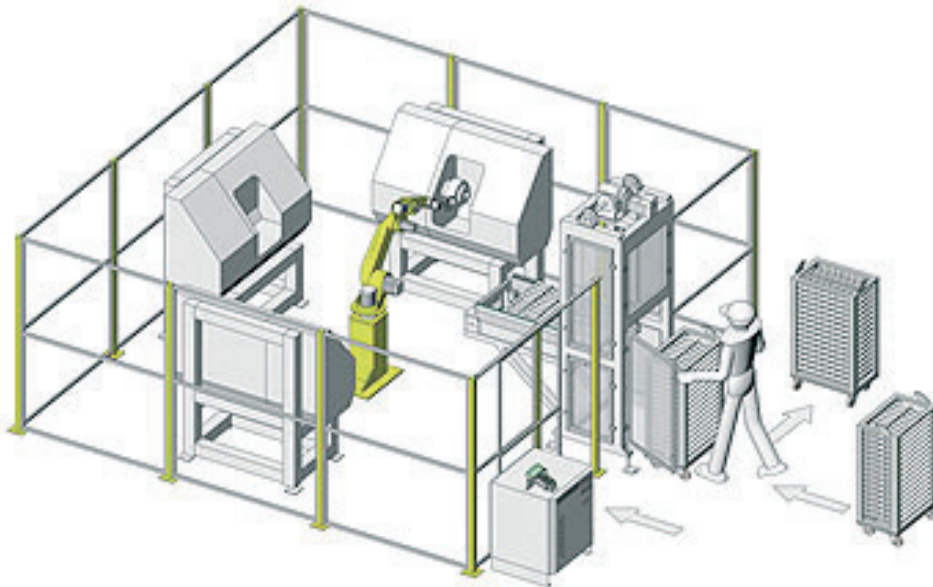


2.4.16 Robotic workstation

Legislative Decree 81/08 App. V and VI, Presidential Decree 459/96 App. I, UNI EN 10218:2006



Machine or set of slave machines used for the manipulation of material or execution of machining by robots or other automated systems. Once set up, the robotic workstation becomes a single entity even if it is made up of several different machines.

The operator's task in a robotic workstation might be to load and unload the materials magazine unless this function is also automated or to carry out programming, set-up, maintenance and repair operations.

2.4.16.1 HAZARDS

The hazards of a robotic workstation are the movements of the robot and the other machines making up the workstation.

Because robots are distinctive in that they make very large, high-energy and high-speed movements, and that the start and direction of motion is hard to predict, the entire area around the robotic workstation must be marked out so that, from outside the area, it is not possible to come into contact with the hazards, taking account of their maximum extension (see 2.2.4 "Safety distances").

This area is called the "protected space" and should be accessible only when all the machines in the workstation are in a safe condition.

The protective measures around the protected space can comprise a combination of the following devices:

- Fixed guards (see "Fixed guards" in 2.2.3.2) that prevent access to the protected space except through openings protected with movable interlocked guards (see "Movable guards" in 2.2.3.2) or with presence detection devices (see 2.2.5.3 "Immaterial barriers" and 2.2.5.4 "Sensitive mats");
- Movable interlocked guards (see "Movable guards" in 2.2.3.2). When your whole body can go inside the protected area, the movable guard must be fitted with a device that prevents involuntary closure;

- Presence detection devices (see 2.2.5.3 “Immaterial barriers” and 2.2.5.4 “Sensitive mats”); these must be located so that you cannot enter the protected area without being detected by them. The robot cannot be restarted until the person is no longer detected.

To use robotic workstations safely the following two fundamental principles must be complied with:

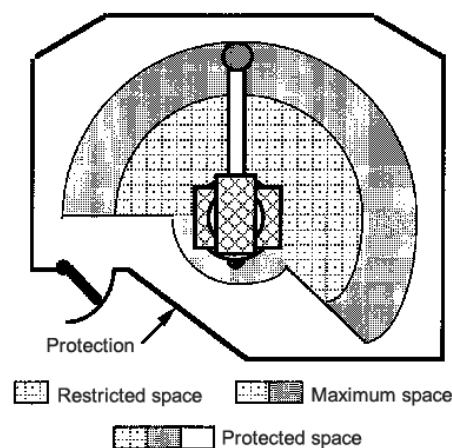
- No people in the protected space during automatic operation;
- Elimination of hazards or, alternatively, their maximum reduction during interventions that have to be done inside the protected space (see 2.4.16.1A “Work inside the protected space”) (e.g. programming, maintenance, etc.).
- Access to the protected space is restricted to authorised personnel who must follow defined procedures such as for programming (see 2.4.16.7 “Programming”).

2.4.16.1A WORK INSIDE THE PROTECTED SPACE

For the safety of the operator who has to work inside the protected space to activate the robot, two areas must be identified, defined as follows:

- **Maximum space:** this is the space that can be covered by the robot’s various moving parts, including any devices applied to its ends and the workpieces being manipulated.
- **Restricted space:** this is a part of the maximum space that can be covered only by the robot’s various moving parts. To ensure that the robot’s movements do not go beyond this space, there must be mechanical stops or other stroke limiters capable of locking it.

Creating such spaces means that the operator, who is inside the protected space, has a safe area in which to operate, including if the robot malfunctions.



Other machines

The individual machines in the workstation, which are built to operate autonomously, such as for example press brake, punching machine, etc., can be used provided that:

- Before going into the protected space, the robot is overridden using a key selector (see 2.2.6.5 “Operating mode selector”);
- The machine can be operated only with its safety equipment activated or reset if they were overridden for automatic operation.

2.4.16.2 CONTROL EQUIPMENT

Starting

The only way to start the robot's hazardous movements is to use specific control devices (see 2.2.6.1 "Starting") that are easy to recognise and are protected against the risk of being accidentally activated (e.g. push-buttons with guard ring, shrouded pedals, etc.).

It should only be possible to start the automatic cycle if:

- All the protective devices are present and working;
- There is nobody inside the protected space;
- The appropriate safety procedures are followed.

2.4.16.2A REMOTE CONTROL

Remote controls (for example using the communication network) must be able to start the machine cycle only when the protective devices are activated. In addition, the remote control must be able to be activated or deactivated with a key selector (see 2.2.6.5 "Operating mode selector") which overrides it when local control is used.

Portable unit

This is a movable unit, connected to the machine control system, held by the operator to program the robot.

2.4.16.2B PORTABLE UNIT

If the machine is fitted with a portable unit:

- It must be easy to use (ergonomic principles);
- When the portable unit is used inside the protected space, it must not be possible to use the robotic workstation with automatic operation;
- There must be an emergency stop on the portable unit (see 2.2.6.4 "Emergency stop");
- The robot movement controls must be of the hold-to-run type (see 2.2.6.2 "Hold-to-run");
- The robot must be designed so that, when a portable unit is used, it can be moved only by this unit;
- All the robot's movements controlled by the portable unit must be at slow speed (for example < 250 mm/sec).

If operations need to be executed at a faster speed, while the operator is in the protected space, the speed must be deliberately selected (for example with a key selector) by the operator and started using an enabling device together with the run-to-hold control.

Unexpected restart

Spontaneous restarts (see 2.3 "Machine electrical systems") of the machine after power is restored must be prevented using a specific device.

Safety stop

The machine must have a control device (see 2.2.6.3 “Stopping”) to stop it safely.

Emergency stop

All machines must have at least one emergency stop device (see 2.2.6.4 “Emergency stop”) placed within easy reach of the operator.

In addition, every control station must be fitted with an emergency stop (see 2.2.6.4 “Emergency stop”). All emergency stops must be reset outside the protected space.

In addition to the technical characteristics defined in the specific sections, the table below shows more clearly the differences between the safety stop control (see 2.2.6.3 “Stopping”) and the emergency stop control (see 2.2.6.4 “Emergency stop”).

	Emergency stop	Safety stop
Positioning	The control must be placed so that the operator has free and quick access to it	The control must be placed taking into account the safety distance calculation
Activation	Manual	Automatic or manual
Safety performance	In compliance with Category 3 of ISO 13849-1:1999 3 or as specified in the risk assessment	In compliance with Category 3 of ISO 13849-1:1999 3 or as specified in the risk assessment
Reset	Manual only	Automatic or manual
Use frequency	Infrequent, only in an emergency	Variable, from every work cycle to rare
Effects	The power to the hazardous part is cut	The machine stops maintaining the safe condition

2.4.16.3 ERGONOMICS**Positioning**

The machine must be installed so that there is free access to the work area even when setting, loading and unloading devices, etc. are being used (for example, lifting devices).

2.4.16.3A ERGONOMICS

This is particularly important in robotic workstations, for example to make it easier for the operator to carry out certain tasks and to reduce human errors during interventions.

For example, the man-machine interface must be easy to interpret (particular attention should be paid to operating and programming devices, portable control devices, on-board software, etc.).

The information provided must clearly indicate the robot work modes and show the reasons for un-programmed stopping.

2.4.16.4 OCCUPATIONAL HEALTH AND SAFETY

Emissions

Depending on the type of machining, a careful risk assessment must be made to decide whether or not the machine needs to be fitted with an appropriate local exhaust ventilation system (see 3.6 “Local exhaust ventilation systems”).

Noise

Find out the noise levels to which staff are exposed when using the machine and follow the employer’s instructions.

2.4.16.5 PERSONAL PROTECTIVE EQUIPMENT

A careful assessment of the machining needs to be made to define what PPE is needed and how it should be used in the various programming, maintenance, use phases, etc.:



Gloves (see 5.6.4 “Gloves giving protection from mechanical risks”) protecting against mechanical risks.



Safety shoes (see 5.7 “Foot protection”) with protective toe cap (S1) (see 5.7.2.1 “Identifying safety shoe characteristics”).



Hearing protectors (see 5.3 “Hearing protection”).

2.4.16.6 OPERATING INSTRUCTIONS

The machine must come with a manual, in Italian, explaining correct use and maintenance, including a programme of periodic inspections.

2.4.16.7 OCCUPATIONAL HEALTH AND SAFETY ACTIONS

Programming

- Programming must be done only by qualified and specially trained staff.
- During programming the robotic workstation and the protected space must be visually checked to ensure that there are no hazard conditions.
- Before using the portable unit, it must be tested to check that it is working properly.
- All faults or problems must be resolved before starting programming.
- Programming must be done without anyone inside the protected space.
- If this is impossible, some protective devices can be temporarily suspended provided that other safety criteria are automatically adopted (portable unit, etc.).
- Before entering the protected space, the programmer must check that all the protective devices are present and working.

- Programming operations must always be started before entering the protected space.
- During programming, automatic operation must not be possible.
- During programming, only the programmer can be inside the protected space.
- The robotic workstation must be under the exclusive control of the programmer while the latter is inside the protected space.
- When programming is complete, any protective devices that were deactivated must be restored.
- A record of programs run must be kept, including all amendments made.
- The program must be checked without anyone inside the protected space.
- If this is not possible, the procedures described above must be applied (slow speed, hold-to-run control, etc.)

Before use

- Read the Operating Instructions and be trained on using the machine safely.
- Check that the guards ([see 2.2.3 "Guards"](#)) and safety devices ([see 2.2.5 "Safety devices"](#)) are present and positioned correctly.
- Check that the guard interlock systems work ([see 2.2.5.1 "Interlock systems"](#)).
- Check that the emergency stop buttons work ([see 2.2.6.4 "Emergency stop"](#)).
- Wear clothes that cannot become entangled with the hazardous moving parts on the machine.
- Do not wear scarves, necklaces, bracelets, watches or rings and tie up long hair.
- Wear the personal protective equipment (PPE) shown in this data sheet.

During use

- Keep the guards on the machine positioned correctly.
- Do not override or tamper with the safety devices. If they have to be deactivated for a specific job, other safety measures must be adopted immediately, such as very slow machining speed and hold-to-run controls, etc.
- Workpiece changeovers should take place only when the machine is stopped.
- Report any malfunctions or faults promptly to the machine supervisor.

After use

- Switch off the machine.
- Put measuring equipment and instruments back in their containers.
- Leave the machine and the area around it (especially the workstation) clean (free of chips, swarf and cutting fluid) and tidy.
- Reactivate any deactivated guards.