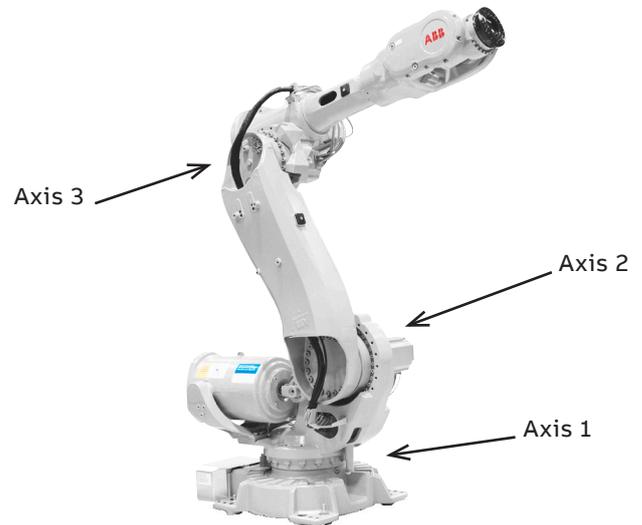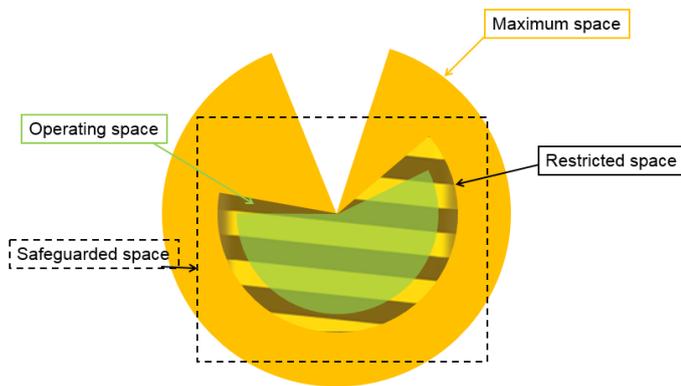# Limiting devices for industrial robot cells

The standards EN ISO 10218-1 and -2 (harmonized standards to the Machinery Directive) give requirements on how to safely limit the space of the industrial robot.

Definitions

The terms in the picture are used and explained in the standard. All spaces in the picture represent the reach of the robot including tools and work pieces for the total reach for the actual application.

- The Maximum space represents the total space where the robot can reach.
- The Operating space is the space that is needed for the application program, which is not a safe limitation of the robot.
- The Restricted space represents the safely limited space which can be accomplished by mechanical limitation on axis 1 and electromechanical/electronic on axes 2 and 3. It is also possible to use a safety software, e.g. Safemove for ABB Industrial Robots. All electromechanical/electronic/software solutions shall fulfil PL d with category 3 or SIL2 with HFT=1.
- The Safeguarded space can then be designed and protected with perimeter guarding - guarding (fencing) and/or safety devices, e.g. light curtains.

Fencing as limiting device

If fencing is used for the safeguard space, the robot with its tool and work piece shall not be placed closer to the fencing than the requirements in EN ISO 13857 give, e.g. with a 40 x 40 mm mesh, the safety distance is 200 mm (if the fence is high enough to prohibit any reaching over to the risk, otherwise longer distance, see EN ISO 13857 for height of fences and corresponding safety distances). The distance is measured from the fence to the outer boundary of the restricted space.
In some cases the guarding can be used not only as perimeter guarding, but also as a limiting device.

From EN ISO 10218-2, 5.4.3
"In cases where the perimeter guard is designed to be the limiting device, the results of the risk assessment shall be used to determine the requirements for the design, strength and deflection for that guard."

However, this is possible only when it can be verified that no hazardous deformations can be caused by the robot.

From EN ISO 10218-2, 5.4.3
"NOTE 4 Using a perimeter guard as a limiting device is normally practicable only when robots cannot cause hazardous deformations of the guard."

In practice – the guarding may be used as the limiting device for small robots placed e.g. in cubicles of polycarbonate when the clause 5.4.3 can be fulfilled. All guarding used as limiting devices must be solid, i.e. no use of mesh, due to the requirements on safety distances according to EN ISO 13857.

"Small robots" are not defined in the standard. The integrator is responsible for calculating if the guard can withstand the power of the robot. All impact possibilities should be taken into account and the calculations should be validated by tests.

For industrial robots of normal size it will be difficult/impossible to stop the robot by the guarding without damages that can cause a hazardous situation.

Collision sensors and over-current protection as limiting devices
Collision sensors and over-current protection are not safety devices and their contribution to stop the robot cannot be relied on.

From EN ISO 10218-2, 5.4.3
"NOTE 3 Devices designed to protect the machine (e.g. over-current protection and collision sensors) are not suitable as limiting devices unless they are specifically designed, tested and determined to be suitable as a safety device for the purpose of limiting motion that complies with ISO 10218-1."

Therefore it cannot be claimed that collision sensors of the robot will stop the robot in time before it causes damages on the guard.

Testing of guards
The new edition of EN 953/ISO 14120, now named EN ISO 14120 "Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards" – is including an informative annex, Annex C, on how a fencing system can be tested. The tests will simulate:
• A person walking in to the fence.
• Throwing of objects from within the cell.

The only limit that is given is the impact energy E=115 J which represents a person walking in to the fence. To test the fencing according to Annex C will not be mandatory when claiming to fulfil EN ISO 14120.

Conclusion
ABB Jokab Safety cannot in any way recommend that a fence should be placed nearer to the robot than the distances required by EN ISO 13857 (with safe limitation of the robot space according to EN ISO 10218-2).

ABB Jokab Safety does not take any responsibility if its fencing is used as a limiting device. It is the sole responsibility of the robot integrator if he decides to use guarding as the limiting device.