MachineDesign

FAQ

Safety Risk Assessment Guidelines for Automation Equipment

Q1: What are the primary safety concerns with automation equipment?

A: Some of the major threats for employees working around automation equipment include crushing (extremities, limbs, and full body) and amputations from mechanical operations. When material handling and moving is involved, heavy objects can bump into or drop on to employees or other pieces of equipment. Typically for automated processes, operators are not in control of these hazardous machine actions. For robots (industrial and collaborative), not only do the payloads need to be assessed for safety concerns, but the end effector as well. For example, end effectors for welding or sintering can quickly become dangerous.

Q2: What is the goal of risk assessment in the end?

A: Risk assessment is a systematic approach to identify and quantify reasonably and foreseeable hazards associated with a machine or process, and to find the right solution for those hazards. But, before deciding the technologies necessary to mitigate the problems, you must consider if the solutions are possible and practical for your application. Some safety features can cause production slowdowns and/or actual production failures if not implemented correctly or even increase the likelihood of workers choosing to bypass the safety solutions.

Q3: How do I get started with my risk assessment?

A: First, do an internal investigation where you focus on the machine as it runs through each mode of operation. Pay attention to the operator as he or she interacts with the machine. If you have multiple operators for each machine, talk with each one. Include maintenance personnel in your conversations. Ask what bothers them about the machine to see if there are any temptations to bypass safety mechanisms already in place.

Second, we suggest companies create a risk assessment team, most of whom should be in-house and could include a variety of talents such as machine operators, engineers, EH&S (environmental, health, and safety) professionals, machine builders, maintenance and service technicians, and production personnel. An outside partner may also be useful, such as the machine expert from the OEM, or those specialized in industrial machine safety. People who are familiar with and work with the machine are key team members are invaluable resources.

Third, be sure that you have team members who are familiar with and have knowledge of every type of technology incorporated in your machine, including the electronic controls, hydraulics or pneumatics systems, and the mechanical operations the machine must go through. In addition, you'll want someone who understands all the options for safety circuits and controls that may be available.

Fourth, consider working with the right partner if you don't have all the expertise in-house. For example, perhaps someone from the machine manufacturer could help with understanding where key hidden complications could occur. Also, most manufacturers do not have someone on staff who fully understand all the safety circuit options that are available and how to integrate them if necessary. In this case, partnering with a safety systems manufacturer could be beneficial.

Q4: With such a varied team, what if they disagree?

A: Risk assessment is subjective—that's why it's important to implement a hazard identification standard, which can be used consistently across all your equipment. Part of this approach is for your team to get used to something that they will standardize on. This standard method for what your company considers safe will lead your cross-functional team to conduct a similar evaluation every time it is done.

Q5: Are there sources that can help with my risk assessment needs?

A: There are many sources, which may approach the challenge slightly differently. Find the one that works best for you and stick with that. For example, ANSI and ISO both have a number of standards a company can adopt. Here are a few to look into: ISO 31000 Risk Management (Guidelines), ISO 31010 Risk Management (Risk assessment techniques), ISO 12100 Safety of Machinery (General principles for design) (Risk assessment and risk reduction), ISO/TR 14121-2, Safety of Machinery (Risk assessment—Part 2: Practical guidance and examples of methods), ANSI Z10 Occupational Health and Safety Management Systems standard, and ANSI B11.0 Safety of Machinery; General Requirements and Risk Assessment.

Q6: How can we prioritize any risks recognized along the way?

A: Along with standardizing your approach, you'll need to standardize a method for quantifying what you find. A number of different frameworks exist, such as ImproSafety, RAMP, and HRN (Hazard Rating Number), which we'll discuss here. The HRN methodology evaluates key elements you'll need to recognize during your evaluation, including the likelihood of an occurrence, the frequency of exposure to the hazard, the degree of possible harm, and the number of people at risk. When quantifying this risk as part of your team effort, it is

helpful to include an odd number of people for a majority vote since quantifying can become rather subjective. Once you have a number for each, multiply them together to come up with your HRN. From that number, you'll know how significant the hazard is and will be able to prioritize your approach to solutions. See the three charts below.

Q7: Once we address those hazards we've identified, are we good to go?

A: Once you've solved your most threatening challenges, you will want to complete a full risk assessment a second time with your safety solutions in place. If the hazard has decreased by the right amount for your team to feel comfortable, then you have accomplished your goal. For highly hazardous situation with multiple entry areas, you may have to go through your assessment several times.

Q8: This is great for my automation equipment, but what about cobots that are working alongside my employees?

A: Cobots are designed to work in and around people, yet you'll want to do a similar analysis for these machines, and make sure that you address each of the different functions the machine is providing. For example, the dangers associated with pick and place operations using pneumatic suction end effectors have a much lower hazard potential than operations where knives, drills, or flames might be used. ISO Type C standards have been written to include cobots and suggest evaluating such things as transient contact or quasi-static contact.

Likelihood of Occurence (LO)		Frequency of Exposure (FE)		Degree of Possible Harm (DPH)		#of Persons at Risk (NPE)	
0.033	Almost impossible	0.1	Infrequently	0.1	Scratch / Bruise	1	1-2
0.5	Highly unlikely	0.2	Annually	0.5	Laceration / Mild Ill Health	2	3-7
1	Unlikely, but could occur	1	Monthly	1	Break minor bone	4	8-15
2	Possible, but unusual	1.5	Weekly	2	Break major bone	8	16-50
5	Even chance, could happen	2.5	Daily	4	Loss of 1 limb / eye	12	51+
8	Possible, not surprised	4	Hourly	8	Loss of 2 limbs		
10	Likely, to be expected	5	Constantly	15	Fatality		
15	Certain						

LO		FE		DPH		NPE		HRN
10	X	5	X	8	X	1	=	400

Negligible	Very Low	Low	Significant	High	Very High	Extreme	Unacceptable
0-1	> 1 - 5	> 5 - 10	> 10 - 50	> 50 - 100	> 100 - 500	> 500 - 1000	> 1000