Industrial Robot Application & Robot Cell

Risk Assessment Checklist for System Integrators

Purpose:
This checklist is intended for **robot system integrators** to verify that **reasonably foreseeable hazards** associated with **industrial robot applications and robot cells** have been identified, evaluated, and reduced to an acceptable level across the **entire lifecycle** of the application.

This checklist supplements, but does **not replace**, a formal documented risk assessment.

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1. General Application Characteristics

☐ **Robot application involves high-energy motion** through a large three-dimensional space
☐ **Robot motion paths are variable or program-dependent**
☐ **Initiation of motion may be difficult to predict** (e.g., program branching, recovery routines)
☐ **Multiple workpiece sizes, weights, or orientations** are handled
☐ **Changes in motion paths may occur** due to process conditions not obvious to operators

Integrator Verification:
☐ Motion behavior under all operating conditions has been evaluated
☐ Non-obvious motion paths have been considered in the risk assessment

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2. Operating Space and Overlap Evaluation

☐ **Operating space overlaps** with other robot applications
☐ **Operating space overlaps** with task zones of other machines or equipment
☐ **Operating space overlaps** with operator task zones
☐ **Shared spaces exist** during commissioning, setup, or maintenance
☐ **Multiple robots operate within shared or adjacent spaces**

Integrator Verification:

☐ All overlapping spaces are identified and documented

☐ Safeguards and layouts address **simultaneous presence and motion**

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3. End-Effector, Fixture, and Workpiece Hazards

☐ **End-effector presents mechanical hazards** (e.g., pinch, cut, puncture, impact)

☐ **Workpieces introduce additional hazards** (shape, edges, temperature, mass)

☐ **Fixtures require operator interaction** during production or setup

☐ **Adaptive or variable fixtures** increase operator exposure

☐ **End-effector changes or exchanges** are foreseeable

Integrator Verification:

☐ End-effector selection is documented as a **risk reduction measure**

☐ Fixture and workpiece hazards are included in the assessment

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4. Lifecycle Task Coverage

☐ Risk assessment includes **commissioning** activities

☐ Risk assessment includes **teaching, programming, and verification**

☐ Risk assessment includes **workpiece loading and unloading**

☐ Risk assessment includes **operator intervention without disassembly**

☐ Risk assessment includes **entering and leaving safeguarded spaces**

☐ Risk assessment includes **starting, stopping, and restarting**

☐ Risk assessment includes **fault recovery and malfunction correction**

☐ Risk assessment includes **control of hazardous energy** (fixtures, clamps, turntables)

☐ Risk assessment includes **integration of control systems, vision systems, or enterprise software**

☐ Risk assessment includes **maintenance, repair, and cleaning**

☐ Risk assessment includes **application changes or redeployment**

☐ Risk assessment includes **decommissioning and disposal**

Integrator Verification:

☐ Risk assessment is **lifecycle-based**, not production-only

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5. Collaborative Application Determination

☐ Application is intended for **collaborative operation**
☐ Operators may be present **within the safeguarded space** while power is available
☐ Collaborative safety functions are implemented:

- ☐ **Hand-Guided Control (HGC)**
- ☐ **Speed and Separation Monitoring (SSM)**
- ☐ **Power and Force Limiting (PFL)**

☐ **Transitions between collaborative and non-collaborative modes** occur
☐ **Multiple operators** may be involved during collaborative tasks

Integrator Verification:
☐ Collaborative mode transitions are evaluated for safety
☐ Restart behavior after collaborative tasks is controlled and verified

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6. Contact Risk Evaluation (Robot ↔ Operator)

☐ Potential **contact between moving robot parts and operators** has been identified
☐ Contact scenarios include:

- ☐ Intentional contact (e.g., hand guiding)
- ☐ Unintentional or foreseeable misuse

☐ Risk assessment evaluates:

- ☐ **Exposed body regions**
- ☐ **Probability and frequency of contact**
- ☐ **Type of contact** (quasi-static or transient)
- ☐ **Speed, force, pressure, momentum**
- ☐ **Mechanical power and energy transfer**

Integrator Verification:
☐ Contact risk is reduced through **design and layout first**
☐ Residual contact risks are controlled below **force and pressure thresholds**

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7. Safeguarded Space and Layout Design

☐ Safeguarded spaces are designed to make contact:

- ☐ **Infrequent**
- ☐ **Avoidable**
  - ☐ Access points are minimized and controlled
  - ☐ Layout discourages unintended operator presence
  - ☐ Detection zones and task zones are clearly defined

Integrator Verification:
☐ Safeguarded space design supports all identified tasks

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8. Risk Reduction Measures

☐ **Engineering controls** are implemented as the primary risk reduction method
☐ **Safeguards and safety functions** are correctly applied
☐ **Administrative controls** are used only where engineering controls are not practicable
☐ **Residual risks** are clearly communicated to the user

Integrator Verification:
☐ Risk reduction measures are documented and traceable to hazards

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9. Validation and Handover

☐ All safety functions have been **verified**
☐ Application behavior has been **validated for intended use**
☐ Changes during integration have been reassessed
☐ Documentation is complete for:

- ☐ Layout
- ☐ Operating limits
- ☐ Foreseeable misuse
- ☐ Maintenance and modification constraints

Integrator Sign-Off:

☐ Application meets applicable safety requirements

☐ Residual risks have been disclosed to the user

Integrator Declaration

☐ I confirm that this robot application and robot cell have been evaluated for reasonably foreseeable hazards across the full lifecycle of use. Identified risks have been reduced to an acceptable level through design, safeguarding, and validated safety functions.

Integrator Name: _____

Company: _____

Date: _____

Signature: _____
