

ENHANCING ROBOT AND MACHINE SAFETY

ENSURING SAFE INTERACTION BETWEEN INDUSTRIAL ROBOTS AND THEIR OPERATORS IS AN ESSENTIAL PART OF A HIGH-FUNCTIONING INTEGRATED SYSTEM.

At Shell-O-Matic, we work with the ANSI/RIA R15.06 (Industrial Robot and Robot Systems Safety Requirements), ISO 10218 (Safety requirements for industrial robots) and ISO 12100/ ISO 13849 (Safety of Machinery) guidelines to provide the comprehensive safety solutions specific to our customers' needs.

Table 2 - Risk level decision matrix

| Severity of Injury | Exposure to the Hazard | Distance of the Hazard | Risk level |
|--------------------|------------------------|------------------------------|------------|
| S1 - Minor | E1 - Low | A1 - Close | NEGLIGIBLE |
| | E2 - High | A2 - Not close/ Not possible | LOW |
| S2 - Moderate | E1 - Low | A1 - Close | MEDIUM |
| | E2 - High | A2 - Not close/ Not possible | HIGH |
| S3 - Serious | E1 - Low | A1 - Close | HIGH |
| | E2 - High | A2 - Not possible | VERY HIGH |

Table 3 - Hierarchy of risk reduction measures

- Elimination
- Substitution
- Limit Interaction
- Safety guards and Safety-Related Parts of the Control System (SSRPS)
- Complementary Protective Measures
- Warnings and Attentional Means
- Administrative Controls
- Personal Protective Equipment (PPE)

Table 5 - Minimum functional safety performance

| Risk Level | PL | Structure Category |
|--------------------------|----|--------------------|
| NEGLIGIBLE (see 6.5.3.1) | b | - |
| LOW | c | 2 |
| MEDIUM | d | 2 |
| HIGH | d | 3 |
| VERY HIGH (see 6.5.3.2) | e | 4 |

Three-step process:

- » Generating a risk assessment matrix of your machinery, as required by the relevant standards
- » Analyzing all interactions between humans and machines
- » Providing risk-reduction strategies

DYNAMIC CONTROL OF ROBOT WORKING ENVELOP

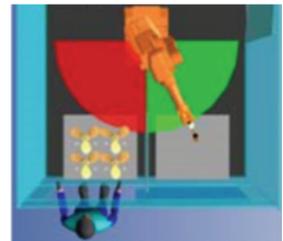
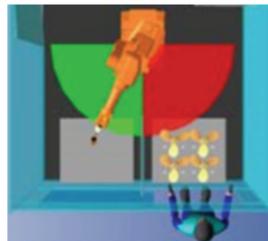
Controlling the robot's working envelop (its reach) is the first step to creating a dynamic and safe collaboration between the robot and an operator.

Robot manufacturers offer software options to dynamically control the robot working envelop as a function of system status.

No restriction on robot working envelop



Dynamic restriction of envelop



Dynamic Robot Working Envelop Control

PROGRAMMABLE SAFETY CONTROLLER

An optional part of the Shell-O-Matic Supervisory system, the programmable safety controller allows for more complex safety logic.

Advantages of the programmable safety controller:

- » Manage the various safety devices and functions required with a robotic cell
- » Scalable
- » Reprogrammable, so it can evolve the logic or system with changing customer needs
- » Communicates at the machine network level
 - Share safety system status
 - Adjust PLC control logic
 - Display appropriate messages on the HMI screen



SAFETY DEVICES

Shell-O-Matic can create a custom safety system tailored to customer needs. The system can be connected to various safety devices, including:

- » Light curtains
- » E-stop buttons
- » Two-hand controls
- » Area scanner
- » Safety mats

This system allows Shell-O-Matic to deliver not only a new state-of-the-art safety system, but also to retrofit or upgrade existing robotic cell safety systems.

