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Risk assessment of machinery – Measures against the defeating of safeguards

A guide for manufacturers and designers

DGUV Information 209-092

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Risk assessment of machinery – Measures against the defeating of safeguards

A guide for manufacturers and designers

The present DGUV Information is the translation of the German edition „DGUV Information 209-092 „Risikobeurteilung von Maschinen und Anlagen – Maßnahmen gegen Manipulation von Schutzeinrichtungen“ (issued April 2019). No liability is accepted for translation errors. In any case, the German original shall prevail.

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1. Introduction

This DGUV information is intended for manufacturers and designers of machinery. It provides support in assessing whether the technical and organisational design principles applied are sufficient to prevent the defeating of safeguards. The present document does not describe specific technical solutions for the design of machinery.

Defeating is any by-passing or rendering ineffective of safeguards. In the interests of the machine manufacturers, foreseeable defeating is considered in this context which aims at using a machine intentionally and in a simple manner in a way which is not foreseen or without the necessary safeguards (see Machinery Directive 2006/42/EC, Annex I, Paragraph 1.4.1 [1]).

The company using a machine is responsible for its safe operation. It is subject to the requirements of the German Occupational Health and Safety Act [2] and the German Ordinance on Industrial Safety and Health [3].
A comprehensive overview of the subject can be found in Fachbereich AKTUELL FBHM-022 “Manipulation von Schutzeinrichtungen – Verhindern, Erschweren, Erkennen“ [4].

In their study [5], occupational health and safety experts and the responsible persons of the companies running the machinery concluded that safeguards on stationary machines are frequently defeated.

There is a need for action, both on the part of the operating companies in the sphere of activity of which the defeating has been carried out and on the part of the manufacturer who must enable safe and ergonomic operation in every life cycle of the machine provided on the market.

In many cases, the inherent design of safeguards is such that the operation of the machine is impaired. This is the case, for example, if the view into the work area is impaired (e.g. due to an inspection window which is too small), if the possible work cycle is not achieved or if activities are not possible at all without defeating (e.g. during setup or troubleshooting and error correction).

If the safeguards of the machine are manipulated as a result, a foreseeable misuse is given, which the manufacturer should have already considered

when designing the machine. The protection concept of a machine must therefore be taken as a basis during its development. Only then can safeguards be designed in such a way that the work tasks on the machine are not obstructed during its intended operation. Accordingly, the manufacturer must provide operating modes for the machine that allow safe setup, maintenance and troubleshooting without the need to defeat the safeguard.

2. Specific requirements to prevent defeating

2.1. General

This chapter lists the manufacturer-specific organisational and technical measures that are required for comprehensive consideration of the resistance of machines against defeating (see Figure 1). The measures shown are specified in the checklist in Annex II (for validation, see Chapter 3).

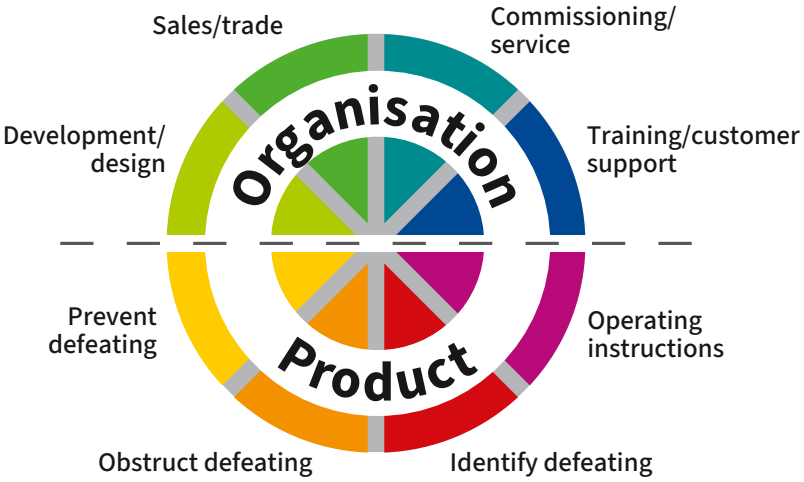

Fig. 1 Overview

Note: *Only rarely do manufacturers have all stages in the life cycle of their machine under their direct control. There are also other factors that influence the resistance to defeating machines, which may not be under the direct control of those responsible for manufacturing. For this very reason, it is of great importance to know these factors (see Annex I).*

2.2. Organisational measures

2.2.1. Overview

When designing and constructing machinery, the manufacturer or designer must ensure that the following measures are complied with. Persons in charge of the company organisation must be made aware of these issues.

Employers must take organisational measures, especially in the departments of development and design, sales and trade, commissioning[1] and service[2] as well as training and customer support (see Figure 1). Sections 2.2.2 to 2.2.5 outline which aspects the staff of these departments must take into account.

2.2.2. Development and design

When designing a machine, it is absolutely essential to consider the protection concept against defeating right from the initial development phase.

When designing the safety measures, all work tasks to be performed on the machine must be considered. This includes commissioning (see also Section 2.2.4), setup, maintenance, troubleshooting and fault elimination as well as cleaning of the machine. Some of these work tasks must also be described by the future operating company, for example in a specification sheet. If this information is not known or incomplete, it is the responsibility of the manufacturing company to explicitly determine or (within the limits of the machine) specify these tasks.

The manufacturer must clarify the intended use of the machine as well as the work tasks with the responsible persons of the operating company.

1 See [1] and EN ISO 12100:2010 [6] for the meaning of this term and the distinction from putting into service.

2 Service means the department under the responsibility of the manufacturer.

The factors include the expected ambient conditions and the properties of the material to be processed. In this way, the suitability of the machine for the intended use can be ensured and the defeating of the safeguards can be prevented as far as possible.

After the protection concept has been developed, it must be checked if there is an incentive to defeat the intended safeguards. It is recommended to involve all future machinery operating companies and all operators in this test. Existing incentives for defeating on the machine should be used to enhance the machine design.

If additional operating modes are required, the misuse of these operating modes in regular operation must be rendered difficult or impossible.

Note: *EN ISO 14119 [7] and TRBS 1151 [13] describe a procedure for testing machines for incentives for defeating. The procedure is available as an app for free download on the website of the Institute for Occupational Safety and Health of DGUV (IFA) [14].*

After placing the machine on the market, the manufacturer is obliged to monitor its use on the market (product monitoring obligation, in Germany: 823 para. 1 German Civil Code). This also includes identifying misuse with defeated safeguards and incorporating the resulting findings into future developments.

2.2.3. Sales and trade

At the time of purchase, the future operator should be thoroughly advised by the manufacturer in order to select a machine which is suitable for the intended requirements. Therefore, the requirements for the intended use of the machine should be known. Conversely, the intended use of the machine must be indicated at the time of sale in order to prevent misunderstandings.

2.2.4. Commissioning and service

The manager of a manufacturing company must sensitise the service personnel to the subject of defeating. Service personnel are not allowed to carry out any defeating during commissioning or maintenance work which might signal to the operating company that the machine cannot be operated without defeating in every phase of its life.

The manufacturer must encourage the service personnel to identify whether the own machines are defeated in order to pass on this information to the design department in the specific case.

Note: *The responsible persons in the operating company represent an important source of information. Both parties benefit from regular feedback on the experience gained during operation and handling of the machine. This feedback should also include reports on possible (near) accidents and dangerous situations.*

Under no circumstances shall the machine be delivered with the auxiliary equipment (e.g. spare actuators) required for defeating.

On completion of maintenance, the service personnel must ensure that all safeguards and maintenance flaps are installed and functional, even if they have not been removed during maintenance. It is useful to check and countersign the procedure together with the operator using a machine-specific checklist.

2.2.5. Training and customer support

For machinery, the operation of which is not generally subject of professional training, manufacturers must ensure that training or instruction are available to the purchaser or, where needed, provide them themselves. These offers must be referred to in the course of the sale. In this context, it is important to consider special operating conditions, such as set-up, troubleshooting, maintenance, and cleaning.

Anyone who operates a machine must be informed about how to obtain information and assistance for machine operation directly from the manufacturer. Any kind of feedback must be forwarded to the development department (verified by the quality management) so that the feedback is evaluated there, and a decision can be made as to whether an adjustment of the design is necessary.

Note: *Defeating during operation is often a measure to eliminate occurring faults, to run machines in an unusual operating mode or to delay the replacement of defective or worn machine elements. As a rule, this occurs intentionally, but occasionally it also occurs because a solution of the problem without defeating is not known. If the manufacturer offers competent advice, the incentive to defeat safeguards is considerably reduced.*

2.3. Product-specific measures

2.3.1. General

The design measures referred to in the following must be assessed individually for each product. Taken as a whole, they can contribute significantly to the prevention of defeating.

2.3.2. Prevent defeating

The prevention of defeating aims at avoiding an incentive to defeat a safeguard in the first place. On a machine without any incentive to defeat, the operating and protective concepts are aligned in such a way that the operator does not perceive any impairment of the work process due to the safeguards. Suitable protection concepts and operating modes are available for all work tasks to be performed on the machine. At the same time, the reliability of the machine helps to avoid errors that could provide an additional incentive for defeating.

The effective prevention of defeating requires compliance with the sequence of risk reduction measures from EN ISO 12100. If risks have already been reduced by design, further protective measures may not be necessary. This almost eliminates the possibility of subsequent manipulation.

When designing machinery and safeguards, the manufacturer or the design department must ensure that ergonomic principles are considered. The manufacturer is also responsible for the provision of easily accessible service and maintenance areas. Displays must be clear and unambiguous. The application of protective measures and the operation of the control devices must be simple and understandable, and it is important that the safeguards allow a sufficient view, for example of the work process. Emissions must also be considered.

Note: *A checklist for ergonomic machine design is available on the IFA website [15].*

It must already be taken into account during the development of the control system that process sequences are clearly structured and have a logical sequence.

It must be possible to interrupt production processes, for example in order to search for and eliminate errors, to readjust process parameters or to check quality. Care must be taken to minimise loss of time and material. Safe means must be provided to eliminate all foreseeable errors.

2.3.3. Obstruct defeating

If the defeating of a safeguard does not require a high expenditure of time or material, it cannot be ruled out that it will be manipulated even if the incentive to defeat is low. Therefore, the efforts to prevent defeating must be increased already during design.

Interlocking devices for guards are defeated most frequently. For this reason, measures according to EN ISO 14119, chapter 7, which make defeating more difficult, must be considered.

2.3.4. Identify defeating

Where appropriate, safety functions and components should be monitored by the control system, both with regard to their function and their position in relation to the process sequence. The defeating of a safeguard in the machine control system is thus detected in good time and can be dealt with accordingly.

2.3.5. Operating instructions

The operating instructions must be written in a comprehensible way and structured so that all relevant contents can be found quickly.

It must describe the actions required on the machine for all life phases, as well as protective measures and their proper application.

3. Validation

Using the list in Annex 2, the manufacturer or designer can check the extent to which the measures described in Chapter 2 to prevent defeating have been implemented. If questions are answered in the negative, it should be examined whether measures should be taken.

The checklist serves as a supplementary document for risk assessment.

List of references

[1] Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery and amending Directive 95/16/EC (recast), L 157/24 Official Journal of the European Union of 9 June 2006

[2] Arbeitsschutzgesetz (ArbSchG) – Gesetz über die Durchführung von Maßnahmendes Arbeitsschutzes zur Verbesserung der Sicherheit und des Gesundheitsschutzes der Beschäftigten bei der Arbeit vom 7. August 1996 (BGBl. I S. 1246); geändert 31. August 2015 (BGBl. I S. 1474)

[3] Betriebssicherheitsverordnung (BetrSichV) – Verordnung über Sicherheit und Gesundheitsschutz bei der Bereitstellung von Arbeitsmitteln und deren Benutzung bei der Arbeit, über Sicherheit beim Betrieb überwachungsbedürftiger Anlagen und über die Organisation des betrieblichen Arbeitsschutzes

[4] DGUV Information FB-HM-022, Manipulation von Schutzeinrichtungen – Verhindern, Erschweren, Erkennen

[5] Apfeld, R.; Huelke, M.; Lüken, K.; Schaefer, M.; Paridon, H.; Windemuth, D.; Zieschang, H.; Preuße, C.; Umbreit, M.; Hüning, A.; Reudenbach, R.; Pfaffinger, F.; Wenchel, K.; Reitz, R.; Pinter, H.: Manipulation von Schutzeinrichtungen an Maschinen. Hrsg.: Hauptverband der gewerblichen Berufsgenossenschaften (HVBG), Sankt Augustin 2006

[6] EN ISO 12100:2010-11 Safety of machinery – General principles for design – Risk assessment and risk reduction

[7] EN ISO 14119:2013-10 Safety of machinery – Interlocking devices associated with guards – Principles for design and selection

[8] ISO 9001:2015-09 Quality management systems – Requirements

[9] ISO/TR 14121-2:2012-06, Safety of machinery – Risk assessment – Part 2: Practical guidance and examples of methods

[10] EN ISO 14120:2015-11, Safety of machinery – Guards – General requirements for the design and construction of fixed and movable guards

[11] EN ISO 13849-1:2015-12, Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design

[12] prEN 1837:2019 Design, Safety of machinery – Integral lighting of machines

[13] TRBS 1151:2015-03, Technische Regeln für Betriebssicherheit – Gefährdungen an der Schnittstelle Mensch-Arbeitsmittel – Ergonomische und menschliche Faktoren, Arbeitssystem

[14] Anreiz für die Manipulation von Schutzeinrichtungen Bewertungsverfahren: App für Android und iOS. www.dguv.de/ifa, Webcode d3295

[15] DGUV Information 209-068, Ergonomische Maschinengestaltung – Checkliste und Auswertungsbogen, www.dguv.de/ifa, Webcode d3443

[16] BekBS 1113:2015-03, Bekanntmachung zur Betriebssicherheit – Beschaffung von Arbeitsmitteln

Annex 1

Other stakeholders and influences

Employees in small manufacturing companies do not always have all processes under their control. There are also factors influencing the tamper resistance of machines, which cannot be influenced at all during production or only to a limited extent. Therefore, it is important to know these factors.

Commerce
The sales department of a company is usually evaluated by its sales. But it also represents the link between manufacturer and operator. Therefore, sales staff must select machines that meet the requirements of the operator. This includes the suitability of the safety concept of the sold machine for the intended use. If unsuitable machines are sold, various causes can lead to their safeguards being defeated later on. This is the case, for example, if the operator has to intervene constantly in the work process.

Purchase
The requirements of the future operator – usually laid down in a specification sheet – serve as the basis for the submission of bids (see also [11, 16]).
It describes exactly which conditions the machine shall fulfil. The manufacturer also needs this information to be able to offer or develop a safety concept that does not restrict operation more than necessary. The persons responsible for purchasing will try to procure the most cost-effective machine possible based on the requirements. It is therefore advisable for the operator to involve the responsible occupational health and safety specialists and the operating personnel in the selection of the machine since these experts can assess whether the machine meets the technical requirements without defeating.

Commissioning
During commissioning by the manufacturer before handing over to the operator, the machine may not yet be fully assembled. Safeguards that are not yet operational are bypassed for work in the danger zone. Hazard areas are accessible because machine parts have not yet been installed.

In terms of safety, this is a very critical phase. Depending on the creativity of the machine designer, suitable machine features support this phase. In order to avoid unnecessary movements, partial movements could be carried out in inching operation with open safeguards. Special measures must be defined for commissioning, which in principle cannot be transferred to subsequent operation.

Setting up
Many machines must be set up by the operator for the subsequent production process. This involves optimising programs, approaching a concealed workpiece with a tool, drawing in material webs and much more. Machines which are not provided with suitable operating modes in this context are inevitably operated with defeated safeguards. This is a shortcoming in the design which lies in the responsibility of the manufacturer. Therefore, operating modes are required in which machine movements for set-up in the hazardous area are safely possible in the presence of trained skilled personnel. The selection is usually made by means of a mode selection switch and a hand-held operating device is used for the operation, if necessary.

Operation
For the operator, throughput, quantities and high cyle rates are the important aspects here. If safeguards obstruct the production cycle, they will sooner or later be disabled. In this context, position switches with separate actuators on safety doors are particularly susceptible. An additional actuator is available as a spare part from the manufacturer, or it can simply be unscrewed from the door. This is quickly implemented, because the single-use screws supplied by the switch manufacturer are usually not used by the machine manufacturer. The machine is thus operated with ineffective safeguards in the further course of the process: this represents a clear violation of legal requirements, which is initially the responsibility of the operator. However, the manufacturer can also be held liable for an unsuitable safety concept. Especially, when the misuse was foreseeable and not sufficiently considered.

Troubleshooting and fault elimination

During troubleshooting, interruptions in the process often need to be analysed. If troubleshooting is not possible with active safeguards, suitable machine operating modes are required. If suitable operating modes are not available, faults can often be identified only with defeated safeguards. This also represents a violation of legal requirements for which both the operator and, in the specific case, the manufacturer are responsible.

Annex 2

Self-testing checklist – Tamper resistance of machines

		Yes	No	Not applicable
1)	Are random tests, e.g. for usability, susceptibility to faults, defeating etc. carried out on predecessor machines and are the results incorporated in new developments?	☐	☐	☐
	Proof: Process description and corresponding evaluations **Explanation:** Accident history and experiences with comparable machines should be included in the risk assessment of the machine. **Source:** EN ISO 12100, Section 5.2 c) EN ISO 12100, Section 7 d) 1)			
2)	Is there an easy way for the operating company to contact the manufacturer?	☐	☐	☐
	Explanation: The manufacturer must state the company name and full address in the operating instructions. A hotline is also helpful for making contact. **Source:** MD 2006/42/EC Annex I 1.7.2.4. a) HVBG-Report 02/2006 Annex, section VIII question 13			
3)	Are employees in the service area instructed neither to carry out nor to recommend defeating? Source: FB HM-022, issue 07/2016	☐	☐	☐
4)	Are service employees instructed to pass on information about any defeating found to the manufacturer? Source: FB HM-022, issue 07/2016	☐	☐	☐
5)	Does a complaint management for feedback from the operating companies exist and are the evaluations taken into account in the development?	☐	☐	☐
	Proof: Quality management of the manufacturer **Source:** ISO 9001			

		Yes	No	Not applicable
6)	Are machine operators and maintenance staff involved in the preparation of the specifications?	☐	☐	☐
	Proof: Operational instructions for the involvement of machine operators and maintenance personnel in the procurement process. **Source:** FBHM-022, issue 07/2016			
7)	Operating concept: Are the necessary operating modes available?	☐	☐	☐
	Explanation: The necessary operating modes are available, which means that the concept is conclusive, all intended applications can be carried out and are adapted to the users. **Source:** MD 2006/42/EC Annex I 1.7.4.2 k) EN ISO 12100 Section 6.4.5.1 d)			
8)	Operating concept: Can the operation be carried out intuitively?	☐	☐	☐
	Source: MD 2006/42/EC Annex I 1.7.4.2 k) EN ISO 12100 Section 6.4.5.1 d)			
9)	Operating concept: Is the operation clear?	☐	☐	☐
	Explanation: The operation must be clear (i.e. the eyes should be able to simultaneously see the control panel with the keys to be operated and the workpiece or tool). **Source:** MD 2006/42/EC Annex I 1.7.4.2 k) EN ISO 12100 Section 6.4.5.1 d)			
10)	Is the safety concept taken into account at an early stage of development?	☐	☐	☐
	Explanation: The manufacturer of machinery or the person authorised by him/her must ensure that a risk assessment is carried out in order to determine the health and safety requirements applicable to the machinery. The machinery must then be designed and constructed taking into account the results of the risk assessment. **Source:** MD 2006/42/EC Annex I Section 1.			

		Yes	No	Not applicable
11)	Have design measures been considered to avoid or reduce errors?	☐	☐	☐

Explanation:
Variations in material properties, different process environments, etc. must be taken into account
Source:
HVBG-Report 2/2006 Annex A, section IX question 15

12)	Does the safety concept include safe measures to eliminate all foreseeable faults?	☐	☐	☐

Proof:
A process FMEA is available. The operating instructions describe a procedure for troubleshooting and fault elimination.
Source:
MD 2006/42/EC Annex I, section 1.7.4.2 q)
EN ISO 12100 Section 6.4.5.1 g) 1)

13)	Is the safety concept designed in such a way that all necessary activities outside of regular operation (e.g. cleaning, setting up) can be carried out easily and safely without defeating?	☐	☐	☐

Proof:
Visual inspection on the machine
Explanation:
Many manufacturers prescribe in the operating instructions that the activities are to be carried out with the machine at a standstill. In order to be able to carry out the activities faster or more thoroughly, they are often carried out while the machine is running with defeated (open) safeguards. Special types of operation, for example inching operation with open safeguards, enable simple and safe execution of the activities without defeating.
Source:
MD 2006/42/EC Annex I, Section 1.6.1

14)	Does the safety concept take into account that the work process can be restarted immediately after access to the machine via safeguards?	☐	☐	☐

Proof:
Visual inspection on the machine
Explanation:
For machinery which may lose its reference point if a safeguard is activated, an interlocking device with guard locking must be provided if necessary.
Source:
MD 2006/42/EC Annex I, Section 1.2.3

		Yes	No	Not applicable
15)	Does the protection concept take into account area shut-offs of the machine?	☐	☐	☐
	Proof: Risk assessment **Source:** MD 2006/42/EC Annex I Section 1.2.4.1			
16)	Does the intended use cover all requirements expected by the operator in all operating phases of the machine?	☐	☐	☐
	Explanation: Machinery must be designed and constructed in such a way that it meets the requirements of the future operator and to enable it to be operated, set up and maintained under the intended conditions – but also taking into account foreseeable misuse – without exposing persons at risk. **Source:** MD 2006/42/EC Annex I Section 1.1.2 a)			
17)	Do the safeguards permit the intended use of the machine in all operating modes and in all phases of its life?	☐	☐	☐
	Source: EN ISO 12100 Section 5.5.3.6			
18)	Is the defeating of safeguards detected in the machine control system?	☐	☐	☐
	Proof: Test of the safeguards in the machine control system **Explanation:** For areas in which an incentive to defeat cannot be completely prevented, it must be checked whether safety functions and components can be monitored by the control system to determine whether their respective switching states match the process sequence. **Source:** MD 2006/42/EC Annex I Section 1.2.1			

		Yes	No	Not applicable
19)	Is there an application-related selection of the safeguards according to ISO/TR 14121-2?	☐	☐	☐

Proof:
Submission of a corresponding comparison
Explanation:
In the implemented variant, the best solution must be plausibly presented.
Source:
EN ISO 12100 Section 5.5.3.6 b)
ISO/TR 14121-2

20)	Are the protective measures understandable and easy to apply?	☐	☐	☐

Source:
EN ISO 12100 Section 5.5.3.6 b)

21)	Are the accesses to hazardous areas secured according to the frequency of their use?	☐	☐	☐

Explanation:
If access to a hazardous area occurs more than once a week, a movable guard with interlocking must be used.
Source:
EN ISO 14120:2015 Section 6.4.4.1

22)	Are the protective measures compatible with each other and negative interactions excluded?	☐	☐	☐

Explanation:
The question must be answered in the affirmative if the safeguards function completely independently of each other or cannot negatively influence each other.
Machines with several conditions for the activation of the safeguard must be considered in more detail.
Source:
MD 2006/42/EC Annex I Section 1.4.1
EN ISO 12100, Section 5.6.2

		Yes	No	Not applicable
23)	Is sufficient visibility, for example of the work process, possible despite the safeguard?	☐	☐	☐

Proof:
Visual inspection on the machine
Explanation:
Guards and protective devices must not restrict the observation of the work process more than necessary.
Source:
MD 2006/42/EC Annex I, Section 1.4.1

24)	Is a sufficient view of the process possible despite the emissions (chips, dust, cooling lubricants etc.)?	☐	☐	☐

Explanation:
In case of high-emission production processes, the working area must be provided with appropriate deflectors or any occurring emissions have to be removed from the field of vision of the person observing the process, for example by means of an extraction system.
Source:
DGUV Information 209-068 chapter 11c)

25)	Is it ensured that the control elements for operating the machine cannot be reached from the danger zone (with the safeguard interlocked)?	☐	☐	☐

Explanation:
Control devices (e.g. start buttons) must be arranged in such a way that they cannot be operated by a person when standing in the danger zone behind the safeguard. Exceptions are special operating modes (e.g. with enabling switch) in which the corresponding safeguard is not active.

26)	Is a material or time expenditure necessary for defeating the safeguard?	☐	☐	☐

Explanation:
In this context, material expenditure means the production or purchase of a tool or key. All work that can be done within a short period of time (use of simple means, such as coins, wire, replacement actuators, etc.) is not considered to require an effort.
Source:
MD Annex I, Section 1.4.1

		Yes	No	Not applicable
27)	Are safety relevant parts of the software protected by a password or similar?	☐	☐	☐
	Explanation: Safety relevant parameters on the machine must be protected against unauthorised modification, for example by a password. **Source:** EN ISO 13849-1 Section 4.6.4			
28)	Does the protection concept take into account that the workpiece can continue to be used after access to the machine through the safeguards?	☐	☐	☐
	Explanation: Can the workpiece that has just been machined still be used after a safeguard has been activated or after the emergency stop has been actuated?			
29)	Are the actuator and possibly the position switch connected to the machine in a non-detachable way?	☐	☐	☐
	Explanation: e. g. welding, gluing, disposable screws, rivets If failures of the interlocking device are to be expected during the lifetime of the machine and rapid replacement is required, the use of non-detachable fastenings does not represent a suitable alternative. In order to safely mitigate the risk in this case, other measures should be applied. **Source:** EN ISO 14119 Section 7.2 c) EN ISO 14119 Tabelle 3			
30)	Are safeguards suitably protected against defeating by simple means?	☐	☐	☐
	Explanation: For example, measures to prevent the bypassing of interlocking devices are described in EN ISO 14119, section 7. **Source:** MD 2006/42/EC Annex I, Section 1.4.1			
31)	Are fixed guards attached in such a way that they do not remain in the protective position after the fastening elements have been released?	☐	☐	☐
	Proof: Visual inspection on the machine by loosening the fastening elements of selected safeguards (random sample). **Source:** MD 2006/42/EC Annex I, Section 1.4.2.1			

		Yes	No	Not applicable
32)	Can the integrated lighting be switched on (if required) even when the machine is switched off?	☐	☐	☐

Proof:
Testing on the machine
Source:
prEN 1837:2019 draft, Section 5.5

33)	Is the machine delivered without a „tampering tool“ (code, key etc.)?	☐	☐	☐

Proof:
Examination upon delivery of the machine
Source:
HVBG-Report 2/2006 Annex A, section VI question 2

34)	Is adequate training or instruction of the operating personnel provided?	☐	☐	☐

Source:
EN ISO 12100 Section 5.5.3.4

35	Is adequate training or instruction of maintenance personnel provided?	☐	☐	☐

Source:
EN ISO 12100 Section 5.5.3.4

36)	Can the service technician perform all work without defeating?	☐	☐	☐

Explanation:
Guards and protective devices must not cause much interference, when servicing the machine, so that the incentive to bypass them is kept to a minimum.
Source:
EN ISO 12100 Section 6.3.3.1
EN ISO 12100 Section 6.2.7
EN ISO 12100 Section 6.2.11.1

		Yes	No	Not applicable
37)	Can the safeguard be maintained in the correct operating state without major maintenance or servicing efforts?	☐	☐	☐

Explanation:
If a safeguard cannot be maintained in the correct operating state without problems, an incentive is often given to render it ineffective or to bypass it in order to be able to continue to use the machine. The maintenance and care effort should be limited to the annual maintenance of the machine and should only require a small amount of time.
Source:
EN ISO 12100 Section 5.5.3.7

38)	Are the requirements of the customers determined before the machine is sold by the sales department?	☐	☐	☐

Explanation:
Does the planned use correspond to the intended use?

39)	Is information on the intended use available to the customer prior to purchase?	☐	☐	☐

Proof:
Information contained in the sales prospectus or other documents accessible to the customer prior to purchase.
Explanation:
The indication of the intended use also includes the specification of maximum workpiece dimensions. Safety relevant information from the operating instructions must not be contradicted in the sales brochure.
Source:
MD 2006/42/EC Annex I 1.7.4.3

40)	Do the operating instructions contain information on the correct working procedures and are the expected skills of the operator/maintenance personnel taken into account?	☐	☐	☐

Explanation:
The question is to be answered positively if the working procedures are described in detail in the operating instructions. In addition, the correct procedure and the correct settings/programming must be demonstrated using case studies. It is also useful to have a booklet/book/website about „Best practice“ examples from the manufacturer on the subject: appropriate handling of common workpieces (if necessary for an entire machine type).
Source:
EN ISO 12100 Section 6.1 Step 3

		Yes	No	Not applicable
41)	Are all the intended procedures described in an understandable way?	☐	☐	☐
	Source: MD 2006/42/EC Annex I Section 1.7.4.1 d)			
42)	Are the operating instructions structured in such a way that operating and maintenance personnel can quickly find and understand the intended course of action?	☐	☐	☐
	Source: MD 2006/42/EC Annex I Section 1.7.4.1 d)			
43)	Do the operating instructions contain sufficient information on the use of the safeguards?	☐	☐	☐
	Source: ISO 14119 Section 9.2.2			

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