

# Machinery Product Regulation

[www.maschinenrichtlinie.de](http://www.maschinenrichtlinie.de)

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## MPR Annex III vs. machinery product



The European Commission has published the proposal of the Machinery Product Regulation (MPR) on the 21<sup>st</sup> of April 2021.

<https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2021:202:FIN>

We are presenting to you Annex III of this Regulation in which we highlighted every occurrence of terms similar to machinery product, but not machinery product.

In detail these terms are:

- machine
- machine product
- machinery

We have not highlighted technical terms such as “human-machine interface”.

----- Deutsch -----

Die Europäische Kommission hat am 21. April 2021 den Vorschlag der Maschinenproduktverordnung (MPR) veröffentlicht.

Wir präsentieren Ihnen Anhang III dieses Entwurfs in welchem wir alle Vorkommen ähnlicher Begriffe zu „machinery product“ hervorgehoben haben, die nicht „machinery product“ sind.

Diese Begriffe sind:

- machine
- machine product
- machinery

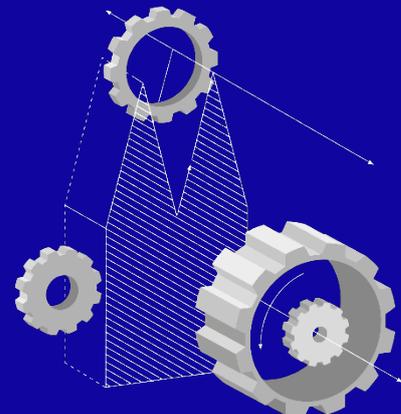
Fachbegriffe wie z.B. „human-machine interface“ haben wir nicht hervorgehoben.

### Major impacts

The draft of the machinery product regulation now distinguishes between machinery and machinery product.

Thus, if in Annex III a requirement is only targeted at machinery, it theoretically does not apply to other products in the scope of the MPR.

To avoid legal disputes and lengthy discussions it would be reasonable to remedy all such errors before the regulation is passed.





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Date: 20<sup>th</sup> July 2021

# 18<sup>th</sup> MASCHINERY DAYS COLOGNE

The week dedicated to the Machinery Directive:  
12<sup>th</sup> – 15<sup>th</sup> October 2021, Maritim Hotel Cologne



**GERMAN  
MACHINERY LAW DAY**  
12<sup>th</sup> October 2021

– Compressed knowledge  
about machine law

– **Lawyer Carsten Laschet**  
Sozietät Friedrich Graf von  
Westphalen & Partner

**SIMULTANEOUS  
INTERPRETING  
IN ENGLISH  
AND GERMAN**



**CONFERENCE  
MACHINERY DIRECTIVE**  
13<sup>th</sup> – 14<sup>th</sup> October 2021

– The conference all about  
the machinery directive

– **Dipl.-Ing. Hans-J. Ostermann**  
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#### WORKSHOPS

15<sup>th</sup> October 2021

- Procure CE-compliant  
machines / assemblies
- Security of machine and  
system controls

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## **ANNEX III**

### **ESSENTIAL HEALTH AND SAFETY REQUIREMENTS RELATING TO THE DESIGN AND CONSTRUCTION OF MACHINERY PRODUCTS**

#### **GENERAL PRINCIPLES**

1. The manufacturer of a machinery product or his or her authorised representative shall ensure that a risk assessment is carried out in order to determine the health and safety requirements, which apply to the machinery product. The machinery product shall then be designed and constructed to prevent and minimise all relevant risks, taking into account the results of the risk assessment.

By the iterative process of risk assessment and risk reduction referred to in the first subparagraph, the manufacturer or his or her authorised representative shall:

- (a) determine the limits of the machinery product, which include the intended use and any reasonably foreseeable misuse thereof;
- (b) determine the risks resulting from interactions between **machinery** in order to achieve the same end that are arranged and controlled so that they function as an integral whole, thus forming a machinery product as defined in Article 3, point (1), point (d);
- (c) identify the hazards that may be generated by the machinery product and the associated hazardous situations, including hazards that may be generated during the lifecycle of the machinery product that are foreseeable at the time of placing of the machinery product on the market as an intended evolution of its fully or partially evolving behaviour or logic as a result of the machinery product designed to operate with varying levels of autonomy. In this respect, where the machinery product integrates an artificial intelligence system, the **machinery** risk assessment shall consider the risk assessment for that artificial intelligence system that has been carried out pursuant to the Regulation ... of the European Parliament and of the Council+ on a European approach for Artificial Intelligence+<sup>1</sup>; .
- (d) estimate the risks, taking into account the severity of the possible injury or damage to health and the probability of its occurrence;
- (e) evaluate the risks, with a view to determining whether risk reduction is required, in accordance with the objective of this Regulation;
- (f) eliminate the hazards or reduce the risks associated with these hazards by application of protective measures, in the order of priority established in section 1.1.2(b).

2. The obligations laid down by the essential health and safety requirements only apply when the corresponding hazard exists for the machinery product in question when it is used under the conditions foreseen by the manufacturer or his or her authorised representative or in foreseeable abnormal situations. However, the principles of safety integration established in section 1.1.2 and the obligations concerning marking of machinery products and instructions referred to in sections 1.7.3 and 1.7.4 apply in all cases.

<sup>1</sup> + OJ: Please insert in the text the number of the Regulation contained in document ... and insert the number, date, title and OJ reference of that Regulation in the footnote

3. The essential health and safety requirements laid down in this Annex are mandatory; however, taking into account the state of the art, it may not be possible to meet the objectives set by them. In that event, the machinery product shall, as far as possible, be designed and constructed with the purpose of approaching those objectives.

4. This Annex is organised into six chapters. The first chapter is of general scope and applicable to all machinery products. The other chapters refer to certain sorts of more specific hazards. Nevertheless, it is essential to examine the whole of this Annex in order to be sure of meeting all the relevant essential requirements. When a machinery product is being designed, the requirements of the first chapter and the requirements of one or more of the other chapters shall be taken into account, depending on the results of the risk assessment carried out in accordance with point 1 of these General Principles. Essential health and safety requirements for the protection of the environment are applicable only to the machinery product referred to in section 2.4.

## 1. ESSENTIAL HEALTH AND SAFETY REQUIREMENTS

### 1.1. GENERAL REMARKS

#### 1.1.1. Definitions

For the purpose of this Annex:

- (a) 'hazard' means a potential source of injury or damage to health;
- (b) 'danger zone' means any zone within and/or around a machinery product in which a person is subject to a risk to his or her health or safety;
- (c) 'exposed person' means any person wholly or partially in a danger zone;
- (d) 'operator' means the person or persons installing, operating, adjusting, maintaining, cleaning, repairing or moving a machinery product;
- (e) 'risk' means a combination of the probability and the degree of an injury or damage to health that can arise in a hazardous situation;
- (f) 'guard' means a part of a machinery product used specifically to provide protection by means of a physical barrier;
- (g) 'protective device' means a device (other than a guard) which reduces the risk, either alone or in conjunction with a guard;
- (h) 'intended use' means the use of a machinery product in accordance with the information provided in the instructions for use;
- (i) 'reasonably foreseeable misuse' means the use of a machinery product in a way not intended in the instructions for use, but which may result from readily predictable human behaviour.

#### 1.1.2. Principles of safety integration

- (a) A machinery product shall be designed and constructed so that it is fit for its function, and can be operated, adjusted and maintained without putting persons at risk when these operations are carried out under the conditions foreseen but also taking into account any reasonably foreseeable misuse thereof. The aim of protective measures shall be to eliminate any risk throughout the foreseeable lifetime of the machinery product including the phases of transport, assembly, dismantling, disabling and scrapping.

- (b) In selecting the most appropriate methods, the manufacturer or his or her authorised representative shall apply the following principles, in the order given:
- i. eliminate or reduce risks as far as possible (inherently safe machinery product design and construction);
  - ii. take the necessary protective measures in relation to risks that cannot be eliminated;
  - iii. inform users of the residual risks due to any shortcomings of the protective measures adopted, indicate whether any particular training is required and specify any need to provide personal protective equipment.
- (c) When designing and constructing a machinery product and when drafting the instructions, the manufacturer or his or her authorised representative shall envisage not only the intended use of the machinery product but also any reasonably foreseeable misuse thereof. The machinery product shall be designed and constructed in such a way as to prevent abnormal use if such use would engender a risk. Where appropriate, the instructions shall draw the user's attention to ways — which experience has shown might occur — in which the machinery product should not be used.
- (d) A machinery product shall be designed and constructed to take account of the constraints to which the operator is subject as a result of the necessary or foreseeable use of personal protective equipment.
- (e) A machinery product shall be designed and constructed in such a way that it is possible for the user to test the safety functions, and the machinery product shall be supplied with all the special equipment and accessories, and where appropriate, with the description of specific functional test procedures, essential to enable it to be tested, adjusted, maintained and used safely.

#### 1.1.3. Materials and products

The materials used to construct a machinery product, or products used or created during its use, shall not endanger persons' safety or health. In particular, where fluids are used, machinery products shall be designed and constructed to prevent risks due to filling, use, recovery or draining.

#### 1.1.4. Lighting

A machinery product shall be supplied with integral lighting suitable for the operations concerned, where the absence thereof is likely to cause a risk despite ambient lighting of normal intensity.

A machinery product shall be designed and constructed so that there is no area of shadow likely to cause nuisance, that there is no irritating dazzle and that there are no dangerous stroboscopic effects on moving parts due to the lighting.

Internal parts requiring frequent inspection and adjustment, and maintenance areas shall be provided with appropriate lighting.

#### 1.1.5. Design of a machinery product to facilitate its handling

A machinery product or each component part thereof, shall:

- (a) be capable of being handled and transported safely;
- (b) be packaged or designed so that it can be stored safely and without damage.

During the transportation of the machinery product and/or its component parts, there shall be no possibility of sudden movements or of hazards due to instability as long as the machinery product and/or its component parts are handled in accordance with the instructions.

Where the weight, size or shape of a machinery product or its various component parts prevents it or them from being moved by hand, the machinery product or each component part shall:

- (a) either be fitted with attachments for lifting gear, or
- (b) be designed so that it can be fitted with such attachments, or
- (c) be shaped in such a way that standard lifting gear can easily be attached.

Where a machinery product or one of its component parts is to be moved by hand, it shall either:

- (a) be easily moveable, or
- (b) be equipped for picking up and moving safely.

Special arrangements shall be made for the handling of tools and/or machinery product parts, which, even if lightweight, could be hazardous.

#### 1.1.6. Ergonomics

Under the intended conditions of use, the discomfort, fatigue and physical and psychological stress faced by the operator shall be reduced to the minimum possible, taking into account ergonomic principles such as:

- (a) allowing for the variability of the operator's physical dimensions, strength and stamina;
- (b) providing enough space for movements of the parts of the operator's body;
- (c) avoiding a machine-determined work rate;
- (d) avoiding monitoring that requires lengthy concentration;
- (e) adapting the human-machinery product interface to the foreseeable characteristics of the operators, including with respect to a machinery product with intended fully or partially evolving behaviour or logic that is designed to operate with varying levels of autonomy;
- (f) adapting a machinery product with intended fully or partially evolving behaviour or logic that is designed to operate with varying levels of autonomy to respond to people adequately and appropriately (verbally through words and non-verbally through gestures, facial expressions or body movement) and to communicate its planned actions (what it is going to do and why) to operators in a comprehensible manner.

#### 1.1.7. Operating positions

The operating position shall be designed and constructed in such a way as to avoid any risk due to exhaust gases and/or lack of oxygen.

If the machinery product is intended to be used in a hazardous environment presenting risks to the health and safety of the operator or if the machinery product itself gives rise to a hazardous environment, adequate means shall be provided to ensure that the operator has good working conditions and is protected against any foreseeable hazards.

Where appropriate, the operating position shall be fitted with an adequate cabin designed, constructed and/or equipped to fulfil the above requirements. The exit shall allow rapid evacuation. Moreover, when applicable, an emergency exit shall be provided in a direction which is different from the usual exit.

#### 1.1.8. Seating

Where appropriate and where the working conditions so permit, work stations constituting an integral part of the machinery product shall be designed for the installation of seats.

If the operator is intended to sit during operation and the operating position is an integral part of the machinery product, the seat shall be provided with the machinery product.

The operator's seat shall enable him to maintain a stable position. Furthermore, the seat and its distance from the control devices shall be capable of being adapted to the operator.

If the machinery product is subject to vibrations, the seat shall be designed and constructed in such a way as to reduce the vibrations transmitted to the operator to the lowest level that is reasonably possible. The seat mountings shall withstand all stresses to which they can be subjected. Where there is no floor beneath the feet of the operator, footrests covered with a slip-resistant material shall be provided.

#### 1.1.9. Protection against corruption

The machinery product shall be designed and constructed so that the connection to it of another device, via any feature of the connected device itself or via any remote device that communicates with the machinery product does not lead to a hazardous situation.

A hardware component for connection that is critical for the compliance of the machinery product with the relevant health and safety requirements shall be designed so that it is adequately protected against accidental or intentional corruption. The machinery product shall collect evidence of a legitimate or illegitimate intervention in the hardware component.

Software and data that are critical for the compliance of the machinery product with the relevant health and safety requirements shall be identified as such and shall be adequately protected against accidental or intentional corruption.

The machinery product shall identify the software installed on it that is necessary for it to operate safely, and shall be able to provide that information at all times in an easily accessible form.

The machinery product shall collect evidence of a legitimate or illegitimate intervention in the software or a modification of the software installed on the machinery product or its configuration.

### 1.2. CONTROL SYSTEMS

#### 1.2.1. Safety and reliability of control systems

Control systems shall be designed and constructed in such a way as to prevent hazardous situations from arising.

Control systems shall be designed and constructed in such a way that:

- (a) they can withstand, where appropriate to the circumstances and the risks, the intended operating stresses and intended and unintended external influences, including malicious attempts from third parties to create a hazardous situation;
- (b) a fault in the hardware or the logic of the control system shall not lead to hazardous situations;

- (c) errors in the control system logic shall not lead to hazardous situations;
- (d) the safety functions cannot be changed beyond the limits defined by the manufacturer in the machinery product risk assessment. The establishment of the limits of the safety functions shall be part of the risk assessment performed by the manufacturer, including any modifications to the settings or rules generated by the machinery product or by operators, covering also the learning phase, which cannot go beyond the limits addressed in the risk assessment;
- (e) reasonably foreseeable human errors during operation shall not lead to hazardous situations;
- (f) the tracing log of the data generated in relation to an intervention and of the versions of safety software uploaded after the machinery product has been placed on the market or put into service, is enabled for five years after such upload, exclusively to demonstrate the conformity of the machinery product with this Annex further to a reasoned request from a competent national authority;
- (g) recording of data on the safety related decision-making process after the machinery product has been placed on the market or put into service, is enabled and that such data is retained for one year after its collection, exclusively to demonstrate the conformity of the machinery product with this Annex further to a reasoned request from a competent national authority.

Control systems of machinery products with fully or partially evolving behaviour or logic that is designed to operate with varying levels of autonomy shall be designed and constructed in such a way that:

- (a) they shall not cause the machinery product to perform actions beyond its defined task and movement space;
- (b) it shall be possible at all times to correct the machinery product in order to maintain its inherent safety.

Particular attention shall be given to the following points:

- (a) the machinery product shall not start unexpectedly;
- (b) the parameters of the machinery product shall not change in an uncontrolled way, where such change may lead to hazardous situations;
- (c) modifications to the settings or rules, generated by the machinery product or by operators covering also the learning phase, shall be prevented, where such modifications may lead to hazardous situations;
- (d) the machinery product shall not be prevented from stopping if the stop command has already been given;
- (e) no moving part of the machinery product or piece held by the machinery product shall fall or be ejected;
- (f) automatic or manual stopping of the moving parts, whatever they may be, shall be unimpeded;
- (g) the protective devices shall remain fully effective or give a stop command;
- (h) the safety-related parts of the control system shall apply in a coherent way to the whole of an assembly of a machinery product.

For wireless control, a failure of the communication or connection or a faulty connection shall not lead to a hazardous situation.

For autonomous mobile machinery products, the control system shall be designed to perform the safety functions by itself as set out in this section, even when actions are ordered by using a remote supervisory function.

#### 1.2.2. Control devices

Control devices shall be:

- (a) clearly visible and identifiable, using pictograms where appropriate;
- (b) positioned in such a way as to be safely operated without hesitation or loss of time and without ambiguity;
- (c) designed in such a way that the movement of the control device is consistent with its effect;
- (d) located outside the danger zones, except where necessary for certain control devices such as an emergency stop or a teach pendant;
- (e) positioned in such a way that their operation cannot cause additional risk;
- (f) designed or protected in such a way that the desired effect, where a hazard is involved, can only be achieved by a deliberate action;
- (g) made in such a way as to withstand foreseeable forces, paying particular attention to emergency stop devices liable to be subjected to considerable forces.

Where a control device is designed and constructed to perform several different actions, namely, where there is no one-to-one correspondence, the action to be performed shall be clearly displayed and subject to confirmation, where necessary.

Control devices shall be so arranged that their layout, travel and resistance to operation are compatible with the action to be performed, taking account of ergonomic principles.

Machinery products shall be fitted with indicators as required for safe operation. The operator shall be able to read them from the control position.

From each control position, the operator shall be able to ensure that no one is in the danger zones, or the control system shall be designed and constructed in such a way that starting is prevented while someone is in the danger zone.

If neither of these possibilities is applicable, before the machinery product starts, an acoustic and/or visual warning signal shall be given. The exposed persons shall have time to leave the danger zone or prevent the **machinery** starting up.

If necessary, means shall be provided to ensure that the machinery product can be controlled only from control positions located in one or more predetermined zones or locations.

Where there is more than one control position, the control system shall be designed in such a way that the use of one of them precludes the use of the others, except for stop controls and emergency stops.

When the machinery product has two or more operating positions, each position shall be provided with all the required control devices without the operators hindering or putting each other into a hazardous situation.

#### 1.2.3. Starting

It shall be possible to start the machinery product only by voluntary actuation of a control device provided for the purpose.

The same requirement applies:

- (a) when restarting the machinery product after a stoppage, whatever the cause;
- (b) when effecting a significant change in the operating conditions.

However, the restarting of the machinery product or a change in operating conditions may be effected by voluntary actuation of a device other than the control device provided for the purpose, on condition that this does not lead to a hazardous situation.

For the machinery product functioning in automatic mode, the starting of the machinery product, restarting after a stoppage, or a change in operating conditions may be possible without intervention, provided this does not lead to a hazardous situation.

Where the machinery product has several starting control devices and the operators can therefore put each other in danger, additional devices shall be fitted to rule out such risks. If safety requires that starting and/or stopping shall be performed in a specific sequence, there shall be devices that ensure that these operations are performed in the correct order.

#### 1.2.4. Stopping

##### 1.2.4.1. Normal stop

The machinery product shall be fitted with a control device whereby the machinery can be brought safely to a complete stop.

Each workstation shall be fitted with a control device to stop some or all of the functions of the machinery product, depending on the existing hazards, so that the machinery product is rendered safe.

The machinery product's stop control shall have priority over the start controls.

Once the machinery product or its hazardous functions have stopped, the energy supply to the actuators concerned shall be cut off.

##### 1.2.4.2. Operational stop

Where, for operational reasons, a stop control that does not cut off the energy supply to the actuators is required, the stop condition shall be monitored and maintained.

##### 1.2.4.3. Emergency stop

The machinery product shall be fitted with one or more emergency stop devices to enable actual or impending danger to be averted.

The following exceptions apply:

- (a) the machinery product in which an emergency stop device would not lessen the risk, either because it would not reduce the stopping time or because it would not enable the special measures required to deal with the risk to be taken;
- (b) portable hand-held and/or hand-guided machinery product.

The device shall:

- (a) have clearly identifiable, clearly visible and quickly accessible control devices;
- (b) stop the hazardous process as quickly as possible, without creating additional risks;
- (c) where necessary, trigger or permit the triggering of certain safeguard movements.

Once active operation of the emergency stop device has ceased following a stop command, that command shall be sustained by engagement of the emergency stop device until that engagement is specifically overridden; it shall not be possible to engage the device without triggering a stop command; it shall be possible to disengage the device only by an appropriate operation, and disengaging the device shall not restart the machinery product but only permit restarting.

The emergency stop function shall be available and operational at all times, regardless of the operating mode.

Emergency stop devices shall be a backup to other safeguarding measures and not a substitute for them.

#### 1.2.4.4. Assembly of machinery products

In the case of a machinery product or parts of a machinery product designed to work together, the **machinery** shall be designed and constructed in such a way that the stop controls, including the emergency stop devices, can stop not only the machinery product itself but also all related equipment, if its continued operation may be dangerous.

#### 1.2.5. Selection of control or operating modes

The control or operating mode selected shall override all other control or operating modes, with the exception of the emergency stop.

If the machinery product has been designed and constructed to allow its use in several control or operating modes requiring different protective measures and/or work procedures, it shall be fitted with a mode selector, which can be locked in each position. Each position of the selector shall be clearly identifiable and shall correspond to a single operating or control mode.

The selector may be replaced by another selection method, which restricts the use of certain functions of the machinery product to certain categories of operator.

If, for certain operations, the **machinery** shall be able to operate with a guard displaced or removed and/or a protective device disabled, the control or operating mode selector shall simultaneously:

- (a) disable all other control or operating modes;
- (b) permit operation of hazardous functions only by control devices requiring sustained action;
- (c) permit the operation of hazardous functions only in reduced risk conditions while preventing hazards from linked sequences;
- (d) prevent any operation of hazardous functions by voluntary or involuntary action on the **machine** product's sensors.

If these four conditions cannot be fulfilled simultaneously, the control or operating mode selector shall activate other protective measures designed and constructed to ensure a safe intervention zone.

In addition, the operator shall be able to control the operation of the parts he or she is working on from the adjustment point.

### 1.2.6. Failure of the power supply or communication network connection

The interruption, the re-establishment after an interruption or the fluctuation in whatever manner of the power supply or communication network connection to the machinery product shall not lead to hazardous situations.

Particular attention shall be given to the following:

- (a) the machinery product shall not start unexpectedly;
- (b) the parameters of the **machinery** shall not change in an uncontrolled way when such change can lead to hazardous situations;
- (c) the machinery product shall not be prevented from stopping if the stop command has already been given;
- (d) no moving part of the machinery product or piece held by the machinery product shall fall or be ejected;
- (e) automatic or manual stopping of the moving parts, whatever they may be, shall be unimpeded;
- (f) the protective devices shall remain fully effective or give a stop command.

## 1.3. PROTECTION AGAINST MECHANICAL RISKS

### 1.3.1. Risk of loss of stability

The machinery product and its components and fittings shall be stable enough to avoid overturning, falling or uncontrolled movements during transportation, assembly, dismantling and any other action involving the machinery product.

If the shape of the machinery product itself or its intended installation does not offer sufficient stability, appropriate means of anchorage shall be incorporated and indicated in the instructions.

### 1.3.2. Risk of break-up during operation

The various parts of machinery product and their linkages shall be able to withstand the stresses to which they are subject when used.

The durability of the materials used shall be adequate for the nature of the working environment foreseen by the manufacturer or his or her authorised representative, in particular as regards the phenomena of fatigue, ageing, corrosion and abrasion.

The instructions shall indicate the type and frequency of inspections and maintenance required for safety reasons. They shall, where appropriate, indicate the parts subject to wear and the criteria for replacement.

Where a risk of rupture or disintegration remains despite the measures taken, the parts concerned shall be mounted, positioned and/or guarded in such a way that any fragments will be contained, preventing hazardous situations.

Both rigid and flexible pipes carrying fluids, particularly those under high pressure, shall be able to withstand the foreseen internal and external stresses and shall be firmly attached and/or protected to ensure that no risk is posed by a rupture.

Where the material to be processed is fed to the tool automatically, the following conditions shall be fulfilled to avoid risks to persons:

- (a) when the work piece comes into contact with the tool, the latter shall have attained its normal working condition;
- (b) when the tool starts and/or stops (intentionally or accidentally), the feed movement and the tool movement shall be coordinated.

#### 1.3.3. Risks due to falling or ejected objects

Precautions shall be taken to prevent risks from falling or ejected objects.

#### 1.3.4. Risks due to surfaces, edges or angles

Insofar as their purpose allows, accessible parts of the **machinery** shall have no sharp edges, no sharp angles and no rough surfaces likely to cause injury.

#### 1.3.5. Risks related to a combined machinery product

Where the machinery product is intended to carry out several different operations with manual removal of the piece between each operation (combined machinery product), it shall be designed and constructed in such a way as to enable each element to be used separately without the other elements constituting a risk for exposed persons.

For this purpose, it shall be possible to start and stop separately any elements that are not protected.

#### 1.3.6. Risks related to variations in operating conditions

Where the machinery product performs operations under different conditions of use, it shall be designed and constructed in such a way that selection and adjustment of these conditions can be carried out safely and reliably.

#### 1.3.7. Risks related to moving parts and psychological stress

The moving parts of the machinery product shall be designed and constructed in such a way as to prevent risks of contact which could lead to accidents or shall, where risks persist, be fitted with guards or protective devices.

All necessary steps shall be taken to prevent accidental blockage of moving parts. In cases where, despite the precautions taken, a blockage is likely to occur, the necessary specific protective devices and tools shall, when appropriate, be provided to enable the equipment to be safely unblocked.

The instructions and, where possible, a sign on the machinery product shall identify these specific protective devices and how they are to be used.

The prevention of risks of contact leading to hazard situations and the psychological stress that may be caused by the interaction with the **machine** shall be adapted to:

- (a) human-machine coexistence in a shared space without direct collaboration;
- (b) human-machine interaction.

The machinery product with fully or partially evolving behaviour or logic that is designed to operate with varying levels of autonomy shall be adapted to respond to people adequately and appropriately (verbally through words or nonverbally through gestures, facial expressions or body movement) and to communicate its planned actions (what it is going to do and why) to operators in a comprehensible manner.

#### 1.3.8. Choice of protection against risks arising from moving parts

Guards or protective devices designed to protect against risks arising from moving parts shall be selected on the basis of the type of risk. The following guidelines shall be used to help to make the choice.

#### 1.3.8.1. Moving transmission parts

Guards designed to protect persons against the hazards generated by moving transmission parts shall be:

- (a) either fixed guards as referred to in section 1.4.2.1, or
- (b) interlocking movable guards as referred to in section 1.4.2.2.

Interlocking movable guards shall be used where frequent access is envisaged.

#### 1.3.8.2. Moving parts involved in the process

Guards or protective devices designed to protect persons against the hazards generated by moving parts involved in the process shall be:

- (a) either fixed guards as referred to in section 1.4.2.1, or
- (b) interlocking movable guards as referred to in section 1.4.2.2, or
- (c) protective devices as referred to in section 1.4.3, or
- (d) a combination of the above.

However, when certain moving parts directly involved in the process cannot be made completely inaccessible during operation owing to operations requiring operator intervention, such parts shall be fitted with:

- (a) fixed guards or interlocking movable guards preventing access to those sections of the parts that are not used in the work, and
- (b) adjustable guards as referred to in section 1.4.2.3 restricting access to those sections of the moving parts where access is necessary.

#### 1.3.9. Risks of uncontrolled movements

When a part of the machinery product has been stopped, any drift away from the stopping position, for whatever reason other than action on the control devices, shall be prevented or shall be such that it does not present a risk.

### 1.4. REQUIRED CHARACTERISTICS OF GUARDS AND PROTECTIVE DEVICES

#### 1.4.1. General requirements

Guards and protective devices shall:

- (a) be of robust construction;
- (b) be securely held in place;
- (c) not give rise to any additional hazard;
- (d) not be easy to by-pass or render non-operational;
- (e) be located at an adequate distance from the danger zone;
- (f) cause minimum obstruction to the view of the production process, and;
- (g) enable essential work to be carried out on the installation and/or replacement of tools and for maintenance purposes by restricting access exclusively to the area where the

work has to be done, if possible without the guard having to be removed or the protective device having to be disabled.

In addition, guards shall, where possible, protect against the ejection or falling of materials or objects and against emissions generated by the machinery product.

#### 1.4.2. Special requirements for guards

##### 1.4.2.1. Fixed guards

Fixed guards shall be fixed by systems that can be opened or removed only with tools.

Their fixing systems shall remain attached to the guards or to the machinery product when the guards are removed.

Where possible, guards shall be incapable of remaining in place without their fixings.

##### 1.4.2.2. Interlocking movable guards

Interlocking movable guards shall:

- (a) as far as possible remain attached to the machinery product when open;
- (b) be designed and constructed in such a way that they can be adjusted only by means of an intentional action.

Interlocking movable guards shall be associated with an interlocking device that:

- (a) prevents the start of hazardous machinery product functions until they are closed and
- (b) gives a stop command whenever they are no longer closed.

Where it is possible for an operator to reach the danger zone before the risk due to the hazardous machinery product functions has ceased, movable guards shall be associated with a guard locking device in addition to an interlocking device that:

- (a) prevents the start of hazardous machinery product functions until the guard is closed and locked, and
- (b) keeps the guard closed and locked until the risk of injury from the hazardous machinery product functions has ceased.

Interlocking movable guards shall be designed in such a way that the absence or failure of one of their components prevents starting or stops the hazardous machinery product functions.

##### 1.4.2.3. Adjustable guards restricting access

Adjustable guards restricting access to those areas of the moving parts strictly necessary for the work shall be:

- (a) adjustable manually or automatically, depending on the type of work involved; and
- (b) readily adjustable without the use of tools.

#### 1.4.3. Special requirements for protective devices

Protective devices shall be designed and incorporated into the control system in such a way that:

- (a) moving parts cannot start up while they are within the operator's reach;
- (b) persons cannot reach moving parts while the parts are moving, and
- (c) the absence or failure of one of their components prevents starting or stops the moving parts.

Protective devices shall be adjustable only by means of an intentional action.

## 1.5. RISKS DUE TO OTHER CAUSES

### 1.5.1. Electricity supply

Where a machinery product has an electricity supply, it shall be designed, constructed and equipped in such a way that all hazards of an electrical nature are or can be prevented.

The safety objectives set out in Directive 2014/35/EU shall apply to a machinery product. However, the obligations concerning conformity assessment and the placing on the market and/or putting into service of a machinery product with regard to electrical risks are governed solely by this Regulation.

### 1.5.2. Static electricity

A machinery product shall be designed and constructed to prevent or limit the build-up of potentially dangerous electrostatic charges and/or be fitted with a discharging system.

### 1.5.3. Energy supply other than electricity

Where a machinery product is powered by source of energy other than electricity, it shall be so designed, constructed and equipped as to avoid all potential risks associated with such sources of energy.

### 1.5.4. Errors of fitting

Errors likely to be made when fitting or refitting certain parts, which could be a source of risk, shall be made impossible by the design and construction of such parts or, failing this, by information given on the parts themselves and/or their housings. The same information shall be given on moving parts and/or their housings where the direction of movement needs to be known in order to avoid a risk.

Where necessary, the instructions shall give further information on these risks.

Where a faulty connection can be the source of risk, incorrect connections shall be made impossible by design or, failing this, by information given on the elements to be connected and, where appropriate, on the means of connection.

### 1.5.5. Extreme temperatures

Steps shall be taken to eliminate any risk of injury arising from contact with or proximity to machinery product parts or materials at high or very low temperatures.

The necessary steps shall also be taken to avoid or protect against the risk of hot or very cold material being ejected.

### 1.5.6. Fire

A machinery product shall be designed and constructed in such a way as to avoid any risk of fire or overheating posed by the machinery product itself or by gases, liquids, dust, vapours or other substances produced or used by the machinery product.

### 1.5.7. Explosion

A machinery product shall be designed and constructed in such a way as to avoid any risk of explosion posed by the machinery product itself or by gases, liquids, dust, vapours or other substances produced or used by the machinery product.

A machinery product shall comply, as far as the risk of explosion due to its use in a potentially explosive atmosphere is concerned, with the provisions of the specific Union harmonisation legislation.

#### 1.5.8. Noise

A machinery product shall be designed and constructed in such a way that risks resulting from the emission of airborne noise are reduced to the lowest level, taking account of technical progress and the availability of means of reducing noise, in particular at source.

The level of noise emission may be assessed with reference to comparative emission data for similar machinery product.

#### 1.5.9. Vibrations

A machinery product shall be designed and constructed in such a way that risks resulting from vibrations produced by the machinery product are reduced to the lowest level, taking account of technical progress and the availability of means of reducing vibration, in particular at source.

The level of vibration emission may be assessed with reference to comparative emission data for similar machinery products.

#### 1.5.10. Radiation

Undesirable radiation emissions from the machinery product shall be eliminated or be reduced to levels that do not have adverse effects on persons.

Any functional ionising radiation emissions shall be limited to the lowest level, which is sufficient for the proper functioning of the machinery product during setting, operation and cleaning. Where a risk exists, the necessary protective measures shall be taken.

Any functional non-ionising radiation emissions during setting, operation and cleaning shall be limited to levels that do not have adverse effects on persons.

#### 1.5.11. External radiation

A machinery product shall be designed and constructed in such a way that external radiation does not interfere with its operation.

#### 1.5.12. Laser radiation

Where laser equipment is used, the following shall be taken into account:

- (a) laser equipment on a machinery product shall be designed and constructed in such a way as to prevent any accidental radiation;
- (b) laser equipment on a machinery product shall be protected in such a way that effective radiation, radiation produced by reflection or diffusion and secondary radiation do not damage health;
- (c) optical equipment for the observation or adjustment of laser equipment on a machinery product shall be such that no health risk is created by laser radiation.

#### 1.5.13. Emissions of hazardous materials and substances

A machinery product shall be designed and constructed in such a way that risks of inhalation, ingestion, contact with the skin, eyes and mucous membranes and penetration through the skin of hazardous materials and substances which it produces can be avoided.

Where a risk cannot be eliminated, the machinery product shall be so equipped that hazardous materials and substances can be contained, captured, evacuated, precipitated by water spraying, filtered or treated by another equally effective method.

Where the process is not totally enclosed during normal operation of the machinery product, the devices for containment or capture, filtration or separation and evacuation shall be situated in such a way as to have the maximum effect.

#### 1.5.14. Risk of being trapped in a machine

A machinery product shall be designed, constructed or fitted with a means of preventing a person from being enclosed within it or, if that is impossible, with a means of summoning help.

#### 1.5.15. Risk of slipping, tripping or falling

Parts of the machinery product where persons are liable to move about or stand shall be designed and constructed in such a way as to prevent persons slipping, tripping or falling on or off these parts.

Where appropriate, these parts shall be fitted with handholds that are fixed relative to the user and that enable them to maintain their stability.

#### 1.5.16. Lightning

A machinery product in need of protection against the effects of lightning while being used shall be fitted with a system for conducting the resultant electrical charge to earth.

### 1.6. MAINTENANCE

#### 1.6.1. Machinery product maintenance

Adjustment and maintenance points shall be located outside danger zones. It shall be possible to carry out adjustment, maintenance, repair, cleaning and servicing operations while the machinery product is at a standstill.

If one or more of the above conditions cannot be satisfied for technical reasons, measures shall be taken to ensure that these operations can be carried out safely (see section 1.2.5).

In the case of automated machinery and, where necessary, other machinery product, a connecting device for mounting diagnostic fault-finding equipment shall be provided.

Automated machinery components, which have to be changed frequently, shall be capable of being removed and replaced easily and safely. Access to the components shall enable these tasks to be carried out with the necessary technical means in accordance with a specified operating method.

#### 1.6.2. Access to operating positions and servicing points

Machinery shall be designed and constructed in such a way as to allow access in safety to all areas where intervention is necessary during operation, adjustment, maintenance and cleaning of the machinery.

In the case of machinery into which persons shall enter for operation, adjustment, maintenance or cleaning, the machinery accesses shall be dimensioned and adapted for the use of rescue equipment in such a way that a timely rescue of the persons is guaranteed.

#### 1.6.3. Isolation of energy sources

A machinery product shall be fitted with means to isolate it from all energy sources. Such isolators shall be clearly identified. They shall be capable of being locked if reconnection could endanger persons. Isolators shall also be capable of being locked where an operator is unable, from any of the points to which he or she has access, to check that the energy is still cut off.

In the case of machinery products capable of being plugged into an electricity supply, removal of the plug is sufficient, if the operator can check from any of the points to which he or she has access that the plug remains removed.

After the energy is cut off, it shall be possible to dissipate normally any energy remaining or stored in the circuits of the machinery product without risk to persons.

As an exception to the requirement laid down in the previous paragraphs, certain circuits may remain connected to their energy sources in order, for example, to hold parts, to protect information, to light interiors, etc. In this case, special steps shall be taken to ensure operator safety.

#### 1.6.4. Operator intervention

The machinery product shall be so designed, constructed and equipped that the need for operator intervention is limited. If operator intervention cannot be avoided, it shall be possible to carry it out easily and safely.

#### 1.6.5. Cleaning of internal parts

The **machinery** shall be designed and constructed in such a way that it is possible to clean internal parts, which have contained dangerous substances or preparations without entering them; any necessary unblocking shall also be possible from the outside. If it is impossible to avoid entering the **machinery**, it shall be designed and constructed in such a way as to allow cleaning to take place safely.

### 1.7. INFORMATION

#### 1.7.1. Information and warnings on the machinery product

Information and warnings on the machinery product shall preferably be provided in the form of readily understandable symbols or pictograms.

##### 1.7.1.1. Information and information devices

The information needed to control a machinery product shall be provided in a form that is unambiguous and easily understood. It shall not be excessive to the extent of overloading the operator.

Visual display units or any other interactive means of communication between the operator and the machinery product shall be easily understood and easy to use.

##### 1.7.1.2. Warning devices

Where the health and safety of persons may be endangered by a fault in the operation of an unsupervised machinery product, the machinery product shall be equipped in such a way as to give an appropriate acoustic or light signal as a warning.

Where a machinery product is equipped with warning devices, these shall be unambiguous and easily perceived. The operator shall have facilities to check the operation of such warning devices at all times.

The requirements of the specific Union legislation concerning colours and safety signals shall be complied with.

#### 1.7.2. Warning of residual risks

Where risks remain despite the inherent safe design measures, safeguarding and complementary protective measures adopted, the necessary warnings, including warning devices, shall be provided.

### 1.7.3. Marking of a machinery product

All machinery products shall be marked visibly, legibly and indelibly with the following minimum particulars:

- (a) the business name and full address of the manufacturer and, where applicable, his or her authorised representative;
- (b) designation of the machinery product;
- (c) the CE marking;
- (d) designation of series or type;
- (e) serial number, if any;
- (f) the year of construction, that is the year in which the manufacturing process is completed.

It is prohibited to pre-date or post-date the machinery product when affixing the CE marking.

Furthermore, a machinery product designed and constructed for use in a potentially explosive atmosphere shall be marked accordingly.

A machinery product shall also bear full information relevant to its type and essential for safe use. Such information is subject to the requirements set out in section 1.7.1.

Where a **machine** product part shall be handled during use with lifting equipment, its mass shall be indicated legibly, indelibly and unambiguously.

### 1.7.4. Instructions

The instructions accompanying the machinery product shall be either ‘Original instructions’ or a ‘Translation of the original instructions’, in which case the translation shall be accompanied by the original instructions.

By way of exception, the maintenance instructions intended for use by specialised personnel mandated by the manufacturer or his or her authorised representative may be supplied in only one official language of the Union which the specialised personnel understand.

The instructions may be provided in a digital format. However, upon purchaser’s request at the time of the purchase of the machinery product, the instructions shall be provided in paper format free of charge.

When the instructions are provided in digital format, the manufacturer shall:

- (a) mark on the machinery product and in an accompanying paper how to access the digital instructions;
- (b) clearly describe which version of the instructions corresponds to the machinery product model;
- (c) be presented in a format that makes it possible for the end user to download the instructions and save them on an electronic device so that he or she can access them at all times, in particular during a breakdown of the **machine**. This requirement also applies to a machinery product where the instruction manual is embedded in the software of the machinery product. General principles for the drafting of instructions

#### 1.7.4.1. General principles for the drafting of instructions

- (a) The instructions shall be drafted in one or more official languages of the Union. The words ‘Original instructions’ shall appear on the language version(s) verified by the manufacturer or his or her authorised representative;
- (b) Where no ‘Original instructions’ exist in the official language or languages of the Member State where the machinery product is to be used, a translation into that/those language(s) shall be provided by the manufacturer or his or her authorised representative or by the person bringing the machinery product into the language area in question. The translations shall bear the words ‘Translation of the original instructions’;
- (c) The contents of the instructions shall cover not only the intended use of the machinery product but also take into account any reasonably foreseeable misuse thereof;
- (d) In the case of a machinery product intended for use by non-professional operators, the wording and layout of the instructions for use shall take into account the level of general education and acumen that can reasonably be expected from such operators.

#### 1.7.4.2. Contents of the instructions

1. Each instruction manual shall contain, where applicable, at least the following information:

- (a) the business name and full address of the manufacturer and, where applicable, of his or her authorised representative;
- (b) the designation of the machinery product as marked on the machinery product itself, except for the serial number (see section 1.7.3);
- (c) the EU declaration of conformity, or a document setting out the contents of the EU declaration of conformity, showing the particulars of the machinery product, not necessarily including the serial number and the signature, or the internet address where the EU declaration of conformity can be accessed.
- (d) a general description of the machinery product;
- (e) the drawings, diagrams, descriptions and explanations necessary for the use, maintenance and repair of the machinery product and for checking its correct functioning;
- (f) a description of the workstation(s) likely to be occupied by operators;
- (g) a description of the intended use of the machinery product;
- (h) warnings concerning ways in which the machinery product shall not be used that experience has shown might occur;
- (i) assembly, installation and connection instructions, including drawings, diagrams and the means of attachment and the designation of the chassis or installation on which the machinery product is to be mounted;
- (j) instructions relating to installation and assembly for reducing noise or vibration;
- (k) instructions for the putting into service and use of the machinery product and, if necessary, instructions for the training of operators;
- (l) information about the residual risks that remain despite the inherent safe design measures, safeguarding and complementary protective measures adopted;
- (m) instructions on the protective measures to be taken by the user, including, where appropriate, the personal protective equipment to be provided;

- (n) the essential characteristics of tools, which may be fitted to the machinery product;
- (o) the conditions in which the machinery product meets the requirement of stability during use, transportation, assembly, dismantling when out of service, testing or foreseeable breakdowns;
- (p) instructions with a view to ensuring that transport, handling and storage operations can be made safely, giving the mass of the machinery product and of its various parts where these are regularly to be transported separately;
- (q) the operating method to be followed in the event of accident or breakdown; if a blockage is likely to occur, the operating method to be followed so as to enable the equipment to be safely unblocked;
- (r) the description of the adjustment and maintenance operations that should be carried out by the user and the preventive maintenance measures that should be observed taking account of the design and the use of the machinery product;
- (s) instructions designed to enable adjustment and maintenance to be carried out safely, including the protective measures that should be taken during these operations;
- (t) the specifications of the spare parts to be used, when these affect the health and safety of operators;
- (u) the following information on airborne noise emissions:
  - i. the A-weighted emission sound pressure level at workstations, where this exceeds 70 dB (A); where this level does not exceed 70 dB (A), this fact shall be indicated;
  - ii. the peak C-weighted instantaneous sound pressure value at workstations, where this exceeds 63 Pa (130 dB in relation to 20 µPa);
  - iii. the A-weighted sound power level emitted by the machinery product, where the A-weighted emission sound pressure level at workstations exceeds 80 dB(A).

These values shall be either those actually measured for the machinery product in question or those established on the basis of measurements taken for a technically comparable machinery product, which is representative of the machinery product to be produced.

In the case of a very large machinery product, instead of the A-weighted sound power level, the A-weighted emission sound pressure levels at specified positions around the machinery product may be indicated.

Where the harmonised standards or technical specifications adopted by the Commission in accordance with Article 17(3) cannot be applied, sound levels shall be measured using the most appropriate method for the machinery product. Whenever sound emission values are indicated, the uncertainties surrounding these values shall be specified. The operating conditions of the machinery product during measurement and the measuring methods used shall be described.

Where the workstation(s) are undefined or cannot be defined, A-weighted sound pressure levels shall be measured at a distance of 1 metre from the surface of the machinery product and at a height of 1,6 metres from the floor or access platform. The position and value of the maximum sound pressure shall be indicated.

With respect to noise reduction machinery products, the instructions shall specify, where appropriate, how to correctly assemble and install that equipment (see also section 1.7.4.2(1), point (j)).

Where specific Union legislation lays down other requirements for the measurement of sound pressure levels or sound power levels, those legal acts shall be applied and the corresponding provisions of this section shall not apply;

- (v) where a machinery product is likely to emit non-ionising radiation, which may cause harm to persons, in particular persons with active or non-active implantable medical devices, information concerning the radiation emitted for the operator and exposed persons;
- (w) where the machinery product design allows emissions of hazardous substances from the machinery product, the characteristics of the capturing, filtration or discharge device if such device is not provided with the machinery product, and any of the following:
  - i. the flow rate for the emission of hazardous materials and substances from the machinery product,
  - ii. the concentration of hazardous materials or substances around the machinery product coming from the machinery product or from materials or substances used with the machinery product,
  - iii. the effectiveness of the capturing or filtration device and the conditions to be observed to maintain its effectiveness over time.

The values referred to in the first subparagraph shall either be actually measured for the machinery product in question or established based on measurements in respect of a technically comparable machinery product, which is representative of the state of the art.

#### 1.7.4.3. Sales literature

Sales literature describing the machinery product shall not contradict the instructions as regards health and safety aspects. Sales literature describing the performance characteristics of machinery products shall contain the same information on emissions as is contained in the instructions.

## 2. SUPPLEMENTARY ESSENTIAL HEALTH AND SAFETY REQUIREMENTS FOR CERTAIN CATEGORIES OF MACHINERY PRODUCTS

Foodstuffs **machinery**, **machinery** for cosmetics or pharmaceutical products, hand-held and/or hand-guided **machinery**, portable fixing and other impact **machinery**, **machinery** for working wood and material with similar physical characteristics and **machinery** for pesticide application shall meet all the essential health and safety requirements described in this chapter (see General Principles, point 4).

### 2.1. FOODSTUFFS **MACHINERY** AND **MACHINERY** FOR COSMETICS OR PHARMACEUTICAL PRODUCTS

#### 2.1.1. General

Machinery intended for use with foodstuffs or with cosmetics or pharmaceutical products shall be designed and constructed in such a way as to avoid any risk of infection, sickness or contagion.

The following requirements shall be observed:

- (a) materials in contact with, or intended to come into contact with, foodstuffs or cosmetics or pharmaceutical products shall satisfy the conditions set down in the relevant Union legal acts. The **machinery** shall be designed and constructed in such a way that these materials can be cleaned before each use. Where this is not possible, disposable parts shall be used;
- (b) all surfaces in contact with foodstuffs or cosmetics or pharmaceutical products, other than surfaces of disposable parts, shall:
  - i. be smooth and have neither ridges nor crevices, which could harbour organic materials. The same applies to their joinings;
  - ii. be designed and constructed in such a way as to reduce the projections, edges and recesses of assemblies to a minimum;
  - iii. be easily cleaned and disinfected, where necessary after removing easily dismantled parts; the inside surfaces shall have curves with a radius sufficient to allow thorough cleaning;
- (c) it shall be possible for liquids, gases and aerosols deriving from foodstuffs, cosmetics or pharmaceutical products as well as from cleaning, disinfecting and rinsing fluids to be completely discharged from the **machinery** (if possible, in a 'cleaning' position);
- (d) **machinery** shall be designed and constructed in such a way as to prevent any substances or living creatures, in particular insects, from entering, or any organic matter from accumulating in, areas that cannot be cleaned;
- (e) **machinery** shall be designed and constructed in such a way that no ancillary substances hazardous to health, including the lubricants used, can come into contact with foodstuffs, cosmetics or pharmaceutical products. Where necessary, **machinery** shall be designed and constructed in such a way that continuing compliance with this requirement can be checked.

#### 2.1.2. Instructions

The instructions for foodstuffs **machinery** and **machinery** for use with cosmetics or pharmaceutical products shall indicate recommended products and methods for cleaning, disinfecting and rinsing, not only for easily accessible areas but also for areas to which access is impossible or inadvisable.

### 2.2. PORTABLE HAND-HELD AND/OR HAND-GUIDED **MACHINERY**

#### 2.2.1. General

Portable hand-held and/or hand-guided **machinery** shall:

- (a) depending on the type of **machinery**, have a supporting surface of sufficient size and have a sufficient number of handles and supports of an appropriate size, arranged in such a way as to ensure the stability of the **machinery** under the intended operating conditions;
- (b) except where technically impossible, or where there is an independent control device, in the case of handles which cannot be released in complete safety, be fitted with manual start and stop control devices arranged in such a way that the operator can operate them without releasing the handles;

- (c) present no risks of accidental starting and/or continued operation after the operator has released the handles. Equivalent steps shall be taken if this requirement is not technically feasible;
- (d) permit, where necessary, visual observation of the danger zone and of the action of the tool with the material being processed.
- (e) have a device or a connected exhaust system, with an extraction connection outlet or equivalent system to capture or reduce emissions of hazardous substances. This requirement does not apply where its application would result in the creation of a new risk, where the main function of the **machinery** is the spraying of hazardous substances and to emissions of internal combustion engines. The handles of portable **machinery** shall be designed and constructed in such a way as to make starting and stopping straightforward.

#### 2.2.1.1. Instructions

The instructions shall give the following information concerning vibrations, expressed as acceleration ( $m/s^2$ ), and transmitted by portable handheld and hand-guided **machinery**:

- (a) the vibration total value from continuous vibrations to which the hand-arm system is subjected;
- (b) the mean value of the peak amplitude of the acceleration from repeated shock vibrations, to which the hand-arm system is subjected;
- (c) the uncertainty of both measurements.

The values referred to in the first subparagraph shall either be those actually measured for the **machinery** in question or those established on the basis of measurements in respect of a technically comparable machinery product, which is representative of the state of the art.

If harmonised standards or technical specifications adopted by the Commission in accordance with Article 17(3) cannot be applied, the vibration data shall be measured using the most appropriate measurement code for the **machinery**.

The operating conditions during measurement and the methods used for measurement, or the reference of the harmonised standard applied, shall be specified.

### 2.2.2. Portable fixing and other impact **machinery**

#### 2.2.2.1. General

Portable fixing and other impact **machinery** shall be designed and constructed in such a way that:

- (a) energy is transmitted to the impacted element by the intermediary component that does not leave the device;
- (b) an enabling device prevents impact unless the **machinery** is positioned correctly with adequate pressure on the base material;
- (c) involuntary triggering is prevented; where necessary, an appropriate sequence of actions on the enabling device and the control device shall be required to trigger an impact;
- (d) accidental triggering is prevented during handling or in case of shock;
- (e) loading and unloading operations can be carried out easily and safely.

Where necessary, it shall be possible to fit the device with splinter guard(s) and the appropriate guard(s) shall be provided by the manufacturer of the **machinery**.

#### 2.2.2.2. Instructions

The instructions shall give the necessary information regarding:

- (a) the accessories and interchangeable equipment that can be used with the **machinery**;
- (b) the suitable fixing or other impacted elements to be used with the **machinery**;
- (c) where appropriate, the suitable cartridges to be used.

### 23. **MACHINERY FOR WORKING WOOD AND MATERIAL WITH SIMILAR PHYSICAL CHARACTERISTICS**

Machinery for working wood and materials with similar physical characteristics shall comply with the following requirements:

- (a) the **machinery** shall be designed, constructed or equipped in such a way that the piece being machined can be placed and guided in safety; where the piece is hand-held on a work-bench, the latter shall be sufficiently stable during the work and shall not impede the movement of the piece;
- (b) where the **machinery** is likely to be used in conditions involving the risk of ejection of work pieces or parts of them, it shall be designed, constructed, or equipped in such a way as to prevent such ejection, or, if this is not possible, so that the ejection does not engender risks for the operator and/or exposed persons;
- (c) the **machinery** shall be equipped with an automatic brake that stops the tool in a sufficiently short time if there is a risk of contact with the tool whilst it runs down;
- (d) where the tool is incorporated into a non-fully automated **machine**, the latter shall be designed and constructed in such a way as to eliminate or reduce the risk of accidental injury.

### 24. **MACHINERY FOR PLANT PROTECTION PRODUCTS APPLICATION**

#### 2.4.1. Definition

‘Machinery for plant protection products application’ means **machinery** specifically intended for the application of plant protection products within the meaning of Article 2, point (1), of Regulation (EC) No 1107/2009 of the European Parliament and of the Council<sup>2</sup>.

#### 2.4.2. General

The manufacturer of **machinery** for pesticide application or his or her authorised representative shall ensure that an assessment is carried out of the risks of unintended exposure of the environment to pesticides, in accordance with the process of risk assessment and risk reduction referred to in the General Principles, point 1.

<sup>2</sup> Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC (OJ L 309, 24.11.2009, p. 1).

Machinery for pesticide application shall be designed and constructed taking into account the results of the risk assessment referred to in the first subparagraph so that the machinery can be operated, adjusted and maintained without unintended exposure of the environment to pesticides.

Leakage shall be prevented at all times.

#### 2.4.3. Controls and monitoring

It shall be possible to easily and accurately control, monitor and immediately stop the pesticide application from the operating positions.

#### 2.4.4. Filling and emptying

The machinery shall be designed and constructed to facilitate precise filling with the necessary quantity of pesticide and to ensure easy and complete emptying, while preventing spillage of pesticide and avoiding the contamination of the water source during such operations.

#### 2.4.5. Application of pesticides

##### 2.4.5.1. Application rate

The machinery shall be fitted with means of adjusting the application rate easily, accurately and reliably.

##### 2.4.5.2. Distribution, deposition and drift of pesticide

The machinery shall be designed and constructed to ensure that pesticide is deposited on target areas, to minimise losses to other areas and to prevent drift of pesticide to the environment. Where appropriate, an even distribution and homogeneous deposition shall be ensured.

##### 2.4.5.3. Tests

In order to verify that the relevant parts of the machinery comply with the requirements set out in sections 2.4.5.1 and 2.4.5.2 the manufacturer or his or her authorised representative shall, for each type of machinery concerned, perform appropriate tests, or have such tests performed.

##### 2.4.5.4. Losses during stoppage

The machinery shall be designed and constructed to prevent losses while the pesticide application function is stopped.

#### 2.4.6. Maintenance

##### 2.4.6.1. Cleaning

The machinery shall be designed and constructed to allow its easy and thorough cleaning without contamination of the environment.

##### 2.4.6.2. Servicing

The machinery shall be designed and constructed to facilitate the changing of worn parts without contamination of the environment.

#### 2.4.7. Inspections

It shall be possible to easily connect the necessary measuring instruments to the machinery to check the correct functioning of the machinery.

#### 2.4.8. Marking of nozzles, strainers and filters

Nozzles, strainers and filters shall be marked so that their type and size can be clearly identified.

#### 2.4.9. Indication of pesticide in use

Where appropriate, the **machinery** shall be fitted with a specific mounting on which the operator can place the name of the pesticide in use.

#### 2.4.10. Instructions

The instructions shall provide the following information:

- (a) precautions to be taken during mixing, loading, application, emptying, cleaning, servicing and transport operations in order to avoid contamination of the environment;
- (b) detailed conditions of use for the different operating environments envisaged, including the corresponding preparation and adjustments required to ensure the deposition of pesticide on target areas while minimising losses to other areas, to prevent drift to the environment and, where appropriate, to ensure an even distribution and homogeneous deposition of pesticide;
- (c) the range of types and sizes of nozzles, strainers and filters that can be used with the **machinery**;
- (d) the frequency of checks and the criteria and method for the replacement of parts subject to wear that affect the correct functioning of the **machinery**, such as nozzles, strainers and filters;
- (e) specification of calibration, daily maintenance, winter preparation and other checks necessary to ensure the correct functioning of the **machinery**;
- (f) types of pesticides that may cause incorrect functioning of the **machinery**;
- (g) an indication that the operator should keep updated the name of the pesticide in use on the specific mounting referred to in section 2.4.9;
- (h) the connexion and use of any special equipment or accessories, and the necessary precautions to be taken;
- (i) an indication that the **machinery** may be subject to national requirements for regular inspection by designated bodies, as provided for in Directive 2009/128/EC of the European Parliament and of the Council<sup>3</sup>;
- (j) the features of the **machinery**, which shall be inspected to ensure its correct functioning;
- (k) instructions for connecting the necessary measuring instruments.

<sup>3</sup> Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides (OJ L 309, 24.11.2009, p. 71).

### 3. SUPPLEMENTARY ESSENTIAL HEALTH AND SAFETY REQUIREMENTS TO OFFSET RISKS DUE TO THE MOBILITY OF MACHINERY

Machinery presenting risks due to its mobility shall meet all the essential health and safety requirements described in this chapter (see General Principles, point 4).

#### 3.1. GENERAL

##### 3.1.1. Definitions

- (a) ‘Machinery presenting risks due to its mobility’ means
- i. machinery the operation of which requires either mobility while working, or continuous or semi continuous movement between a succession of fixed working locations, or
  - ii. machinery which is operated without being moved, but which may be equipped in such a way as to enable it to be moved more easily from one place to another.
- (b) ‘Driver’ means a person responsible for the movement of a machine, who may be transported by the machinery or may be on foot, accompanying the machinery, or may guide the machinery by remote control or may remotely supervise the autonomous mobile machinery product regardless of the distance and the means of control communication.
- (c) ‘Autonomous mobile machinery’ means a mobile machinery that has an autonomous mode, in which all the essential safety functions of the mobile machinery are ensured in its travel and working operations area without permanent interaction of an operator.

#### 3.2. WORK POSITIONS

##### 3.2.1. Driving position

Visibility from the driving position shall be such that the driver can, in complete safety for himself or herself and the exposed persons operate the machinery and its tools in their foreseeable conditions of use. Where necessary, appropriate devices shall be provided to remedy risks due to inadequate direct vision.

Machinery on which the driver is transported shall be designed and constructed in such a way that, from the driving positions, there is no risk to the driver from inadvertent contact with the wheels and tracks.

The driving position of ride-on drivers shall be designed and constructed in such a way that a driver's cab may be fitted, provided this does not increase the risk and there is room for it. The cab shall incorporate a place for the instructions needed for the driver.

##### 3.2.2. Seating

Where there is a risk that operators or other persons transported by the machinery may be crushed between parts of the machinery and the surroundings should the machinery roll or tip over, in particular for machinery equipped with a protective structure referred to in section 3.4.3 or 3.4.4, the machinery shall be designed or equipped with a restraint system so as to keep the persons in their seats or in the protective structure, without restricting movements necessary for operations or movements relative to the structure caused by the suspension of the seats. Such restraint systems or provision shall not be fitted if they increase the risk.

A visual or audible signal shall be provided at the driving position alerting the driver when the restraint system is not active.

### 3.2.3. Positions for other persons

If the conditions of use provide that persons other than the driver may occasionally or regularly be transported by the **machinery** or work on it, appropriate positions shall be provided which enable them to be transported or to work on it without risk.

The second and third subparagraphs of section 3.2.1 also apply to the places provided for persons other than the driver.

### 3.2.4. Supervisory control function

Autonomous mobile machinery products shall have a supervisory control function specific to the autonomous mode. This function shall allow the operator to remotely receive information from the **machine**. The supervisory control function shall only allow actions to stop and to start remotely the **machine**. It shall be designed and constructed to allow those actions only when the driver can see directly or indirectly the **machine's** movement and working area and the protective devices are operational.

The information the driver receives from the **machine** when the supervisory control function is active shall enable the driver to have a complete and accurate view of the operation, movement and safe positioning of the **machine** in its travel and working area.

This information shall alert the driver of the occurrence of unforeseen or dangerous situations present or impending, which require driver's intervention.

If the supervisory control function is not active, the **machinery** shall not be able to operate.

## 3.3. CONTROL SYSTEMS

If necessary, steps shall be taken to prevent unauthorised use of controls.

In the case of remote controls, each control unit shall clearly identify the **machinery** to be controlled from that unit.

The remote control system shall be designed and constructed in such a way as to affect only:

- (a) the **machinery** in question;
- (b) the functions in question.

Remote controlled **machinery** shall be designed and constructed in such a way that it will respond only to signals from the intended control units.

### 3.3.1. Control devices

The driver shall be able to actuate all control devices required to operate the **machinery** from the driving position, except for functions, which can be safely actuated only by using control devices located elsewhere. These functions include, in particular, those for which operators other than the driver are responsible or for which the driver has to leave the driving position in order to control them safely.

Where there are pedals, they shall be so designed, constructed and fitted as to allow safe operation by the driver with the minimum risk of incorrect operation. They shall have a slip-resistant surface and be easy to clean.

Where their operation can lead to hazards, notably dangerous movements, the control devices, except for those with pre-set positions, shall return to the neutral position as soon as they are released by the operator.

In the case of wheeled **machinery**, the steering system shall be designed and constructed in such a way as to reduce the force of sudden movements of the steering wheel or the steering lever caused by shocks to the guide wheels.

Any control that locks the differential shall be so designed and arranged that it allows the differential to be unlocked when the **machinery** is moving.

The sixth paragraph of section 1.2.2, concerning acoustic and/or visual warning signals, applies only in the case of reversing.

### 3.3.2. Starting/moving

All travel movements of self-propelled **machinery** with a ride-on driver shall be possible only if the driver is at the controls.

Where, for operating purposes, **machinery** is fitted with devices which exceed its normal clearance zone (e.g. stabilisers, jib, etc.), the driver shall be provided with the means of checking easily, before moving the **machinery**, that such devices are in a particular position which allows safe movement.

This also applies to all other parts which; to allow safe movement, have to be in particular positions, locked if necessary.

Where it does not give rise to other risks, movement of the **machinery** shall depend on safe positioning of the aforementioned parts.

It shall not be possible for unintentional movement of the **machinery** to occur while the engine is being started.

The movement of an autonomous mobile machinery product shall take into account the risks related to the area where it is intended to move and work.

### 3.3.3. Travelling function

Without prejudice to road traffic regulations, self-propelled **machinery** and its trailers shall meet the requirements for slowing down, stopping, braking and immobilisation so as to ensure safety under all the operating, load, speed, ground and gradient conditions allowed for.

The driver shall be able to slow down and stop self-propelled **machinery** by means of a main device. Where safety so requires, in the event of a failure of the main device, or in the absence of the energy supply needed to actuate the main device, an emergency device with a fully independent and easily accessible control device shall be provided for slowing down and stopping.

Where safety so requires, a parking device shall be provided to render stationary **machinery** immobile. This device may be combined with one of the devices referred to in the second paragraph, if it is purely mechanical.

Remote-controlled **machinery** shall be equipped with devices for stopping operation automatically and immediately and for preventing potentially dangerous operation in the following situations:

- (a) if the driver loses control;
- (b) if it receives a stop signal;
- (c) if a fault is detected in a safety-related part of the system;
- (d) if no validation signal is detected within a specified time.

Section 1.2.4 does not apply to the travelling function.

Autonomous mobile machinery products shall comply with any of the following conditions:

- (a) it shall move and operate in an enclosed zone fitted with a peripheral protection system comprising guards or protective devices;
- (b) it shall be equipped with devices intended to detect any human, domestic animal or any other obstacle in its vicinity, where those obstacles could give rise to a risk to health and safety of persons or of domestic animals or to safe operation of the machinery product.

The movements of mobile machinery products connected with one or more trailers or towed equipment, including autonomous mobile machinery products, connected with one or more trailers or towed equipment, shall not give rise to risks for persons, domestic animals or any other obstacle in the danger zone of such machinery products and trailers or towed equipment.

#### 3.3.4. Movement of pedestrian-controlled machinery

Movement of pedestrian-controlled self-propelled machinery shall be possible only through sustained action on the relevant control device by the driver. In particular, it shall not be possible for movement to occur while the engine is being started. The control systems for pedestrian-controlled machinery shall be designed in such a way as to minimise the risks arising from inadvertent movement of the machine towards the driver, in particular:

- (a) Crushing;
- (b) injury from rotating tools.

The speed of travel of the machinery shall be compatible with the pace of a driver on foot.

In the case of machinery on which a rotary tool may be fitted, it shall not be possible to actuate the tool when the reverse control is engaged, except where the movement of the machinery results from movement of the tool. In the latter case, the reversing speed shall be such that it does not endanger the driver.

#### 3.3.5. Control circuit failure

A failure in the power supply to the power-assisted steering, where fitted, shall not prevent machinery from being steered during the time required to stop it.

For autonomous mobile machinery, a failure in the steering system shall not have an impact on the safety of the machinery.

### 3.4. PROTECTION AGAINST MECHANICAL RISKS

#### 3.4.1. Uncontrolled movements

A machinery product shall be designed, constructed and where appropriate placed on its mobile support in such a way as to ensure that, when moved, uncontrolled oscillations of its centre of gravity do not affect its stability or exert excessive strain on its structure.

#### 3.4.2. Moving transmission parts

By way of exception to section 1.3.8.1, in the case of engines, moveable guards preventing access to the moving parts in the engine compartment need not have interlocking devices if they have to be opened either by the use of a tool or key or by a control located in the driving position, providing the latter is in a fully enclosed cab with a lock to prevent unauthorised access.

### 3.4.3. Roll-over and tip-over

Where, in the case of self-propelled machinery with a ride-on driver, operator(s) or other person(s), there is a risk of rolling or tipping over, the machinery shall be fitted with an appropriate protective structure, unless this increases the risk.

This structure shall be such that in the event of rolling or tipping over it affords the ride-on person(s) an adequate deflection-limiting volume.

In order to verify that the structure complies with the requirement laid down in the second paragraph, the manufacturer or his or her authorised representative shall, for each type of structure concerned, perform appropriate tests or have such tests performed.

### 3.4.4. Falling objects

Where, in the case of self-propelled machinery with a ride-on driver, operator(s) or other person(s), there is a risk due to falling objects or material, the machinery shall be designed and constructed in such a way as to take account of this risk and fitted, if its size allows, with an appropriate protective structure.

This structure shall be such that, in the event of falling objects or material, it guarantees the ride-on person(s) an adequate deflection-limiting volume.

In order to verify that the structure complies with the requirement laid down in the second paragraph, the manufacturer or his or her authorised representative shall, for each type of structure concerned, perform appropriate tests or have such tests performed.

### 3.4.5. Means of access

Handholds and steps shall be designed, constructed and arranged in such a way that the operators use them instinctively and do not use the control devices to assist access.

### 3.4.6. Towing devices

All machinery used to tow or to be towed shall be fitted with towing or coupling devices designed, constructed and arranged in such a way as to ensure easy and secure connection and disconnection and to prevent accidental disconnection during use.

Insofar as the tow bar load so requires, such machinery shall be equipped with a support with a bearing surface suited to the load and the ground.

### 3.4.7. Transmission of power between self-propelled machinery (or tractor) and recipient machinery

Removable mechanical transmission devices linking self-propelled machinery (or a tractor) to the first fixed bearing of recipient machinery shall be designed and constructed in such a way that any part that moves during operation is protected over its whole length.

On the side of the self-propelled machinery (or tractor), the power take-off to which the removable mechanical transmission device is attached shall be protected either by a guard fixed and linked to the self-propelled machinery (or tractor) or by any other device offering equivalent protection.

It shall be possible to open this guard for access to the removable transmission device. Once it is in place, there shall be enough room to prevent the drive shaft damaging the guard when the machinery (or the tractor) is moving.

On the recipient machinery side, the input shaft shall be enclosed in a protective casing fixed to the machinery.

Torque limiters or freewheels may be fitted to universal joint transmissions only on the side adjoining the driven **machinery**. The removable mechanical transmission device shall be marked accordingly.

All recipient **machinery**, the operation of which requires a removable mechanical transmission device to connect it to self-propelled **machinery** (or a tractor), shall have a system for attaching the removable mechanical transmission device so that, when the **machinery** is uncoupled, the removable mechanical transmission device and its guard are not damaged by contact with the ground or part of the **machinery**.

The outside parts of the guard shall be so designed, constructed and arranged that they cannot turn with the removable mechanical transmission device. The guard shall cover the transmission to the ends of the inner jaws in the case of simple universal joints and at least to the centre of the outer joint or joints in the case of wide-angle universal joints.

If means of access to working positions are provided near to the removable mechanical transmission device, they shall be designed and constructed in such a way that the shaft guards cannot be used as steps, unless designed and constructed for that purpose.

### 3.5. PROTECTION AGAINST OTHER RISKS

#### 3.5.1. Batteries

The battery housing shall be designed and constructed in such a way as to prevent the electrolyte being ejected on to the operator in the event of rollover or tip over and to avoid the accumulation of vapours in places occupied by operators.

A machinery product shall be designed and constructed in such a way that the battery can be disconnected with the aid of an easily accessible device provided for that purpose.

The batteries with automatic charging for mobile **machinery**, including autonomous mobile machinery products, shall be designed to prevent hazards referred to in sections 1.3.8.2. and 1.5.1., including the risks of contact or collusion of the **machine** with a person or another **machine** when the **machine** moves autonomously to the charging station.

#### 3.5.2. Fire

Depending on the hazards anticipated by the manufacturer, **machinery** shall, where its size permits:

- (a) either allow easily accessible fire extinguishers to be fitted, or
- (b) be provided with built-in extinguisher systems.

#### 3.5.3. Emissions of hazardous substances

The second and third paragraphs of section 1.5.13 do not apply where the main function of the **machinery** is the spraying of products. However, the operator shall be protected against the risk of exposure to such hazardous emissions.

Ride-on mobile **machinery** having spraying of products as the main function shall be equipped with filtration cabs or equivalent safety measures.

#### 3.5.4. Risk of contact with live overhead power lines

Depending on the height of the machinery products, mobile machinery product shall, where relevant, be designed, constructed and equipped, so as to prevent the risk of contact with an energised overhead power line or the risk of creating an electric arc between any part of the **machinery** or an operator driving the **machinery** and an energised overhead power line.

When the risk of contact or electric arc with an energised overhead power line cannot be fully avoided, mobile machinery products shall be designed, constructed and equipped in such a way that all hazards of an electrical nature are prevented or can be prevented in the event of contact or electrical arc with an energized power line.

### 3.6. INFORMATION AND INDICATIONS

#### 3.6.1. Signs, signals and warnings

All machinery products shall have signs and/or instruction plates concerning use, adjustment and maintenance, wherever necessary, so as to ensure the health and safety of persons. They shall be chosen, designed and constructed in such a way as to be clearly visible and indelible.

Without prejudice to the provisions of road traffic regulations, machinery product with a ride-on driver shall have the following equipment:

- (a) an acoustic warning device to alert persons;
- (b) a system of light signals relevant to the intended conditions of use; the latter requirement does not apply to machinery product intended solely for underground working and having no electrical power;
- (c) where necessary, there shall be an appropriate connection between a trailer and the machinery product for the operation of signals.

Remote-controlled **machinery** which, under normal conditions of use, exposes persons to the risk of impact or crushing shall be fitted with appropriate means to signal its movements or with means to protect persons against such risks. The same applies to machinery product, which involves, when in use, the constant repetition of a forward and backward movement on a single axis where the area to the rear of the **machine** is not directly visible to the driver.

Machinery shall be constructed in such a way that the warning and signalling devices cannot be disabled unintentionally. Where it is essential for safety, such devices shall be provided with the means to check that they are in good working order and their failure shall be made apparent to the operator.

Where the movement of **machinery** or its tools is particularly hazardous, signs on the **machinery** shall be provided to warn against approaching the **machinery** while it is working; the signs shall be legible at a sufficient distance to ensure the safety of persons who have to be in the vicinity.

#### 3.6.2. Marking

The following shall be shown legibly and indelibly on all machinery products:

- (a) nominal power expressed in kilowatts (kW);
- (b) mass of the most usual configuration, in kilograms (kg);

and, where appropriate:

- (a) maximum drawbar pull provided for at the coupling hook, in Newtons (N);
- (b) maximum vertical load provided for on the coupling hook, in Newtons (N).

#### 3.6.3. Instructions

### 3.6.3.1. Vibrations

The instructions shall give the following information concerning vibrations, expressed as acceleration ( $\text{m/s}^2$ ), transmitted by the **machinery** to the hand-arm system or to the whole body:

- (a) the vibration total value from continuous vibrations to which the hand-arm system is subjected;
- (b) the mean value of the peak amplitude of the acceleration from repeated shock vibrations, to which the hand-arm system is subjected;
- (c) the highest root mean square value of weighted acceleration to which the whole body is subjected, if it exceeds 0,5  $\text{m/s}^2$ . Where this value does not exceed 0,5  $\text{m/s}^2$ , this shall be mentioned;
- (d) the uncertainty of measurements.

These values shall be either those actually measured for the **machinery** in question or those established on the basis of measurements taken for technically comparable **machinery**, which is representative of the **machinery** to be produced.

Where harmonised standards or technical specifications adopted by the Commission in accordance with Article 17(3) cannot be applied, the vibration shall be measured using the most appropriate measurement code for the **machinery** concerned.

The operating conditions during measurement and the measurement codes used shall be described.

### 3.6.3.2. Multiple uses

The instructions for a machinery product allowing several uses depending on the equipment used and the instructions for the interchangeable equipment shall contain the information necessary for safe assembly and use of the basic machinery product and the interchangeable equipment that can be fitted.

### 3.6.3.3. Autonomous mobile machinery products

The instructions for use of autonomous mobile machinery products shall specify the characteristics of its intended travel, working areas and danger zones.

## 4. SUPPLEMENTARY ESSENTIAL HEALTH AND SAFETY REQUIREMENTS TO OFFSET HAZARDS DUE TO LIFTING OPERATIONS

**Machinery** presenting hazards due to lifting operations shall meet all the relevant essential health and safety requirements described in this chapter (see General Principles, point 4).

### 4.1. GENERAL

#### 4.1.1. Definitions

- (a) 'Lifting operation' means a movement of unit loads consisting of goods and/or persons necessitating, at a given moment, a change of level;
- (b) 'Guided load' means a load where the total movement is made along rigid or flexible guides whose position is determined by fixed points;
- (c) 'Working coefficient' means the arithmetic ratio between the load guaranteed by the manufacturer or his or her authorised representative up to which a component is able to hold it and the maximum working load marked on the component;

- (d) 'Test coefficient' means the arithmetic ratio between the load used to carry out the static or dynamic tests on lifting **machinery** or a lifting accessory and the maximum working load marked on the lifting **machinery** or lifting accessory;
- (e) 'Static test' means the test during which lifting **machinery** or a lifting accessory is first inspected and subjected to a force corresponding to the maximum working load multiplied by the appropriate static test coefficient and then re-inspected once the said load has been released to ensure that no damage has occurred;
- (f) 'Dynamic test' means the test during which lifting **machinery** is operated in all its possible configurations at the maximum working load multiplied by the appropriate dynamic test coefficient with account being taken of the dynamic behaviour of the lifting **machinery** in order to check that it functions properly;
- (g) 'Carrier' means a part of the **machinery** on or in which persons and/or goods are supported in order to be lifted.

#### 4.1.2. Protection against mechanical risks

##### 4.1.2.1. Risks due to lack of stability

Machinery shall be designed and constructed in such a way that the stability required by section 1.3.1 is maintained both in service and out of service, including all stages of transportation, assembly and dismantling, during foreseeable component failures and also during the tests carried out in accordance with the instruction handbook. To that end, the manufacturer or his or her authorised representative shall use the appropriate verification methods.

##### 4.1.2.2. Machinery running on guide rails and rail tracks

Machinery shall be provided with devices, which act on the guide rails or tracks to prevent derailment.

If, despite such devices, there remains a risk of derailment or of failure of a rail or of a running component, devices shall be provided which prevent the equipment, component or load from falling or the **machinery** from overturning.

##### 4.1.2.3. Mechanical strength

**Machinery**, lifting accessories and their components shall be capable of withstanding the stresses to which they are subjected during their lifetime, both in and, where applicable, out of use, under the installation and operating conditions provided for and in all relevant configurations, with due regard, where appropriate, to the effects of atmospheric factors and forces exerted by persons. This requirement shall also be satisfied during transport, assembly and dismantling.

Machinery and lifting accessories shall be designed and constructed in such a way as to prevent failure from fatigue and wear, taking due account of their intended use.

The materials used shall be chosen on the basis of the intended working environments, with particular regard to corrosion, abrasion, impacts, extreme temperatures, fatigue, brittleness, radiation and ageing.

Machinery and lifting accessories shall be designed and constructed in such a way as to withstand the overload in the static tests without permanent deformation or patent defect. Strength calculations shall take account of the value of the static test coefficient chosen to guarantee an adequate level of safety. That coefficient has, as a general rule, the following values:

- (a) manually-operated machinery and lifting accessories: 1,5;
- (b) other machinery: 1,25.

Machinery shall be designed and constructed in such a way as to undergo, without failure, the dynamic tests carried out using the maximum working load multiplied by the dynamic test coefficient. This dynamic test coefficient is chosen so as to guarantee an adequate level of safety: the coefficient is, as a general rule, equal to 1,1. As a general rule, the tests will be performed at the nominal speeds provided for. Should the control circuit of the machinery allow for a number of simultaneous movements, the tests shall be carried out under the least favourable conditions, as a general rule by combining the movements concerned.

#### 4.1.2.4. Pulleys, drums, wheels, ropes and chains

Pulleys, drums and wheels shall have a diameter commensurate with the size of the ropes or chains with which they can be fitted.

Drums and wheels shall be designed, constructed and installed in such a way that the ropes or chains with which they are equipped can be wound without coming off.

Ropes used directly for lifting or supporting the load shall not include any splicing other than at their ends. Splicings are, however, tolerated in installations, which are intended by design to be modified regularly according to needs of use.

Complete ropes and their endings shall have a working coefficient chosen in such a way as to guarantee an adequate level of safety. As a general rule, this coefficient is equal to 5.

Lifting chains shall have a working coefficient chosen in such a way as to guarantee an adequate level of safety. As a general rule, this coefficient is equal to 4.

In order to verify that an adequate working coefficient has been attained, the manufacturer or his or her authorised representative shall, for each type of chain and rope used directly for lifting the load and for the rope ends, perform the appropriate tests or have such tests performed.

#### 4.1.2.5. Lifting accessories and their components

Lifting accessories and their components shall be sized with due regard to fatigue and ageing processes for a number of operating cycles consistent with their expected life-span as specified in the operating conditions for a given application.

Moreover:

- (a) the working coefficient of wire-rope/rope-end combinations shall be chosen in such a way as to guarantee an adequate level of safety; this coefficient is, as a general rule, equal to 5. Ropes shall not comprise any splices or loops other than at their ends;
- (b) where chains with welded links are used, they shall be of the short-link type. The working coefficient of chains shall be chosen in such a way as to guarantee an adequate level of safety; this coefficient is, as a general rule, equal to 4;
- (c) the working coefficient for textile ropes, slings or webbing is dependent on the material, method of manufacture, dimensions and use. This coefficient shall be chosen in such a way as to guarantee an adequate level of safety; it is, as a general

rule, equal to 7, provided the materials used are shown to be of very good quality and the method of manufacture is appropriate to the intended use. Should this not be the case, the coefficient is, as a general rule, set at a higher level in order to secure an equivalent level of safety. Textile ropes, slings or webbings shall not include any knots, connections or splicing other than at the ends of the sling, except in the case of an endless sling;

- (d) all metallic components making up, or used with, a sling shall have a working coefficient chosen in such a way as to guarantee an adequate level of safety; this coefficient is, as a general rule, equal to 4;
- (e) the maximum working load of a multilegged sling is determined on the basis of the working coefficient of the weakest leg, the number of legs and a reduction factor which depends on the slinging configuration;
- (f) in order to verify that an adequate working coefficient has been attained, the manufacturer or his or her authorised representative shall, for each type of component referred to in (a), (b), (c) and (d), perform the appropriate tests or have such tests performed.

#### 4.1.2.6. Control of movements

Devices for controlling movements shall act in such a way that the **machinery** on which they are installed is kept safe.

- (a) Machinery shall be designed and constructed or fitted with devices in such a way that the amplitude of movement of its components is kept within the specified limits. The operation of such devices shall, where appropriate, be preceded by a warning.
- (b) Where several fixed or rail-mounted **machine** products can be manoeuvred simultaneously in the same place, with risks of collision, such **machinery** shall be designed and constructed in such a way as to make it possible to fit systems enabling these risks to be avoided.
- (c) Machinery shall be designed and constructed in such a way that the loads cannot creep dangerously or fall freely and unexpectedly, even in the event of partial or total failure of the power supply or when the operator stops operating the **machine**.
- (d) It shall not be possible, under normal operating conditions, to lower the load solely by friction brake, except in the case of **machinery** whose function requires it to operate in that way.
- (e) Holding devices shall be designed and constructed in such a way that inadvertent dropping of the loads is avoided.

#### 4.1.2.7. Movements of loads during handling

The operating position of **machinery** shall be located in such a way as to ensure the widest possible view of trajectories of the moving parts, in order to avoid possible collisions with persons, equipment or other **machinery**, which might be manoeuvring at the same time and liable to constitute a hazard.

Machinery with guided loads shall be designed and constructed in such a way as to prevent persons from being injured by movement of the load, the carrier or the counterweights, if any.

#### 4.1.2.8. Machinery serving fixed landings

##### 4.1.2.8.1. *Movements of the carrier*

The movement of the carrier of **machinery** serving fixed landings shall be rigidly guided to and at the landings. Scissor systems are also regarded as rigid guidance.

#### 4.1.2.8.2. Access to the carrier

Where persons have access to the carrier, the **machinery** shall be designed and constructed in such a way as to ensure that the carrier remains stationary during access, in particular while it is being loaded or unloaded.

The **machinery** shall be designed and constructed in such a way as to ensure that the difference in level between the carrier and the landing being served does not create a risk of tripping.

#### 4.1.2.8.3. Risks due to contact with the moving carrier

Where necessary in order to fulfil the requirement expressed in the second paragraph of section 4.1.2.7, the travel zone shall be rendered inaccessible during normal operation.

When, during inspection or maintenance, there is a risk that persons situated under or above the carrier may be crushed between the carrier and any fixed parts, sufficient free space shall be provided either by means of physical refuges or by means of mechanical devices blocking the movement of the carrier.

#### 4.1.2.8.4. Risk due to the load falling off the carrier

Where there is a risk due to the load falling off the carrier, the **machinery** shall be designed and constructed in such a way as to prevent this risk.

#### 4.1.2.8.5. Landings

Risks due to contact of persons at landings with the moving carrier or other moving parts shall be prevented.

Where there is a risk due to persons falling into the travel zone when the carrier is not present at the landings, guards shall be fitted in order to prevent this risk. Such guards shall not open in the direction of the travel zone. They shall be fitted with an interlocking device controlled by the position of the carrier that prevents:

- (a) hazardous movements of the carrier until the guards are closed and locked;
- (b) hazardous opening of a guard until the carrier has stopped at the corresponding landing.

#### 4.1.3. Fitness for purpose

When lifting **machinery** or lifting accessories are placed on the market or are first put into service, the manufacturer or his or her authorised representative shall ensure, by taking appropriate measures or having them taken, that the **machinery** or the lifting accessories which are ready for use — whether manually or power-operated — can fulfil their specified functions safely.

The static and dynamic tests referred to in section 4.1.2.3 shall be performed on all lifting **machinery** ready to be put into service.

Where the **machinery** cannot be assembled in the manufacturer's premises or in the premises of his or her authorised representative, the appropriate measures shall be taken at the place of use by the manufacturer, or by his or her authorised representative or by another subject on the manufacturers' behalf. Otherwise, the measures may be taken either in the manufacturer's premises or at the place of use.

## 42. REQUIREMENTS FOR MACHINERY PRODUCTS WHOSE POWER SOURCE IS OTHER THAN MANUAL EFFORT

### 4.2.1. Control of movements

Hold-to-run control devices shall be used to control the movements of the **machinery** or its equipment. However, for partial or complete movements in which there is no risk of the load or the **machinery** colliding, the said devices may be replaced by control devices authorising automatic stops at pre-selected positions without the operator holding a hold-to-run control device.

### 4.2.2. Loading control

Machinery with a maximum working load of not less than 1 000 kilograms or an overturning moment of not less than 40 000 Nm shall be fitted with devices to warn the driver and prevent dangerous movements in the event:

- (a) of overloading, either as a result of the maximum working load or the maximum working moment due to the load being exceeded, or
- (b) of the overturning moment being exceeded.

### 4.2.3. Installations guided by ropes

Rope carriers, tractors or tractor carriers shall be held by counterweights or by a device allowing permanent control of the tension.

## 43. INFORMATION AND MARKINGS

### 4.3.1. Chains, ropes and webbing

Each length of lifting chain, rope or webbing not forming part of an assembly shall bear a mark or, where this is not possible, a plate or irremovable ring bearing the name and address of the manufacturer or his or her authorised representative and the identifying reference of the relevant certificate.

The certificate mentioned above shall show at least the following information:

- (a) the name and address of the manufacturer and, if appropriate, his or her authorised representative;
- (b) a description of the chain or rope, which includes:
  - i. its nominal size,
  - ii. its construction,
  - iii. the material from which it is made, and
  - iv. any special metallurgical treatment applied to the material;
- (c) the test method used;
- (d) the maximum load to which the chain or rope should be subjected in service. A range of values may be given on the basis of the intended applications.

#### 4.3.2. Lifting accessories

Lifting accessories shall show the following particulars:

- i. identification of the material where this information is needed for safe use;
- ii. the maximum working load.

In the case of lifting accessories on which marking is physically impossible, the particulars referred to in the first paragraph shall be displayed on a plate or other equivalent means and securely affixed to the accessory.

The particulars shall be legible and located in a place where they are not liable to disappear as a result of wear or jeopardise the strength of the accessory.

#### 4.3.3. Lifting machinery

The maximum working load shall be prominently marked on the **machinery**. This marking shall be legible, indelible and in an un-coded form.

Where the maximum working load depends on the configuration of the **machinery**, each operating position shall be provided with a load plate indicating, preferably in diagrammatic form or by means of tables, the working load permitted for each configuration.

Machinery intended for lifting goods only, equipped with a carrier, which allows access to persons, shall bear a clear and indelible warning prohibiting the lifting of persons. This warning shall be visible at each place where access is possible.

### 44. INSTRUCTIONS

#### 4.4.1. Lifting accessories

Each lifting accessory or each commercially indivisible batch of lifting accessories shall be accompanied by instructions setting out at least the following particulars:

- (a) the intended use;
- (b) the limits of use (particularly for lifting accessories such as magnetic or vacuum pads which do not fully comply with section 4.1.2.6(e));
- (c) instructions for assembly, use and maintenance;
- (d) the static test coefficient used.

#### 4.4.2. Lifting machinery

Lifting **machinery** shall be accompanied by instructions containing information on:

- (a) the technical characteristics of the **machinery**, and in particular:
  - i. the maximum working load and, where appropriate, a copy of the load plate or load table described in the second paragraph of section 4.3.3,
  - ii. the reactions at the supports or anchors and, where appropriate, characteristics of the tracks,
  - iii. where appropriate, the definition and the means of installation of the ballast;
- (b) the contents of the logbook, if the latter is not supplied with the **machinery**;
- (c) advice for use, particularly to offset the lack of direct vision of the load by the operator;

- (d) where appropriate, a test report detailing the static and dynamic tests carried out by or for the manufacturer or his or her authorised representative;
- (e) for **machinery**, which is not assembled on the premises of the manufacturer in the form in which it is to be used, the necessary instructions for performing the measures referred to in section 4.1.3 before it is first put into service.

## 5. SUPPLEMENTARY ESSENTIAL HEALTH AND SAFETY REQUIREMENTS FOR MACHINERY PRODUCTS INTENDED FOR UNDERGROUND WORK

Machinery products intended for underground work shall meet all the essential health and safety requirements described in this chapter (see General Principles, point 4).

### 5.1. RISKS DUE TO LACK OF STABILITY

Powered roof supports shall be designed and constructed in such a way as to maintain a given direction when moving and not slip before and while they come under load and after the load has been removed. They shall be equipped with anchorages for the top plates of the individual hydraulic props.

### 5.2. MOVEMENT

Powered roof supports shall allow for unhindered movement of persons.

### 5.3. CONTROL DEVICES

The accelerator and brake controls for movement of **machinery** running on rails shall be hand-operated. However, enabling devices may be foot-operated.

The control devices of powered roof supports shall be designed and positioned in such a way that, during displacement operations, operators are sheltered by a support in place. The control devices shall be protected against any accidental release.

### 5.4. STOPPING

Self-propelled **machinery** running on rails for use in underground work shall be equipped with an enabling device acting on the circuit controlling the movement of the **machinery** such that movement is stopped if the driver is no longer in control of the movement.

### 5.5. FIRE

Section 3.5.2 (b) is mandatory in respect of **machinery**, which comprises highly flammable parts.

The braking system of **machinery** intended for use in underground workings shall be designed and constructed in such a way that it does not produce sparks or cause fires.

Machinery with internal combustion engines for use in underground workings shall be fitted only with engines using fuel with a low vaporising pressure and which exclude any spark of electrical origin.

### 5.6. EXHAUST EMISSIONS

Exhaust emissions from internal combustion engines shall not be discharged upwards.

## 6. SUPPLEMENTARY ESSENTIAL HEALTH AND SAFETY REQUIREMENTS FOR MACHINERY PRODUCTS PRESENTING PARTICULAR RISKS DUE TO THE LIFTING OF PERSONS

Machinery products presenting risks due to the lifting of persons shall meet all the relevant essential health and safety requirements described in this chapter (see General Principles, point 4).

## 6.1. GENERAL

### 6.1.1. Mechanical strength

The carrier, including any trapdoors, shall be designed and constructed in such a way as to offer the space and strength corresponding to the maximum number of persons permitted on the carrier and the maximum working load.

The working coefficients for components set out in sections 4.1.2.4 and 4.1.2.5 are inadequate for **machinery** intended for the lifting of persons and shall, as a general rule, be doubled. Machinery intended for lifting persons or persons and goods shall be fitted with a suspension or supporting system for the carrier designed and constructed in such a way as to ensure an adequate overall level of safety and to prevent the risk of the carrier falling.

If ropes or chains are used to suspend the carrier, as a general rule, at least two independent ropes or chains are required, each with its own anchorage.

### 6.1.2. Loading control for **machinery** moved by power other than human strength

The requirements of section 4.2.2 apply regardless of the maximum working load and overturning moment, unless the manufacturer can demonstrate that there is no risk of overloading or overturning.

## 6.2. CONTROL DEVICES

Where safety requirements do not impose other solutions, the carrier shall, as a general rule, be designed and constructed in such a way that persons in the carrier have means of controlling upward and downward movements and, if appropriate, other movements of the carrier.

In operation, those control devices shall override any other devices controlling the same movement with the exception of emergency stop devices.

The control devices for the movements referred to in the first paragraph shall be of the hold-to-run type except where the carrier is completely enclosed. If there is no risk of persons or objects on the carrier colliding or falling and no other risks due to the upward and downward movements of the carrier, control devices authorising automatic stops at preselected positions may be used instead of hold-to-run type control devices

## 6.3. RISKS TO PERSONS IN OR ON THE CARRIER

### 6.3.1. Risks due to movements of the carrier

Machinery for lifting persons shall be designed, constructed or equipped in such a way that the acceleration or deceleration of the carrier does not engender risks for persons.

### 6.3.2. Risk of persons falling from the carrier

The carrier shall not tilt to an extent, which creates a risk of the occupants falling, including when the **machinery** and carrier are moving.

Where the carrier is designed as a workstation, provision shall be made to ensure stability and to prevent hazardous movements.

If the measures referred to in section 1.5.15 are not adequate, carriers shall be fitted with a sufficient number of suitable anchorage points for the number of persons permitted on the

carrier. The anchorage points shall be strong enough for the use of personal protective equipment against falls from a height.

Any trapdoor in floors or ceilings or side doors shall be designed and constructed in such a way as to prevent inadvertent opening and shall open in a direction that obviates any risk of falling, should they open unexpectedly.

#### 6.3.3. Risk due to objects falling on the carrier

Where there is a risk of objects falling on the carrier and endangering persons, the carrier shall be equipped with a protective roof.

### 6.4. MACHINERY SERVING FIXED LANDINGS

#### 6.4.1. Risks to persons in or on the carrier

The carrier shall be designed and constructed in such a way as to prevent risks due to contact between persons and/or objects in or on the carrier with any fixed or moving elements. Where necessary in order to fulfil this requirement, the carrier itself shall be completely enclosed with doors fitted with an interlocking device that prevents hazardous movements of the carrier unless the doors are closed. The doors shall remain closed if the carrier stops between landings where there is a risk of falling from the carrier.

The **machinery** shall be designed, constructed and, where necessary, equipped with devices in such a way as to prevent uncontrolled upward or downward movement of the carrier. These devices shall be able to stop the carrier at its maximum working load and at the foreseeable maximum speed.

The stopping action shall not cause deceleration harmful to the occupants, whatever the load conditions.

#### 6.4.2. Controls at landings

Controls, other than those for emergency use, at landings shall not initiate movements of the carrier when:

- (a) the control devices in the carrier are being operated,
- (b) the carrier is not at a landing.

#### 6.4.3. Access to the carrier

The guards at the landings and on the carrier shall be designed and constructed in such a way as to ensure safe transfer to and from the carrier, taking into consideration the foreseeable range of goods and persons to be lifted.

### 6.5. MARKINGS

The carrier shall bear the information necessary to ensure safety including:

- (a) the number of persons permitted on the carrier,
- (b) the maximum working load.