Robotics in the Workplace: How to Keep Employees Safe and Limit Exposure to OSHA Citations

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Today's workplace is rapidly changing and so is its workforce. An increasing number of jobs once performed by humans are now performed by robots, and this has not escaped OSHA's attention. In fact, an OSHA test case is currently underway regarding the protection of employees when working with robots.

The first instance of a robot-related fatality in the United States occurred July 21, 1984, in a die-cast factory. Over the subsequent 15 years, OSHA and the National Institute for Occupational Safety and Health ("NIOSH") published guidance regarding robotics safety. In light of this test case and the increasingly broad range of hazards that OSHA targets, it is likely that OSHA and NIOSH will soon update guidelines for the safety of employees who work with or around robots. Despite the age of some of the existing OSHA and NIOSH recommendations regarding safe work with robots, they provide a helpful framework for employers to rely on in their efforts to keep employees safe and avoid costly OSHA citations. Most incidents of injury occur during activities such as maintenance, programming, and adjustments of robots. To avoid such incidents, employers should consider the following fundamental areas for safety improvements.

Designing Robotic Workstations

When designing robotic workstations, there are a number of factors to consider, such as how much space the robot will need to function. This will likely be more than a human being would need to conduct the same task. Employers need to be sure that adequate clearance distances are established.

One of the most important features of a safe robotic workstation is a safety fence, at least six feet in height, with an electrical interlocking gate. It should not be possible to access the robotic workstation when the gate is closed. This will prevent unauthorized entry into the range of the robot’s moving parts. When the gate is opened, the operation of the robot should stop. Deliberate manual action should be required to restart the robot’s automatic operation. In addition, employers should:

- avoid free-standing steel posts—these create “pinch points” where an unsuspecting worker can become trapped between the post and the robot’s arm;
- consider limit switches and fixed stops located near an axis of rotation or translation;
- provide barriers between the robotic equipment and the object if freestanding objects in the robot’s proximity cannot be avoided; and
- be aware that safety rails, chains, ropes, and floor markings, although useful as a cautionary reminder, do not provide adequate perimeter guarding.

Another important feature of a safe robotic workstation is a presence sensing device. Presence sensing devices include light curtain installations, pressure floor mats, and ultrasonic sensors on the robot’s arm. When a...
presence is sensed by the device, the robot is triggered to either operate at a greatly reduced speed or halt motion entirely. The ideal design includes more than one presence sensing device.

Furthermore, employers should do the following:

- Contemplate all aspects of robotic controls. Controls from which the robot can be operated should never be located within the area where the robot is working and should always be guarded against accidental operation.

- Include as much remote technology as possible so that most troubleshooting can occur outside the robot’s workstation. The control panel should feature single function controls, allowing an operator to control single pieces of equipment in the workstation safely, and user-prompt displays to minimize human errors.

- Make sure that there are numerous emergency stops located in easily accessible and convenient locations, as well as a portable programming control device that contains an emergency stop.

- Consider whether an emergency stop should cut off power or trigger a braking system to avoid additional hazards like the sudden dropping of a robot’s arm or flinging of a work piece.

**Training for Employees and Supervisors**

Extensive safety training should be provided for all employees who are expected to have any possible contact with the robot system. Workers must be familiar with all working aspects of the robot, including the full range of motion, known hazards, programming information, locations of emergency stop buttons and power sources, and the importance of safety barriers. Training should also include procedures for freeing a colleague who becomes caught. It is important to emphasize that just because a robot is stopped does not mean it will remain stopped, and just because a robot is a repeating a motion does not mean it will continue to repeat only that motion.

Newly trained employees should be closely supervised until they adjust to the robot. Training requirements do not, however, only apply to newly hired, inexperienced employees. Experienced robot programmers and operators should also receive refresher training courses that allow them to stay up to date with technological advancements and remind them of the concern for safety. Supervisors should receive the same robotics training as other employees and operate under the assumption that no one is permitted to enter the robotic workstation without first reducing the speed of the robot or halting its movement.

**Establishing Policies and Procedures Regarding Robotics Safety**

Employers should create written safety rules for working around robotics. These rules and procedures should be strictly enforced and violations should result in disciplinary action. Policies should require employee training, detail energy control procedures, and mandate periodic inspections. It may be advisable to establish different personnel for robotics safety to avoid conflicts of interest and assure proper supervision of robotic workstations.

Unauthorized personnel should never enter the robot workstation or access the robotic controls. Operators should never be in the area where the robot is working while the robot is operational. Lockout procedures and control panel protection should be employed. Further, a buddy system should be created, mandating the presence of another worker with access to an emergency stop any time that an employee enters the robotic workstation.

**Conducting a Systematic Safety Analysis**

If an employer has robotics in the workplace, it is important to conduct a systematic safety analysis to assess existing hazards and how they should be addressed. Two popular strategies for such an analysis are the Job Safety Analysis and the Fault Tree Analysis. The Job Safety Analysis involves identifying hazards faced by employees in each step that they take to complete a task and developing solutions for each hazard. When conducting this type of analysis, employers should keep in mind the variability in the way that tasks may be performed.

Alternatively, a Fault Tree Analysis begins by defining the unwanted injury event and then graphically constructing the sequence of events and conditions that could lead to that event. Failure rates and human reliability values can allow probabilities of sequences to be completed. For this analysis, knowledge of the events that could lead to an injury is essential.

Whichever type of analysis an employer conducts, it is important to ensure that selected devices and procedures are appropriate for actual and anticipated tasks and hazards, considering the robot’s use, programming, and maintenance operations. Employers should evaluate maintenance policies and records to determine the degree
of potential hazard exposures inside robotic workstations and ensure that robots meet current industry standards.

By taking these safety measures, employers that use robotics in the workplace can significantly reduce the risk of employee injuries and demonstrate their commitment to safety in this brave new world.

This article was written with contributions from Theresa E. Thompson, Summer Associate.

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