ROCKFORD SYSTEMS, LLC

GOT ROBOTICS? GET SAFEGUARDING!

PLAYING IT SAFE WITH ROBOTICS

Robotics is a growing field as more and more companies are incorporating industrial automation into their production processes. In just the first nine months of 2016, 23,985 robots were ordered from North American companies, many of which require machine guarding equipment to maximize productivity and safety. Robots are used for replacing humans who were performing unsafe, hazardous, highly repetitive, and unpleasant tasks. They are utilized to accomplish many different types of application functions such as material handling, assembly, arc welding, resistance welding, machine tool load/unload functions, painting/spraying, etc.

POTENTIAL HAZARDS

Studies indicate that many robot injuries occurring in robotic automation typically occur during non-routine operating conditions, such as programming, maintenance, repair, testing, setup, or adjustment when the worker may temporarily be within the robot's working envelope.

Non-Safeguarded Robots

As stated by OSHA, mechanical hazards might include workers colliding with equipment, being crushed, or trapped by equipment, or being injured by falling equipment components. For example, a worker could collide with the robot's arm or peripheral equipment as a result of unpredictable movements, component malfunctions, or random program changes. The worker could be injured by being trapped between the robot's arm and other peripheral equipment or being crushed by peripheral equipment as a result of being impacted by the robot into this equipment.

Mechanical hazards also can result from the mechanical failure of components associated with the robot or its power source, drive components, tooling or end-effector, and/or peripheral equipment. The failure of gripper mechanisms with resultant release of parts, or the failure of end-effector power tools such as grinding wheels, buffing wheels, deburring tools, power screwdrivers, and nut runners are a few of the possibilities.

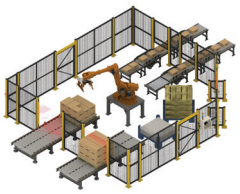
Non-Safeguarded Robot

Human errors can result in hazards both to personnel and equipment. Errors in programming, interfacing peripheral equipment, connecting input/output sensors, can all result in unpredictable movement or action by the robot which can result in personnel injury or equipment breakage.

Human errors in judgment frequently result from incorrectly activating the teach pendant or control panel. The greatest human judgment error results from becoming so familiar with the robot's redundant motions that personnel are too trusting in assuming the nature of these motions and place themselves in hazardous positions while programming or performing maintenance within the robot's work envelope.

SAFEGUARDING AUTOMATION CELLS

Robots in the workplace are generally associated with the machine tools or process equipment. Robots are machines, and as such, must be safeguarded in ways similar to those presented for any hazardous remotely controlled machine, falling under the general duty clause or OSHA 1910.212(a)(1) or 1910.212(a)(3)ii. Refer to https://www.osha.gov/SLTC/robotics/standards.html and OSHA's compliance directive on robotics STD 01-12-002 at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=170 for more information.



Robotics Packaging Cell
Courtesy: Banner Engineering

Various techniques are available to prevent employee exposure to the hazards which can be imposed by robots. The most common technique is through the installation of perimeter guarding with interlocked gates. A critical parameter relates to the manner in which the interlocks function. Of major concern is whether the computer program, control circuit, or the primary power circuit, is interrupted when an interlock is activated. The various industry standards should be investigated for guidance; however, it is generally accepted that the primary motor power to the robot should be interrupted by the interlock.

Although ANSI standards are guidelines, many U.S. industry experts experts agree that ANSI standards provide the best guidelines for safeguarding machinery that doesn't have a vertical OSHA requirement.

ANSI/RIA R15.06-2012 is the most recent U.S. Standard on Industrial Robots, which requires that perimeter guards contain the robot automation. These guards are required to have a 12-inch sweep and a 60-inch height (ANSI/RIA R15.06-1999). However, CSA 2003 cite best practices at a 6-inch (.15m) sweep and a 72-inch (1.8m) height.

When a robot is to be used in a workplace, the employer should accomplish a comprehensive operational safety/health hazard analysis and then devise and implement an effective safeguarding system which is fully responsive to the situation. In general, the scale of the automation cell will drive the scale of the safeguarding. (Various effective safeguarding techniques are described in ANSI B11.19-2010.)

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ROCKFORD SYSTEMS CAN HELP

During Rockford Systems Onsite Risk Assessments and Onsite Machine Surveys, we find one of the most common problems with robotics is the failure to accurately calculate safety distances, typically used in regard to the installation of safety mats. Robots make rapid and wide-reaching moves. The goal is to stop a robot before it can hurt someone.

Robotics Palletizer and Stretch Wrapper Cell
Courtesy: Banner Engineering

Any robot that moves more that 10 inches per second must be safeguarded adequately. Safe distance is determined by the following Robotics Industry Associations (RIA) formula with the following parameters:

DS= 63 inches per second (IPS) X(TS+ TC+ TR) + DPF

DPF= 1.2 m (48 in.)

Where:

DS= minimum safe distance

TS= stopping time of device

TC= worst stopping time of control system

TR= response time of safeguarding device including interface

DPF= maximum travel distance toward a hazard once someone has entered the field

So the total horizontal space to be protected is 48 in. plus 63 IPS, multiplied by the total time delay between detection of a person in the protected area and the actual time it takes for the robot to stop.

It's imperative that the automation cell and all aspects of machine use be identified and considered when selecting and implementing a robotics safeguarding. Ultimately, the best type of protective measure will be the device or system that provides maximum protection, with minimal impact on normal machine operation.

Please call 1-800-922-7533 or visit www.rockfordsystems.com for more information.