# RISK ASSESSMENT OF MACHINERY

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The article focuses the risk assessment of indeterminate machinery. It based on current ISO standard. In the first part of article is description of the sys-tem assessed. Then the evaluation procedure is explained the frequency and dura-tion of the threat, the possibility of avoiding danger or limiting damage and the level of possible injury is determined. From this data, we can determine the sever-ity of the threat. The following section deals with the specific risks that arise in the operation of any machines. These risks need to be assessed. The article also focuses on pictograms, which are also used in risk assessment.

## *Risk assessment of machinery*

The existing dangers to which employees are exposed during operation or maintenance can be identified and reduced using a systematic risk assessment tailored for each device's particular requirements.

## *Determination of the required performance level*

It deals with risk reduction by the safety parts of the control system under consideration. This method only contributes to the estimation of risk reduction and aims to provide guidance to the designer and standard setter in determining the PLr, for each safety function it performs.

The risk assessment assumes the situation before taking action on the intended safety function. Risk mitigation by other technical measures that are independent of the control system (for example, mechanical protection devices) or additional safety functions may be determined to determine the PLr, the intended safety function. The severity of the injury (indicated by the letter S) is relatively easy to estimate (eg cut, amputation, fatal injury). In terms of frequency of occurrence, ancillary parameters are used to improve risk estimation. These parameters are:

• frequency and duration of the threat (F) a

• possibility of avoiding danger or limiting damage (P)

Experience has shown that these parameters can be combined as seen in the figure, with the risk ranging from low to high. It should be emphasized that this is a qualitative process that only results in a risk assessment.

## *Degree of severe injury S1 and S2*

In estimating the risk arising on failure of the safety function it is considered only slight injuries (normally reversible), serious injuries (normally irreversible) and death. When determining S1 and S2, the normal consequences of the accident and the heal-ing process must be taken into account.

S1 - bruising or laceration without complications

S2 - amputation or death

## *Frequency or duration threat F1 and F2*

The generally valid time to be selected for parameters F1 and F2 cannot be speci-fied. However, the following explanation could facilitate the correctness of the deci-sion when there are doubts.

F2 must be chosen if the person is frequently or constantly endangered. It is irrele-vant whether the same persons or different persons are exposed to successive threats, for example when using lifts. The frequency of occurrence of parameters must be selected according to the frequency and duration of access to the threat.

If the designer knows the requirement for the safety function, the frequency of oc-currence and duration of this requirement can be chosen instead of the frequency of occurrence and duration of access to the threat. In this part of ISO 13849, the fre-quency of occurrence of a safety function is considered more than once a year.

The duration of the hazard must be assessed on the basis of an average value that can be determined in relation to the overall use of the equipment. For example, if it is necessary to reach regularly between the tools of the machine during its cycle in order to complete and move the workpieces, F2 must be selected. If such an approach is only necessary occasionally, F1 must be selected.

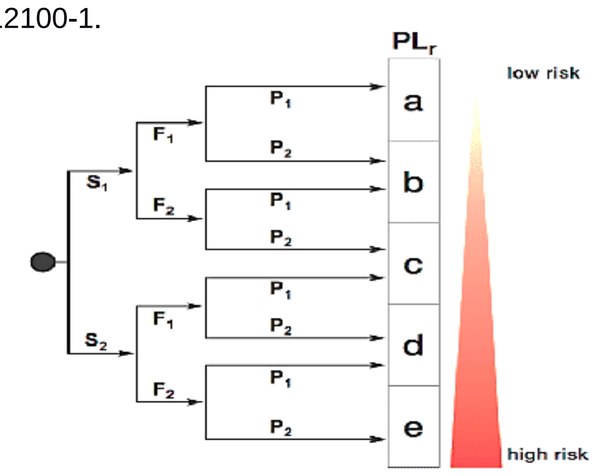
## *Possibility to avoid threat P1 and P2*

It is very important to know whether a threat situation can be identified and avoided before an accident occurs. For example, serious consideration must be given to whether the threat can be directly identified by physical characteristics or only by technical means, such as indicators. Other important aspects that influence the choice of the P parameter are, for example:

- operation with or without supervision
- operation management by experts or non-professionals
- speed at which the risk increases (for example fast or slow)
- the possibility of preventing threats (such as leaks)
- practical safety experience relevant to the process

If a hazard occurs, only P1 must be selected if there is a real possibility to prevent the accident or significantly reduce its effect.

P2 must only be selected if there is almost no possibility of preventing danger. The figure below provides instructions for determining the safety PLr, which depends on the risk assessment. This scheme must be considered for each safety function. The risk assessment method is based on ISO 14121 and must be used in accordance with ISO 12100-1.




*Risk graph for determining the required performance level for a safety function*

## *Risk reduction*

Risk reduction can be achieved by eliminating the hazards or by individually or simultaneously reducing each of the two elements that determine the associated risk:

- Severity of damage from the considered danger,
- The likelihood of this damage

## *Design measures*

Design measures for self-safety eliminate hazards or reduce associated risks by appropriate selection of the design characteristics of the machine itself or the interaction between exposed persons and the machine.

## *Precautions or additional measures*

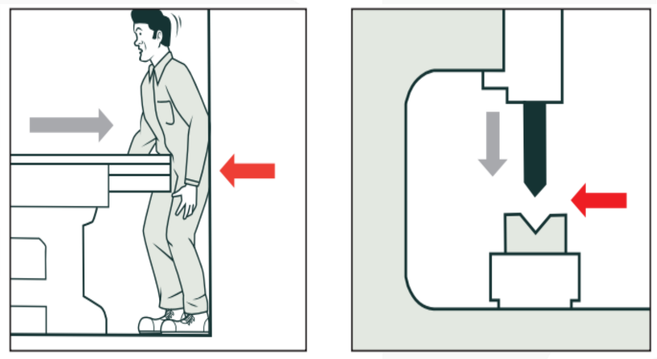
When considering intended use and foreseeable misuse, adequate safety protection and additional protective measures may be used to reduce the risk if the hazard cannot be eliminated or its associated risk can be sufficiently reduced by the use of self-safety design measures.

## *Usage information*

If, despite design measures to ensure one's own safety, despite safety protection and the adoption of additional protective measures, risks remain, then residual risks must be identified in the use information. Usage information must include

- Operating procedures for the use of machines that take into account the expected capabilities of the persons using the machine,
- Recommended safety work procedures for residual risk at various stages of the machine's life,
- A description of any recommended personal protective equipment, including details of their use and any training in their use.

Information on use must not be a substitute for the correct application of design measures for personal safety, security protection or additional measures.



*Examples of crushing hazards*

## *Conclusion*

The article focuses on the risk assessment of machinery. The relevant standards are used in the article, they are: ISO 12100-1Safety of machinery. General principles for design. Risk assessment and risk reduction, which is derived on the basis of ISO 14121-1 Safety of machinery. Risk assessment. Part 1: Principles, the article also mentions the standard STN ISO 31000 Risk management. Guidelines. This contribution may be appropriate to guide procedures in the risk assessment of machinery.

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