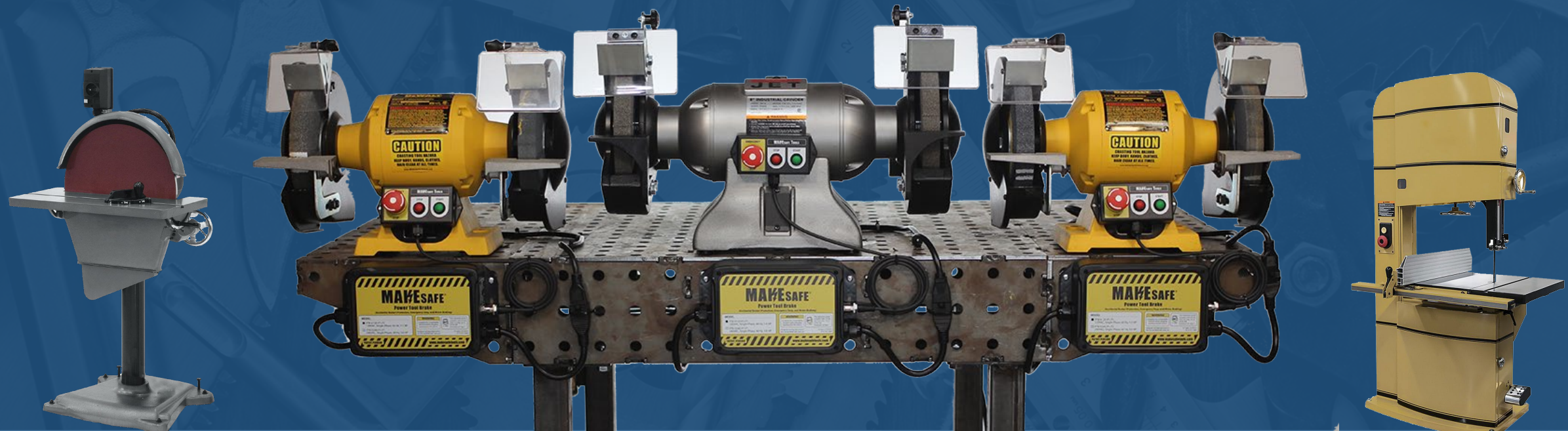
MAKESAFE® TOOLS

AMERICAN SOCIETY OF SAFETY PROFESSIONALS

Greater San Jose Chapter

Practical Machine Guarding

(OSHA Compliance & Injury Prevention)



Why this Topic?

- Because 40,000 people each year suffer from traumatic machinery-related injuries, and it's been the same for over a decade.
- Because machine guarding has been on the top ten list of most commonly citations every year for a decade.
- And because many of these injuries and citations are easily avoidable by implementing some simple safeguards.
- Because machine cost has nothing to do with it.
- Because it sometimes feels like details don't matter … until they do.

Agenda

- Does this apply to me?
- Can we afford it?
- A simple risk assessment:
  - Step 1 – Watch, listen, learn
  - Step 2 – Write it down
  - Step 3 – Prioritize
  - Step 4 – Implement
- Insights on where to start
- Commercial options

Does this apply to me?

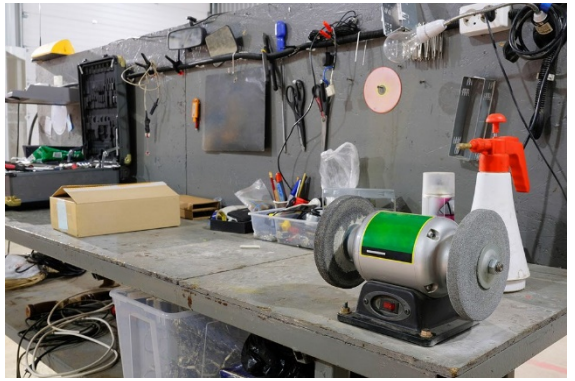
- Does your company employ people?
- Do you have a role in safety, supervision, and/or management?
- Do you have machines?

Everything with a Motor

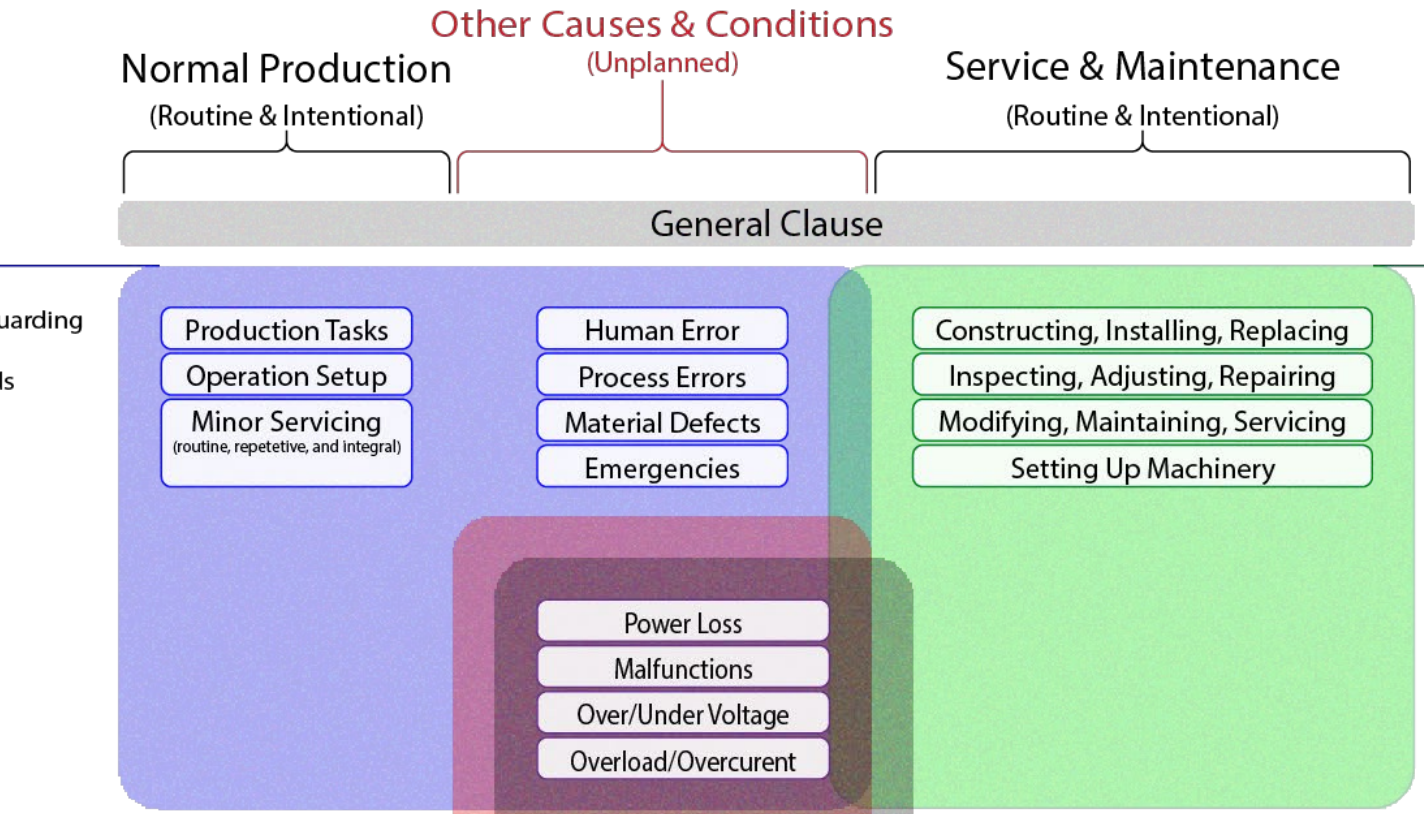
Production Machinery & Tool Rooms

Process Machinery

Maintenance Closets



What applies?



Machine Guarding

OSHA 29 CFR 1910 Subpart O -
Machinery and Machine Guarding
ANSI B11 Series -
Machinery Safety Standards

Hazardous Energy Control

OSHA 1910.147 - The control of hazardous energy (lockout/tagout)
ANSI Z244.1 - The Control of Hazardous Energy Lockout, Tagout and Alternative Methods

Electrical & Fire Safety

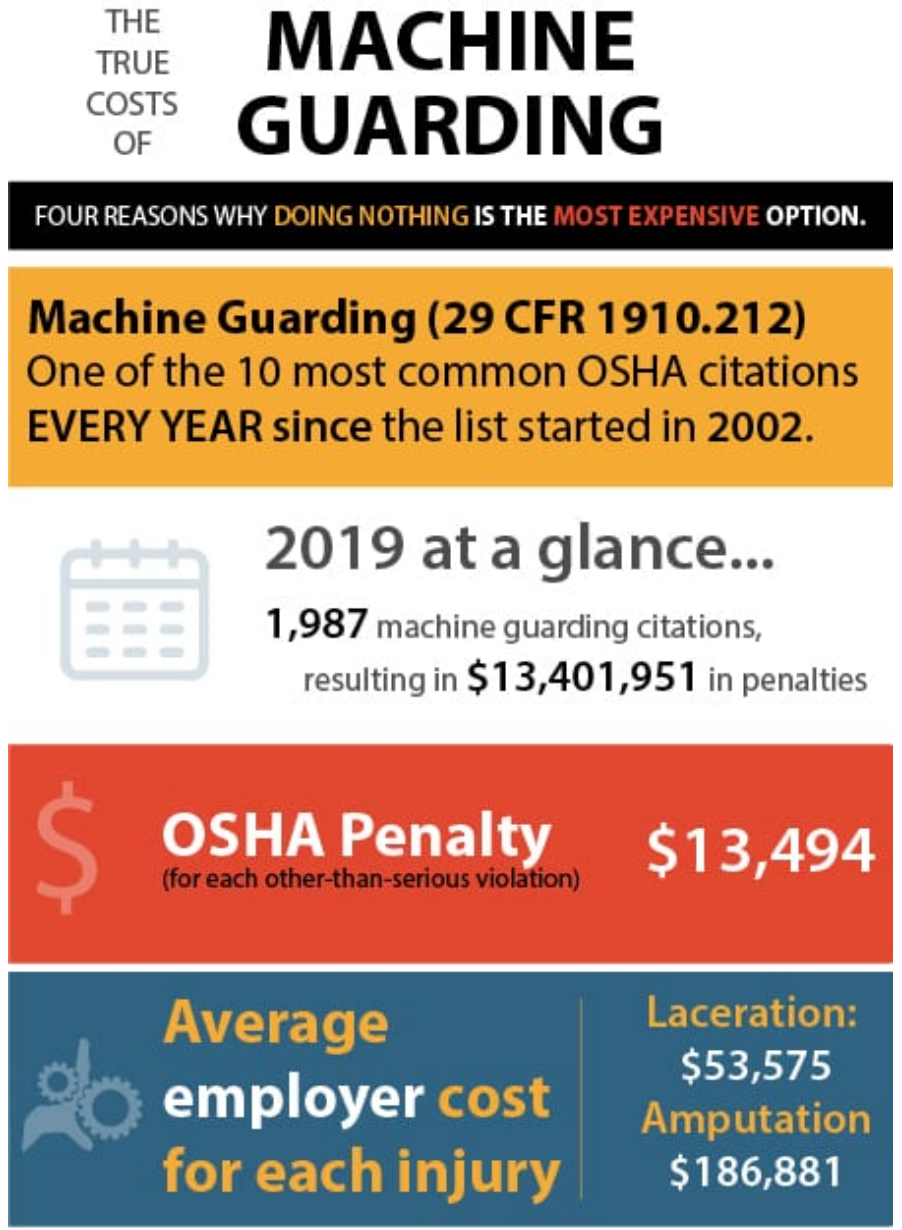
NFPA 70 - National Electric Code
NFPA 79 - Electrical Standard for Indusrial Machinery
OSHA 29 CFR 1910 Subpart S - Electrical

Nationally Recognized Test Labs

UL508 - Standard for Industrial Control Equipment
UL 60947 - Low-Voltage Switchgear and Controlgear

Can I Afford It?

- It doesn't need to be expensive
- It might even be free!



Watch, Listen, Learn (risk assessments)

- Planning:
  - What machines do we have?
  - Who should be involved?
- Machine Prep:
  - What is it? *(listen, learn)*
  - Where is it? *(watch)*
  - What is it used for? *(listen, watch)*
  - Who uses it? *(listen, watch)*
  - Are there any machine-specific standard(s)? *(learn)*
  - Is there a quick guide? *(learn)*
  - Any history with the machine? *(watch, listen)*

Watch, Listen, Learn (risk assessments)

- Identify any job hazards:
  - During: setup, use, power-down, maintenance *(listen, watch)*
  - Low hanging fruit! *(listen, watch)*
  - Compare to quick guide
  - Check machine-specific standard(s)
  - Document what you find!

Misconceptions …

New Tool = Compliant Tool

Most brand-new tools, even those from reputable companies, are non-compliant out of the box. It is not a manufacturer's legal responsibility to protect operators - it's yours!

Inexpensive Tool = Inexpensive Hazard

Many companies struggle to justify spending hundreds of dollars on safeguards for a bench grinder that cost less than $200 yet an injury or fatality resulting from a $200 bench grinder has the same human and financial cost as one caused by a $2,000,000 press.

Prioritize (risk assessments)

- Quantify each hazard using a risk assessment template (UL has a good one)
- Use a reasonable approach to identify which hazards to tackle first
- Document it!

Risk Assessment Template

Equipment: Mold Press (Machine name) RD-437 (Machine #) BRT-NXC (SAP #)

Location: Manufacturing B (Building)

Assessment Team Members

Start Date [Date]

Accident follow up Yes or No

Team Lead: Jannet Wells

Members: [Names here]

Contact UL for more information: www.ul.com/MachineRiskAssessment, email: FactoryServices@ul.com, 1-877-UL-HELPS

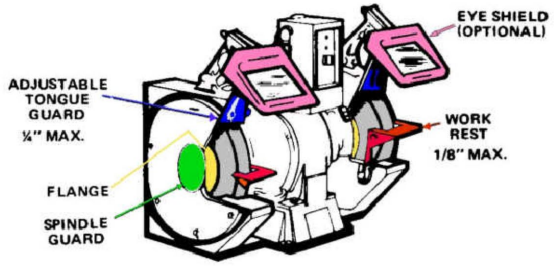
Instruction: Please follow Risk Assessment Steps below. Use Risk Assessment Flow Chart and Risk Factor Definitions.

Risk Level: 1–8 Represents Low Level 9–14 Represents Medium Level 15–20 Represents High Level

				Risk Level Estimate							Method of Reduction						Final Risk Estimate							
Task #	Task	Affected Persons	Hazard Type	Frequency of Exposure 1,2,4	Probability of Injury 1,2,4,6	Severity of Injury 1,3,6,10	Number of People Exposed	Protracted time in Danger Zone	Est. Risk Level	Tolerable?	Design	Safe-guarding	Admin. Controls	Method description	Date Final Follow-up Accessed	Owner	Frequency of Exposure 1,2,4	Probability of Injury 1,2,4,6	Severity of Injury 1,3,6,10	Number of People Exposed	Protracted time in Danger Zone	Final Risk Level	Tolerable?	Notes
	Normal Operation																							
1	Open guard to load or unload materials. Guard interlock switch not safety rated. Circuit not control reliable.	Operator / Helper	10.1 - Failure/disorder of the control system	4	4	10	1	0	18	No		X	X	Add safety rated switch and control reliable stopping circuit. Ensure all guards comply with OSHA/ANSI guard openings. E-Stop accessible.	########	J. Wells	1	1	6	1	0	8	Yes	
2	During production, operator cleans excess material off press.	Materials Handler	1.1 - Crushing hazard	4	2	6	1	0	12	No		X	X	Light curtain detects operator presence and is wired into a Control Reliable stopping circuit. Control Reliable circuit includes functional safety rated components, redundant wiring, monitoring, and redundant final switching elements. E-Stop is provided. Operator uses a tool to clean. Validated by 3rd party.	########	J. Wells	4	1	3	1	0	8	Yes	
									0	Yes												0	Yes	
	Maintenance Activities																							
3	Replace hydraulic cylinder.	Maintenance Personnel	1.9 - High pressure fluid injection or ejection hazard	1	6	10	1	1	18	No			X	Use LOTO procedures to ensure all energy is removed.	########	J. Wells	0	0	0	1	1	1	Yes	
									0	Yes												0	Yes	
	Commissioning/Other																							
4	**N/A – Machine already installed.**								0	Yes												0	Yes	
5	**Plant Visitors are not allowed close to machine. Supervisors are trained operators.**								0	Yes												0	Yes	

https://www.ul.com/resources/understanding-importance-machine-risk-assessment

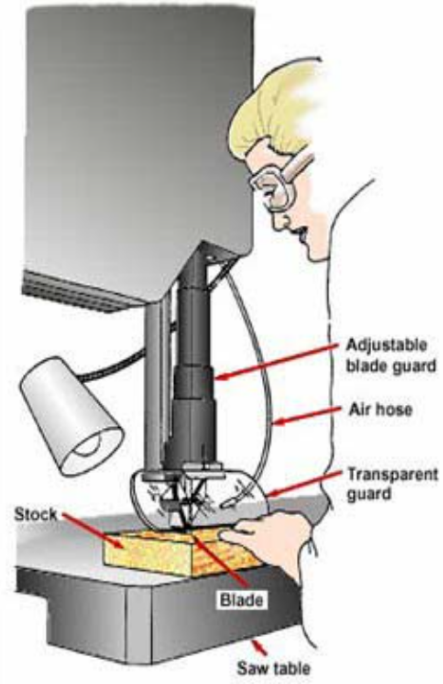
Checklist for Abrasive Wheel Equipment Grinders[1]



Standard 29 CFR 1910	Description	YES	NO[2]
From the Abrasive Wheel standard			
215(a)(2)	Do side guards cover the spindle, nut and flange and 75% of the wheel diameter?		
215(a)(4)	Is the work rest used and kept adjusted to within 1/8-inch (0.3175cm) of the wheel?		
215(b)(9)	Is the adjustable tongue guard on the top side of the grinder used and kept to within 1/4-inch (0.6350cm) of the wheel?		
215(d)(1)	Is the maximum RPM rating of each abrasive wheel compatible with the RPM rating of the grinder motor?		
215(d)(1)	Before new abrasive wheels are mounted, are they visually inspected and ring tested?		
From other OSHA standards			
22(a)	Is cleanliness maintained around grinders?		
94(b)(2)	Are dust collectors and powered exhausts provided on grinders used in operations that produce large amounts of dust?		
133(a)(1)	Are goggles or face shields always worn when grinding?		

Band Saws

Band saws use thin, flexible, continuous steel strips with cutting teeth on one edge. They are used primarily for cutting curves in stock or in food processing plants to cut and trim meat, poultry, and fish. The blade runs on two pulleys, driver and idler, and through a work table where material is manually fed. Automatic feeds can be used for production cutting. However, this machine is usually considered a manual-feed tool. The two types of band saws, horizontal and vertical, are named for their respective cutting blade positions.



Vertical band saw in operation

Operator Involvement

The operator is required to hand-feed and manipulate the stock against the blade to saw along a predetermined line. The user must also keep the stock flat on the work table and exert the proper cutting force.

Point of Operation

Potential Hazard:

- Contact with the blade is the most common cause of injury. Extreme caution is necessary because the operator's hands may come close to the saw blade, and a band saw cannot be completely guarded.

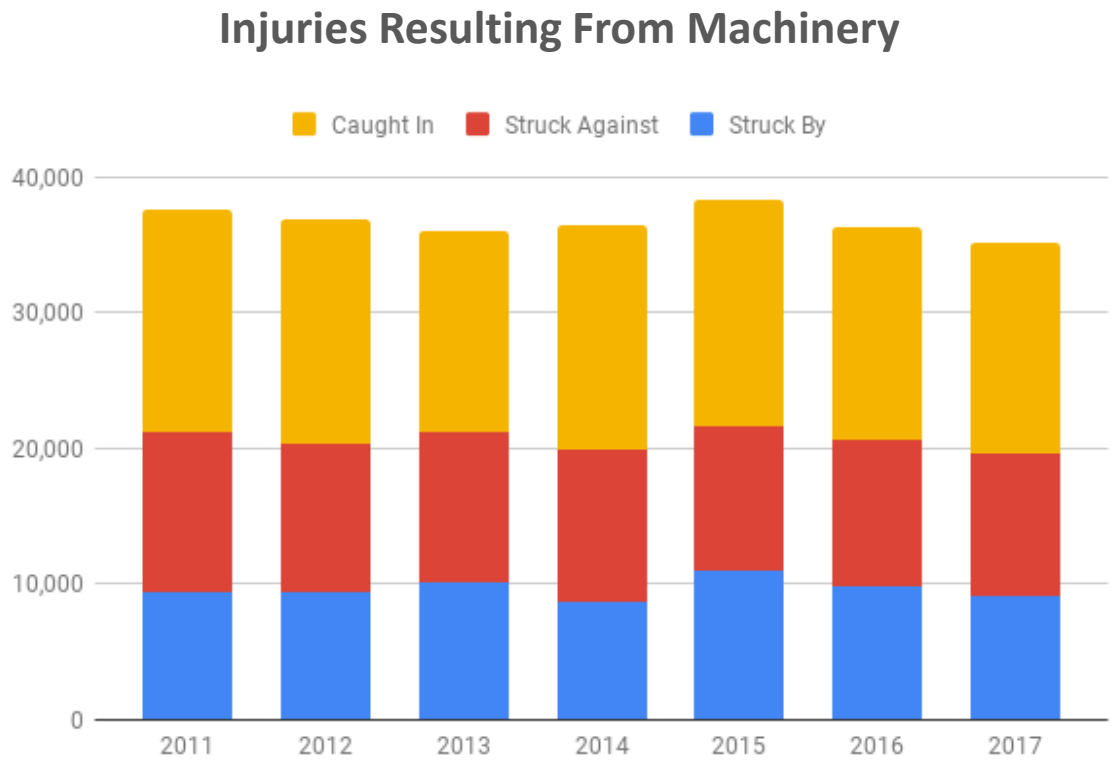
Solutions:

- Guard the entire blade except at the point of operation (the working portion of the blade between the bottom of the guide rolls and the table). [29 CFR 1910.213(i)(1)]
- Use a self-adjusting guard for the portion of the blade between the sliding guide and the upper saw so that it raises and lowers with the guide. [29 CFR 1910.213(i)(1)]
- Fully enclose the pulley mechanism. [29 CFR 1910.219(d)]

INJURY PREVENTION

Injury Profiles

- This is only reported injuries resulting in missed days from work or medical treatment.
- By population, that means over 1,100 incidents in Los Angeles alone.



Number of nonfatal occupational injuries and illnesses involving days away from work by [all] workers, All U.S., all ownerships, 2011 – 2017.

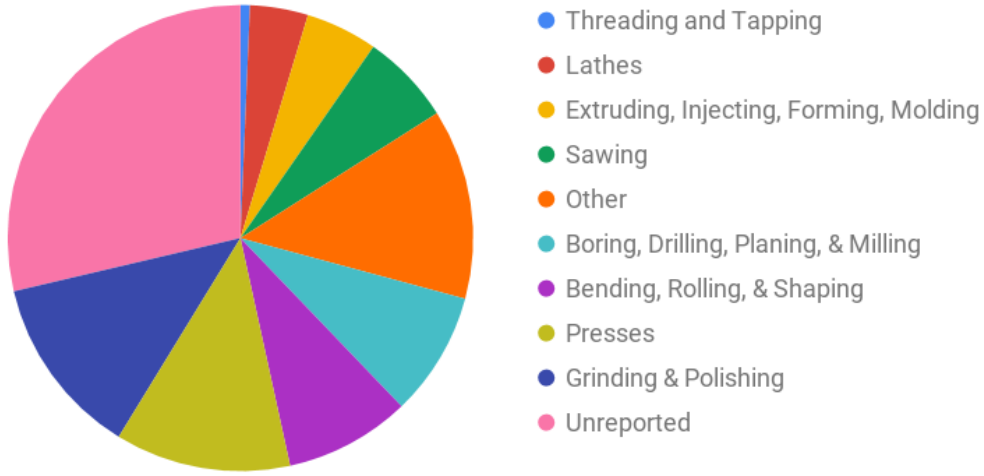
SOURCE: Bureau of Labor Statistics, U.S. Department of Labor, Jul 6, 2019

INJURY PREVENTION

Injury Profiles

- Worst Offenders
  - Grinders & Polishers
  - Presses, Benders, Rollers, Shapers
  - Drills, Mills, & Planers
  - Saws

Injuries Resulting From Machinery



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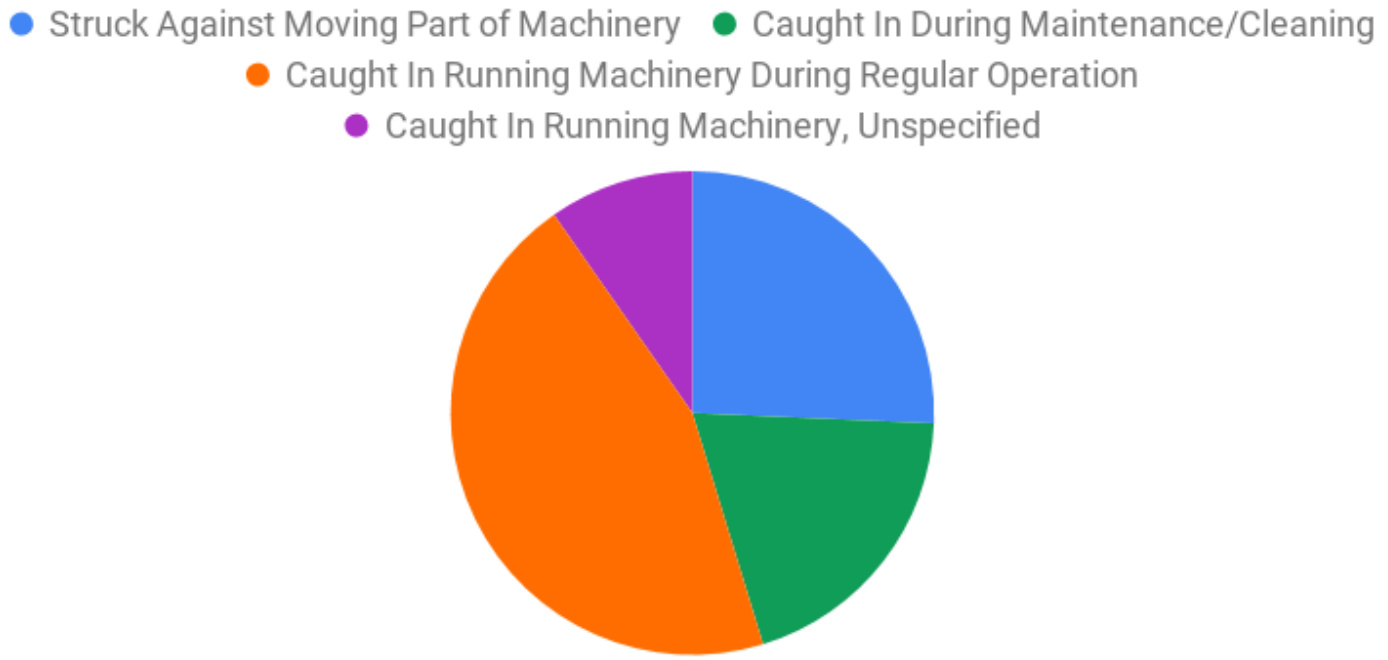
INJURY PREVENTION

Injury Profiles

- More than 50% of the injuries are not a result of “regular operation”.
- So when and how do these injuries occur?

Injuries Resulting From Machinery



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INJURY PREVENTION

Injury Profiles

Common Cause:

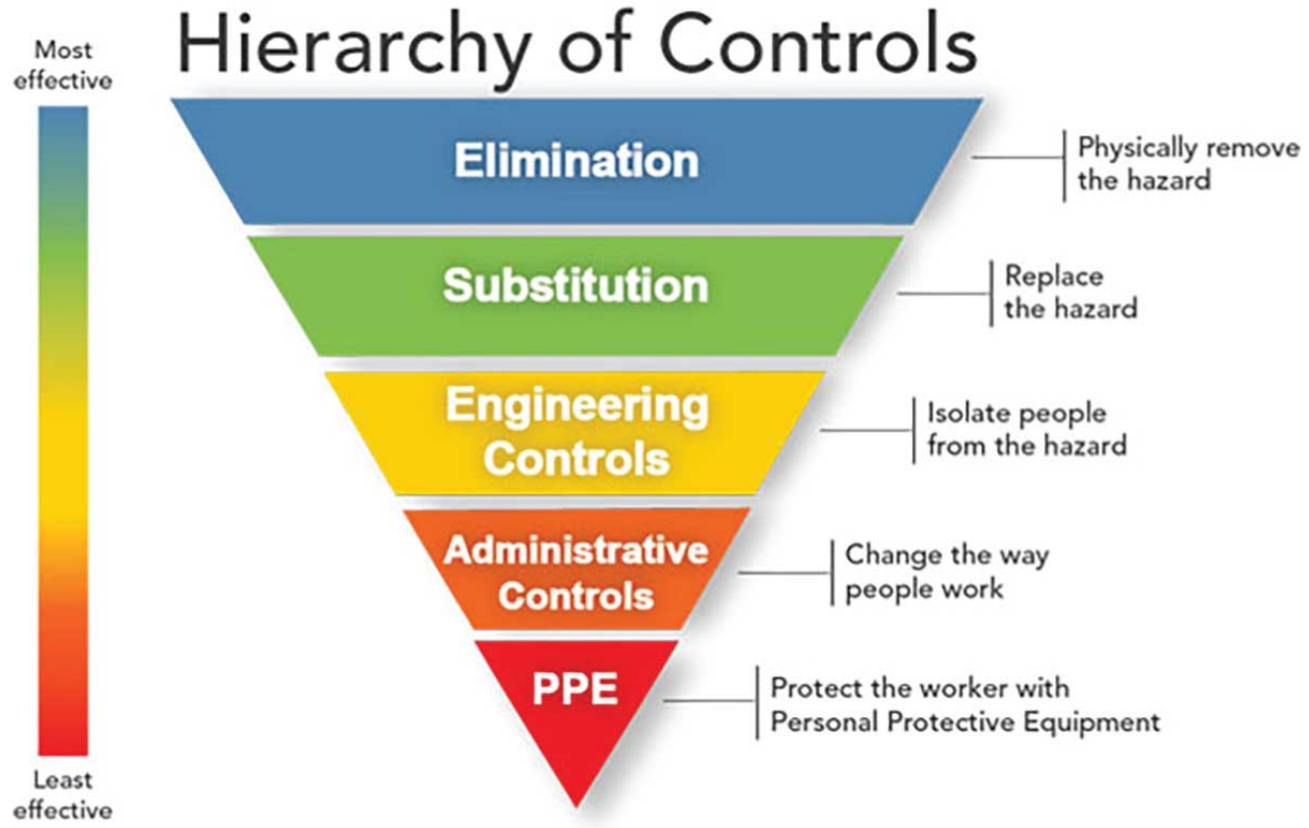
- The Control of Hazardous Energy (Lockout Tagout)
- Unintentional Restart
- Coasting
- Emergency Situations & E-Stop

Common Times:

- Before & After Operation (Setup/Cleanup)
- Jams, Cutoffs, Malfunctions
- Power Loss (1910.213(b)(3))
- Emergencies (1910.213(b)(1))
- Maintenance and Cleaning

Make Changes (risk assessments)

- Find a way to protect from each hazard
- “Guards” vs. “engineering controls”
- Buy or DIY the fix
- Reassess
- Document it!
- Iterate



Other P-P-P Pressures

People

- Can’t get in the way.
- Can’t be bypassed.
- Can’t cause additional hazards.
- Can’t be “too hard”.

Production

- Can’t slow people down.
- Can’t impact workflow.

Profit

- Can’t be expensive to implement or use.
- Can’t require significant training.

Means of Mitigation

- A look at your options for how to prevent injury and comply.

Common Cause:

- The Control of Hazardous Energy (Lockout Tagout)
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Lock Out Tag Out

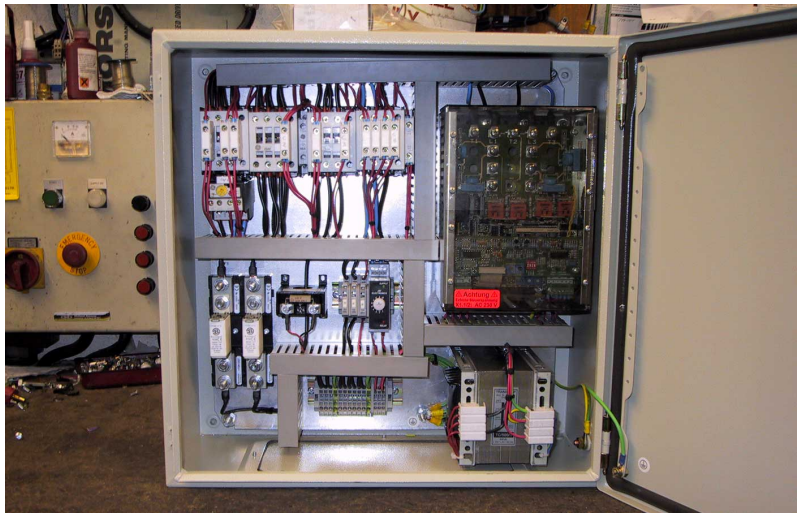
- Lots of information online
- Lots of product options

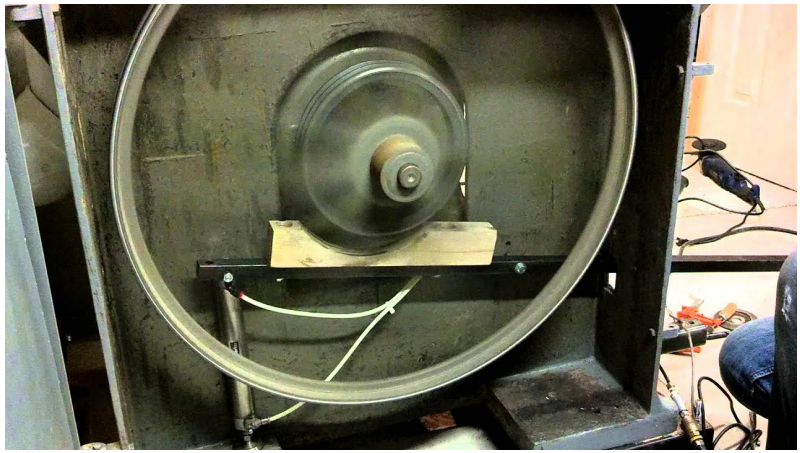
Restart Prevention

- Lots of Names:
  - “Safe Start”
  - “Accidental Restart Protection”
  - “Anti-Automatic Restart Protection”
  - “Low Voltage Dropout”
- Beware … there is a reason they’re low cost.

Braking Systems

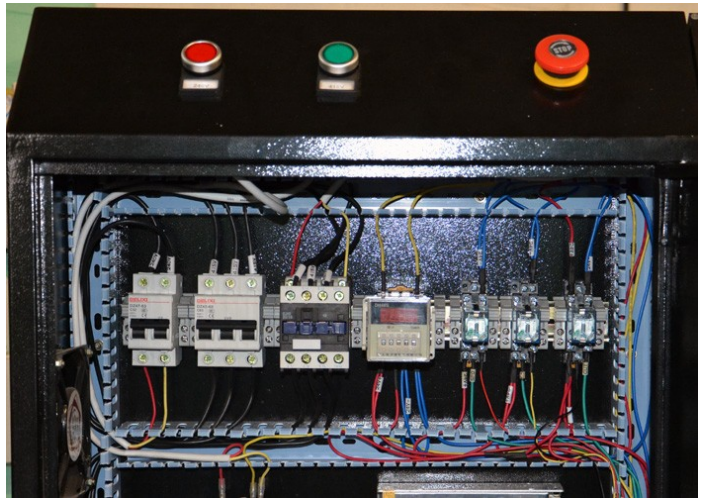
- Braking Systems
  - OEM vs. Retrofit
  - Mechanical Braking
  - Electrical (Motor) Braking





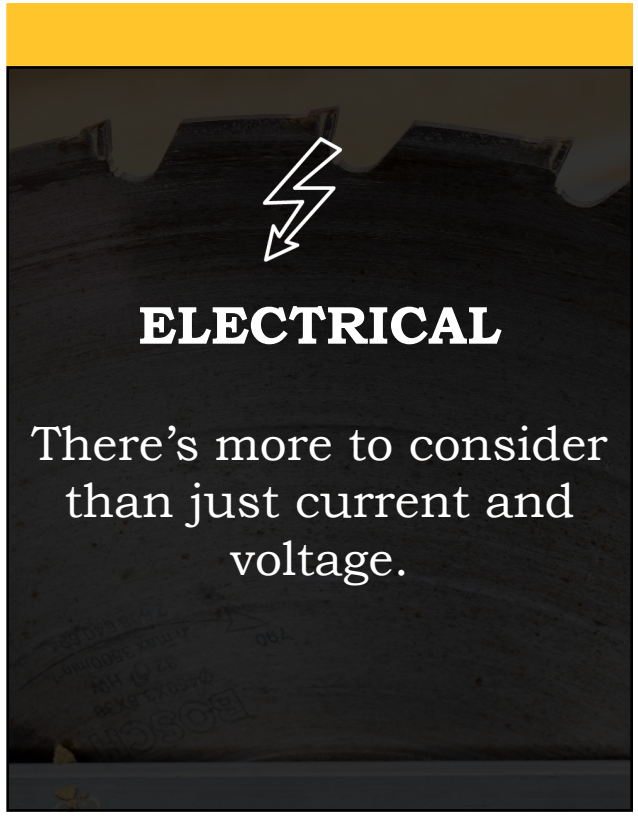
Emergency Stop

- E-Stop Categories
- ANSI Requirements



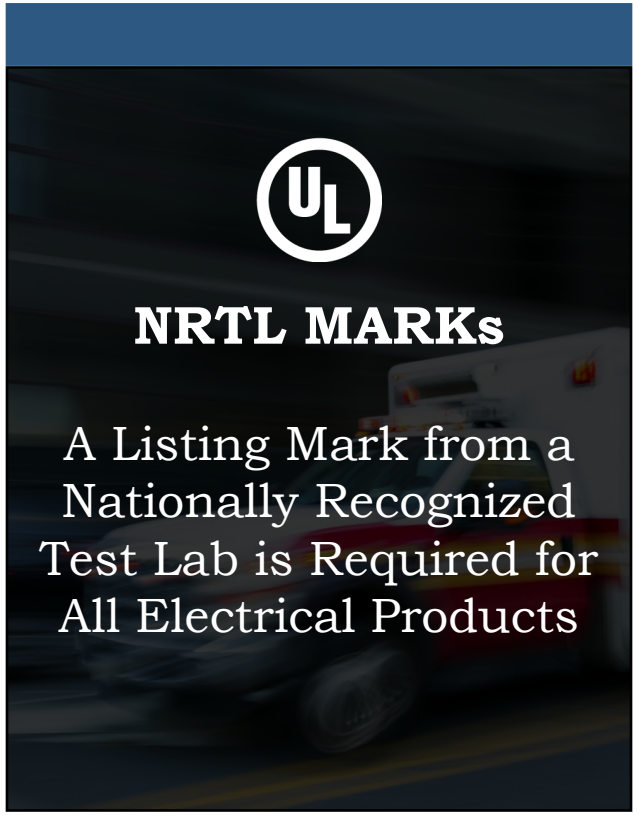
Specifications

Considerations when purchasing and specifying electrical safeguards.



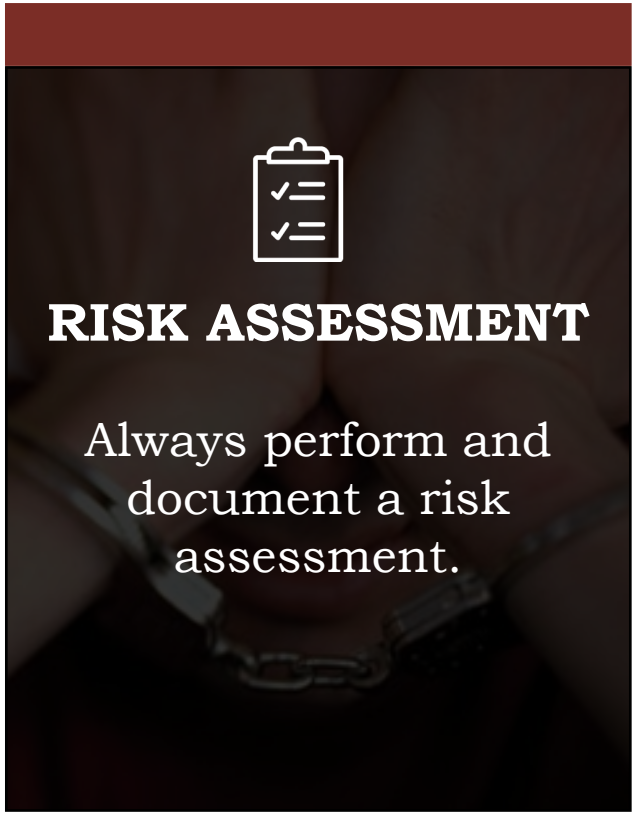
ELECTRICAL

There's more to consider than just current and voltage.



NRTL MARKs

A Listing Mark from a Nationally Recognized Test Lab is Required for All Electrical Products

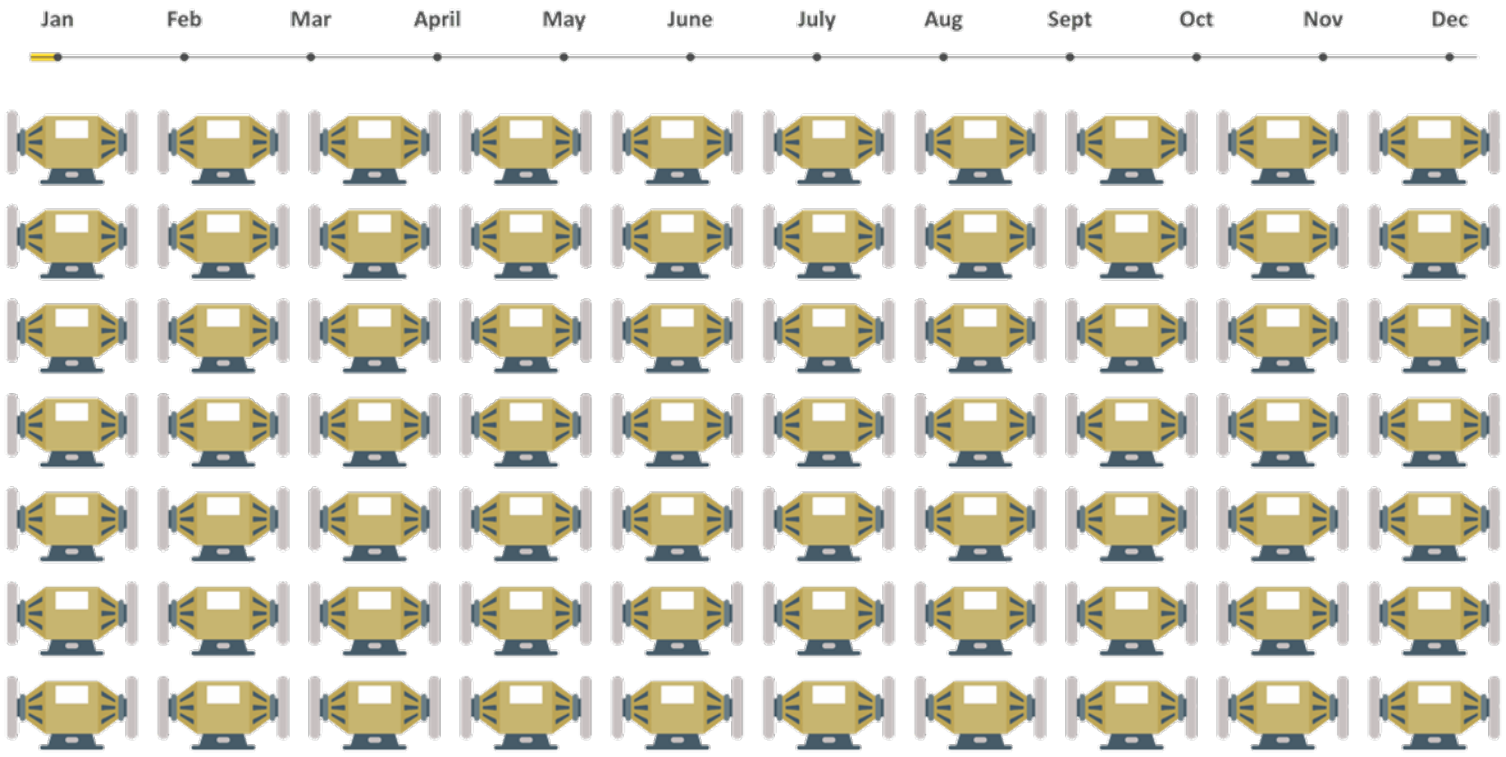


RISK ASSESSMENT

Always perform and document a risk assessment.

Misleading Products

- Customer: Aerospace parts manufacturer
- Intent: Protect operators and comply w/ anti-restart regulation.
- Context: Customer has a pedestal bench grinder at each CNC operator station, used for tool sharpening.
- Project Scope: Install commercially available anti-restart devices on 70 bench grinders.
- Result: Based on monthly testing, between one and three devices failed each month.



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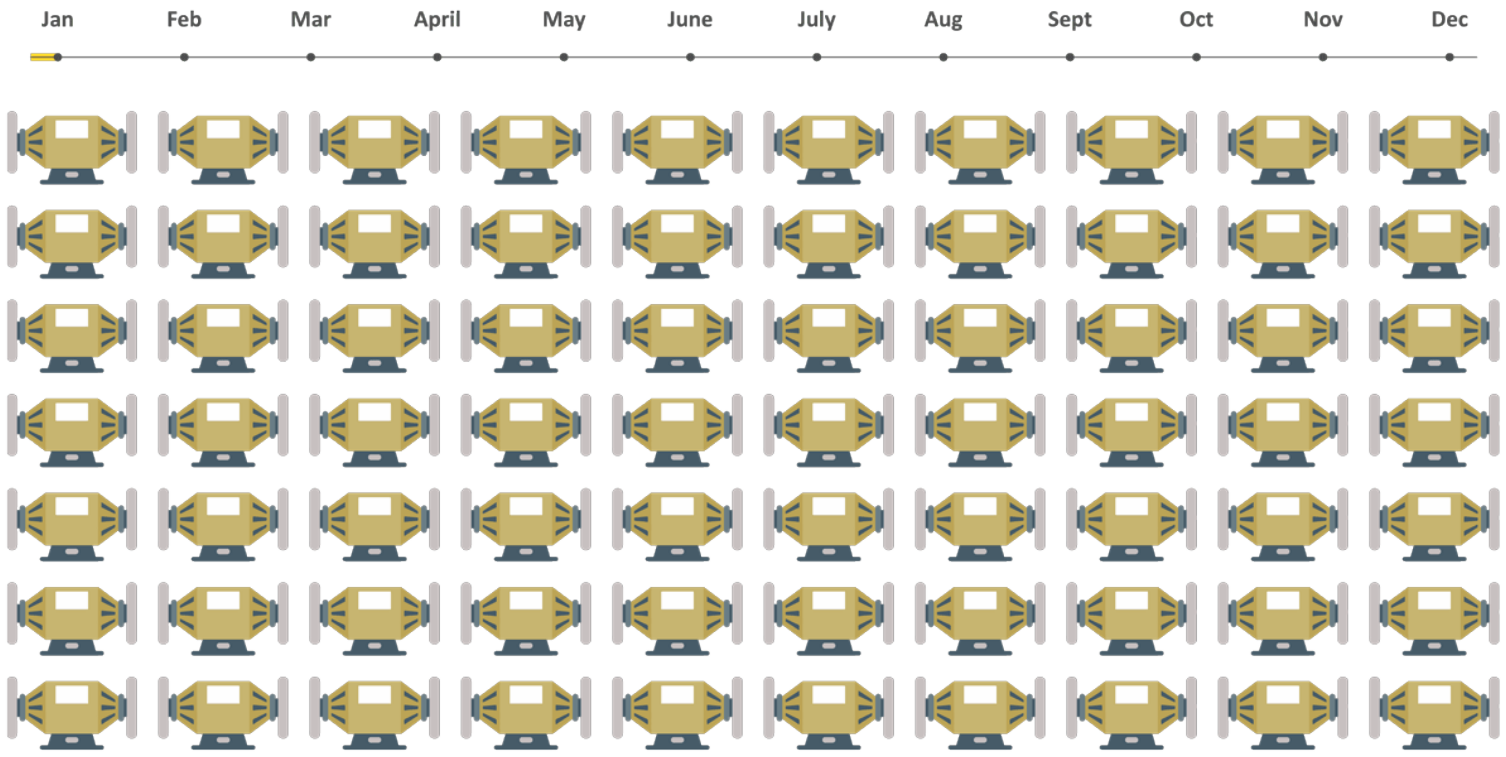


Why they fail (Electrically)

The Machine

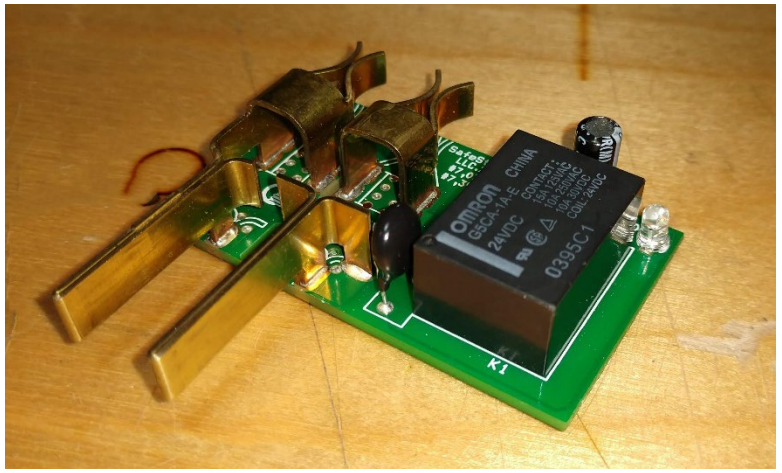
8” Bench Grinder

1HP

120V, 60Hz

8A

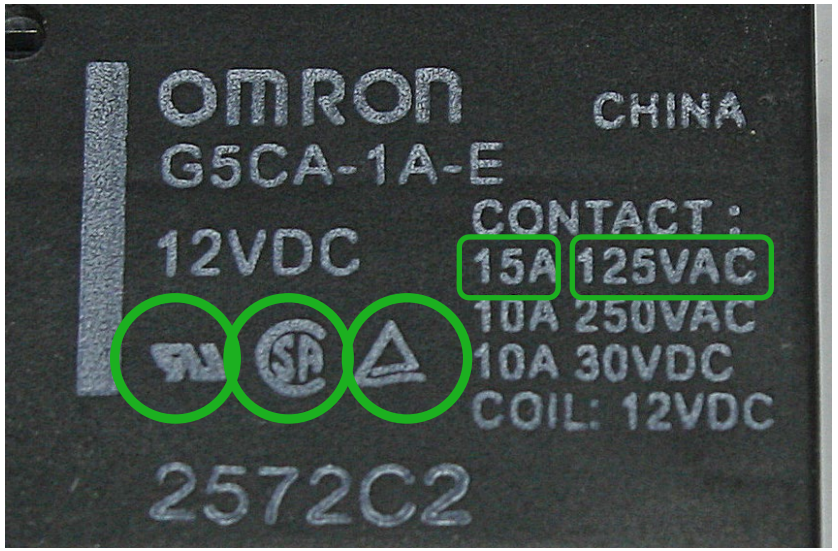
The Failed Device



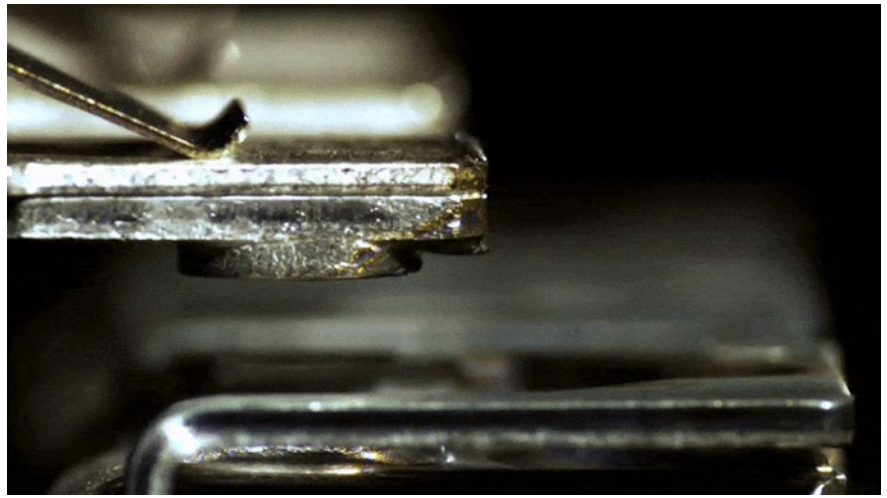
Just One of Many

The product shown here is just one of many anti-restart devices that suffer from the same shortcomings.

The Relay Inside



Why they fail (Electrically)



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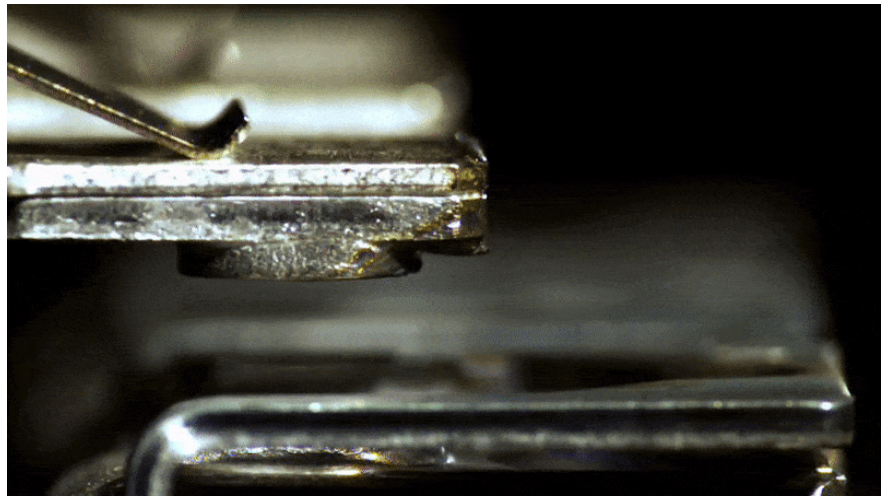


Why they fail (NRTLs)

UL 246A - Appliance Controls

"This category covers controllers … [with] one or more output switching components to directly control … household-type appliances, such as portable luminaires, audio/video equipment, etc."

"They are not intended for controlling motor-operated appliances"

UL 508 - Industrial Control Equipment

"These requirements cover industrial control devices, and devices accessory thereto, for starting, stopping, regulating, controlling, or protecting electric motors. "

Two relays with similar current ratings under each standard

(to scale)

Commercial Options

* In some cases, OSHA considers momentary foot switches to meet basic anti-restart and e-stop requirements.

Features & Protection

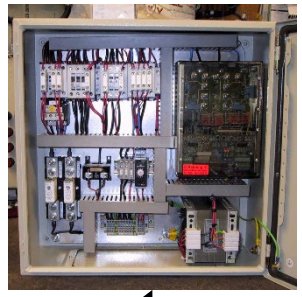
Magnetic Switches
(anti-restart only)

In-Line Protection Devices
(anti-restart only)

Momentary Foot Switches
(anti-restart & e-stop*)

UL508A Control Boxes
(anti-restart + e-stop)

MAKESafe One-Stop
(anti-restart + e-stop + motor braking)



Custom Control Cabinets
(anything you want …)

Cost

$20 — $40-$150 — $400-$1,000 — $3000+

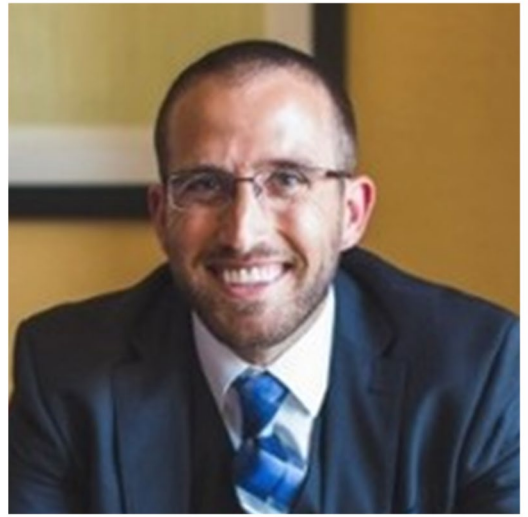
Bandsaw Demo

Features

- Category-1 Emergency Stop Button
- Unintentional Restart Prevention
- Motor Braking
- Installs in <5 min.
- Works with most industrial machines

I’m here to help!

- www.makesafetools.com
- scott@makesafetools.com
- (415) 937-1808



Scott Swaaley, PE

Founder and President,

MAKESafe Tools, Inc.