To The Point
Industrial Robotics Risks & Best Practices

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Manufacturers often use robots in processes that can be hazardous to workers or in repetitive applications where high levels of precision may be required. Most recently, a new class of robots has emerged, those which are intended to work alongside or collaboratively with their human counterparts, so-called "cobots." Ironically, robots themselves can create hazards to employees, exposing them to bodily injury if the machinery is not properly installed and guarded. Accident reports involving robots demonstrate that injuries most often occur while robots are being programmed or maintained - when employees are located inside what is called the working envelope of the robot. There are documented cases of employees being trapped or struck by robots, leading to severe injury and even death.

The first line of defense against accidents is conducting a comprehensive risk assessment as required by ANSI/RIA R15.06-2012 American National Standard for Industrial Robots and Robot Systems-Safety Requirements. Best practices for risk assessments involve working with the robotic integrator for all new systems or equipment and repeating the assessment any time a system or process changes.

A well-developed risk assessment will look at all the tasks associated with a given system to include training/ programming, operation & maintenance; identify specific risks and the necessary engineering or operational controls to mitigate these hazards. An effective risk assessment may also inform purchasing decisions and the development of written policies or procedures around robot use, supervision, and maintenance.

Prudent companies recognize robots as potentially hazardous machines and ensure they are properly guarded to prevent employees from direct or incidental contact. ANSI/RIA R15.06-2012 also includes specific safety standard for industrial robots requirements for safety and guarding.

Another consideration is that robots and automated systems should also be reviewed from a cyber security standpoint as these may be potential targets for unauthorized individuals. Safety interlocks and other programmed functions can be reset or completely bypassed which may also put employees at risk.

Preventing Injury Techniques

- Barrier guarding is one of the most effective control methods in preventing robots from injuring employees. Below are the most common methods of barrier guarding:
  - **Interlocked barrier guarding** entails a fixed gate that surrounds the perimeter of the robot, tall enough to prevent employees from climbing over it. When the entrance to the gate is opened, the robot and any other associated machinery automatically shut down. Best practices often require a manual re-start to engage the robot once the gate has been closed and re-locked.
  - **Fixed barrier guarding** is also a fixed gate that prevents access to the robot on all sides. The difference between fixed guarding and interlocked guarding is that fixed barriers have doors that can only be opened or removed with special tools.
  - **Awareness barrier guarding** devices are railings or chains that warn employees about hazardous conditions. Employees can still enter the working envelope without the robot turning off automatically. Keep in mind that warning guards cannot adequately protect employees from robotic hazards and are only useful when no other barrier guarding is possible.

- **Presence-sensing devices** shut down the machinery when an employee steps on a pressure sensitive mat or breaks a light field sensor. Cameras, scanners and other types of sensing systems may also be used to protect the operating envelope.
- **Emergency robot braking** can immediately stop dangerous robot movement through a braking system rather than shutting off the power. Some robotic systems may reboot or reset when power is restored creating an additional hazard particularly when an emergency extraction may need to occur.
- **Emergency stops** accessible to employees outside of the robot cage that can override all systems.
- **Lockout/tagout procedures** are critical for all robot systems control panels or work centers and devoted circuit panels.
- **Warning signs** at the entrance to the barrier gate can make employees aware of the potential for a crushing injury.

Regulations

While there are no specific robotic safety standards under the Occupational Safety and Health Administration, all employers must adhere to the General Duty Clause, which states that employers must provide employees with a workplace "free from recognized hazards likely to cause death or serious physical harm." OSHA has also developed a "Robotics" resource page under its Safety and Health topics section. Here, the specific OSHA standards that cover machine guarding and lockout/tagout procedures can be found as well as other national and international resources that may provide guidance.

Using Robot Technology Safely & Effectively

As robot technology becomes more affordable, companies are increasingly using robots to streamline their processes and ensure better product quality. When investing in robotic equipment or systems, ensure your integrator is involved in conducting the risk assessment of the proposed operations to identify hazards and implement the appropriate controls. For existing robotic systems, complete a risk assessment if one has never been conducted and regularly update the risk assessment to reflect any changes that may adversely impact the risk of injury or damage.

Resources

Robotics Industry Association (RIA)

National Institute for Occupational Safety and Health (NIOSH) Workplace Safety & Health Topics-Robotics

OSHA Technical Manual: Section IV-Chapter 4 Industrial Robots and Robot Safety System

UK Health & Safety Executive (HSEW) RR906 Collision and injury criteria when working with collaborative robots

Learn More & Connect

For more information on protecting your business, contact your local risk engineer, visit the Chubb Risk Consulting Library, or check out www.chubb.com/engineering.

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