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European Union directive concerning machinery This article relies excessively on references to primary sources. Please improve this article by adding secondary or tertiary sources. Find sources: "Machinery Directive" – news · newspapers · books · scholar · JSTOR (July 2017) (Learn how and when to remove this message) The Machinery Directive, Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 is a European Union directive concerning machinery and certain parts of machinery.[1] Its main intent is to ensure a common safety level in machinery placed on the market or put in service in all member states and to ensure freedom of movement within the European Union by stating that "member states shall not prohibit, restrict or impede the placing on the market and/or putting into service in their territory of machinery which complies with [the] Directive". Economic directives apply to products. They were taken under the new approach in order to facilitate the free movement of goods and products in the European Union by removing barriers to trade in the European market. The particularity of these guidelines is that they set the basic requirements or Essential Health and Safety Requirements (EHSR) that apply to all manufacturers who wish to put their products on the European market. If a product meets the essential health and safety requirements, then the product can be placed on the market. One way of demonstrating compliance with the ESHR can be done through compliance with harmonized European standards or any other solution that allows demonstrating a similar level of safety. Consequently, the Machinery Directive belongs to the economic legislation. It applies to products designed to be sold (or enabled) in the European Union for the first time. It addresses manufacturers, importers, and dealers of machinery and safety components and applies to new equipment. This directive harmonizes the level of safety of products designed and manufactured by different manufacturers. Already installed machines lie outside the scope of this Directive, because they are already on the market. Resale of used machines is governed by national laws. The directive applies to machinery as well as interchangeable equipment, safety components, lifting accessories, chains/ropes/webbing, removable mechanical transmission devices and partly completed machinery. Machinery that is covered by more specific directives is excluded from the scope of this directive. The machinery excluded from the scope includes: agricultural and forestry tractors motor vehicles and their trailers certain electric and electronic products such as household appliances or office equipment The first publication of the Machinery Directive took place in 1989 – Directive 89/392/EEC of 14/06/89 published in OJ L 183 of 06.29.89 according to Article 100a of the Rome Treaty. The date of entry into force of this Directive was 1 January 1993, with a mandatory effective date of 1 January 1995. The following directives were subsequently introduced amending Directive 89/392/EEC. Directive 91/368/EEC, which extended the scope of the Machinery Directive to interchangeable equipment, machinery moving and lifting machinery (excluding people). Therefore, Annex I has been expanded (adding / modifying parts 3, 4 and 5 of Annex I of the Directive). Directive 93/44/EEC, which extended the scope of the Machinery Directive: safety components, Machinery intended for lifting, the movement of people. Directive 93/68/EEC has introduced harmonized provisions relating to "CE" marking. A second publication of the Machinery Directive took place in 1998 – Directive 98/37/EC of 22 June 1998 on the harmonization of the laws of all Member States relating to machinery. This directive is the codified version of Directive 89/392/EEC as amended by the directives listed above. Machine Directive 1998/37/EC This was amended by the following directive: Directive 98/79/EC has been a minor amendment relating to the exclusion of medical devices. Machinery Directive 98/37/EC remained in force until 29 December 2009. The third publication of the Machinery Directive took place in 2006 – called new Directive 2006/42/EC, and was adopted in April and 9 June 2006, published in the Official Journal of the EU. The first recital of Directive 2006/42/EC notes that this "new Machinery Directive " is not entirely new, but is based on Directive 98/37/EC which itself has codified Directive "Machinery" 89/392/EEC amended by Directives 91/368/EEC, 93/44/EEC, 93/68/EEC and 98/79/EC. Requirements of the new Machinery Directive were transcribed into national law of each country of the European Union (transcript had to be made before 29 June 2008) so that this new machine Directive shall apply starting from 29 December 2009 and replaces Machinery Directive 98/37/EC. Requirements of this machinery directive and associated European regulations concerns both manufacturers of machine and safety components, machinery distributors and users. The Directive 2006/42/EC lays down the foundation and regulatory basis for the harmonization of Essential Health and Safety Requirements (EHSR) in the field of machinery at the Community level. No transition period took place in 2009, because manufacturers had more than three years to anticipate these developments and be aware of new requirements. Changes in relation to the Essential Health and Safety Requirements (EHSR) of the previous directive do not deeply change the Essential Health and Safety Requirements (EHSR). A new Regulation (EU) 2023/1230 of the European Parliament and of the Council of 14 June 2023 on machinery replaces Directive 2006/42/EC on machinery.[2] The Regulation applies from 20 January 2027. However, some rules apply earlier such as the requirements for notified bodies on the 20 January 2024.[3] ^ "Directive 2006/42/EC". Retrieved 22 May 2015. ^ "Regulation (EU) 2023/1230 of the European Parliament and of the Council of 14 June 2023 on machinery and repealing Directive 2006/42/EC of the European Parliament and of the Council and Council Directive 73/361/EEC". Retrieved 18 December 2023. ^ "Regulation 2023/1230/EU - machinery 2006/42/EC". Retrieved 18 December 2023. Harmonized standards - Machinery (MD) Europa website on Machinery Retrieved from " ObjectiveDirective 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC aims at the free market circulation on machinery and at the protection of workers and consumers using such machinery. It defines essential health and safety requirements of general application, supplemented by a number of more specific requirements for certain categories of machinery. Where, for machinery, the hazards referred to in Annex I of the Directive are wholly or partly covered more specifically by other Community Directives, this Directive shall not apply, or shall cease to apply, to that machinery in respect of such hazards from the date of implementation of those other directives. Remark: Directive 2006/42/EC has been repealed by Regulation (EU) 2023/1230 on machinery. This Regulation applies from 20 January 2027. DefinitionsThis Directive applies to machinery, interchangeable equipment, safety components, lifting accessories, chains, ropes and webbing, removable mechanical transmission devices and partly completed machinery as defined in Art. 2 of the Directive. ContentsMember States shall take all appropriate measures to ensure that partly completed machinery can be placed on the market only if it satisfies the relevant provisions of this Directive.Essential health and safety requirements relating to the the design and construction of machinery are defined in Annex I of the Directive.Member States should ensure their capacity to carry out effective market surveillance, taking account of guidelines developed by the Commission, in order to achieve the proper and uniform application of this Directive.Member States shall institute or appoint the competent authorities to monitor the conformity of machinery and partly completed machinery and define tasks, organisation and powers.The manufacturers should retain full responsibility for certifying the conformity of their machinery to the provisions of this Directive. The CE marking should be fully recognised as being the only marking which guarantees that machinery conforms to the requirements of this Directive.The manufacturer or his authorised representative should also ensure that a risk assessment is carried out for the machinery which he wishes to place on the market. For this purpose, he should determine which are the essential health and safety requirements applicable to his machinery and in respect of which he must take measures.The machinery must then be designed and constructed taking into account the results of the risk assessment.Machinery must be designed and constructed so that it is fitted 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 manufacturer or his authorised representative should prepare a technical construction file which must be available on request and which demonstrates conformity of the machinery with the essential health and safety requirements.Member States should provide for penalties applicable to infringements of the provisions of this Directive. Those penalties should be effective, proportionate and dissuasive. Machinery safety in the United Kingdom is governed by two key sets of regulations that are crucial for anyone involved in the manufacture, operation, or maintenance of industrial machines.Supply of Machinery (Safety) Regulations 2008 and CE MarkingThe Supply of Machinery (Safety) Regulations 2008, amended by the Supply of Machinery (Safety) (Amendment) Regulations 2011, forms the cornerstone of machinery safety in the UK. These regulations mandate that all machines introduced to the European market bear the CE mark, in compliance with the European Machinery Directive 2006/42/EC.To ensure compliance with these regulations, machines must meet the following criteria:A system of conformity assessment must be in place.Machines must adhere to the Essential Health and Safety Requirements of the Machinery Directive, reflecting the latest industry standards.Each machine should be accompanied by a Declaration of Conformity (DoC).User instructions must be provided in the language of the end user.A comprehensive Technical File must be compiled.CE marking should be visibly displayed.At Procter Machine Safety, our machine guards come with a Declaration of Conformity and may be CE marked, depending on specific circumstances. We are committed to helping you navigate the complexities of these regulations. (Consider adding an internal link to your White Paper for more information.)Provision and Use of Work Equipment Regulations 1998 (PUWER 98)The Provision and Use of Work Equipment Regulations 1998, commonly known as PUWER 98, impose responsibilities on individuals and organizations that own, operate, or oversee the use of work equipment.For newly introduced machines and those being used for the first time, a PUWER assessment is essential. Notably, Regulation 11 of PUWER focuses on safeguarding against dangerous machine components. Key aspects include:Regulation 11(1): Employers must implement effective measures (as specified in Regulation 11(2)) to prevent access to hazardous machine parts or to halt machine movement before personnel can enter danger zones.Regulation 11(3): Specific requirements pertain to machine guards and protective devices.Regulation 11(4): Measures in Regulation 11(3) apply to “protection appliances” such as jigs, holders, and push-sticks.While PUWER does not mandate adherence to specific standards, following the Approved Code of Practice and Guidance (ACOP) from the Health & Safety Executive (HSE) is often sufficient for demonstrating compliance. Although not legally obligatory, conforming to ACOP and applicable standards is the best practice for conducting thorough risk assessments and ensuring legal compliance.During inspections, HSE inspectors will generally expect organizations to have followed the PUWER ACOP.For further information and resources related to machinery safety regulations, please explore these valuable sources: Published 27 Oct 2022Last Modified 29 Aug 202311 min How safe is your industrial work environment? This guide explains machine safety, covers regulations and machine guarding products, and helps you take preventative measures to protect personnel.Machinery is commonplace in industrial environments like factories, however, it comes with a number of risks. Moving parts, hot surfaces, presses, clamps, and sharp edges pose clear dangers, and it is imperative that operators are protected against them.Operational precautions and training are vital for safe machinery use. As a first step, it is imperative to minimise risks by implementing guarding or protection. It is also important to have clear warning signs fitted.The addition of machinery safety systems using sensors, switches, and optoelectronic protective devices for monitoring how an operator interacts with a machine is a secondary measure when physical guarding is impractical.Machine Safety DefinitionMachine safety refers to the measures and precautions taken to protect individuals from hazards posed by machines and equipment in various settings, such as factories, workplaces, and public spaces.Industrial machinery is very dangerous. Potential injuries include:Cuts and puncture wounds from sharp edgesSkin abrasions from rough surfacesBurns and scalds from escaping steam or hot surfacesCrushing injuries if workers are caught between moving parts or between a wall and part of a machineLimbs may get caught on moving parts such as belts and rollersConcussions and wounds from moving parts or ejected objectsNot a pretty picture. Operating machines safely is vital. Poorly maintained equipment is more prone to hazardous breakdowns and power failures. Make sure all machine operators are properly trained and conduct regular work equipment and machinery safety risk assessments.Let's look at key products that can be integrated into machinery or production lines to ensure the health and safety of your employees:Here are some key industrial machine safety rules and regulations:The European Machinery Safety DirectiveAlso known as Directive 2006/42/EC, this applies to a wide range of industrial machinery, including safety accessories. It sets out health and safety requirements to protect workers operating factory machinery and includes both general steps and machine-specific safety measures.ISO 13849-1 & ISO 13850The International Organisation for Standardisation (ISO), based in Geneva, Switzerland, defines internationally applicable standards for use across industry and commerce. ISO 13849-1 relates to the safety of machinery. It sets out requirements for safe design and performance levels, as well as electrical, hydraulic, mechanical and pneumatic control systems. Meanwhile, the ISO 13850:2015 standard relates specifically to emergency stop systems in industrial machinery, setting out key principles for their function and design. It does not apply to handheld machines or those not made safer by emergency stops.IEC Machine Safety StandardsThe International Electrotechnical Commission (IEC) defines international standards for electrical and electronic devices. IEC 62061 is a standard concerning safety-focused electrical control systems for machinery, and it relates to the entire system lifecycle, from planning to decommissioning. IEC 61508 is a set of machinery safety standards concerning automatic protection systems for industrial equipment. The central concept is that safety systems must either work as designed or fail predictably and safely. A streamlined engineering process eliminates errors and omissions.Industrial machinery performs different functions and appears to have little in common. But while the fine details may differ, the fundamentals of operating safely are the same.The following principles apply to lathe machines, grinding machines, presses, machine tools, and packaging machines.Read the operating manual of any newly acquired machine carefully, even if you know the basics. Always follow the instructions givenAlways wear machine-appropriate personal protective equipment (PPE). Closed-toe shoes protect your feet from impact and falling items and reduce slip risk. Full wrap goggles shield your eyes from debris that may escape guarding. Cut-resistant gloves can ward off injuries caused by exposure to sharp edges and bladesOnly operate equipment for which you have received full machine safety trainingVisually assess the machinery and its fixtures and fittings before use, looking for any potential problemsTie back loose clothing and hair and remove any jewellery to avoid entanglementEnsure that there are no slipping or tripping hazards in the vicinityEnsure you know the location of the emergency stop button if one is present and make sure you can access it immediately if neededEstablish clear lockout procedures and install barriers as appropriate, enabling the complete cessation of electrical current in an emergency or for maintenance. Presence-detecting light curtains will induce an emergency shutdown if they detect limbs in hazardous areasMake sure appropriate guarding is securely installed to protect operators and critical parts of the machinery itself from flying debris, sparks, moving parts, or entanglement hazards. In addition, the cabling should be properly protected. Use guarding free from its own hazards, such as sharp edges. Always switch off the machinery when you are finished using itInstall easy-to-understand safety warning signs in visible locations, for anybody in the vicinity of the machineEnsure that a well-thought-through cleaning and maintenance system is in place so that workers involved in such tasks are not exposed to unnecessary risksOnly fully trained technicians should conduct repairs and modificationsInternational Standard EN ISO 12100 (Safety of Machinery - General Principles for Design - Risk Assessment and Risk Reduction) is exceptionally detailed. It identifies the hazards, describes the risks to be considered by the designer, and contains principles for design and methods for safe construction and risk reduction.EN ISO 14121 (Safety of Machinery - Risk Assessment) describes the iterative process for analysing, assessing, and reducing risks to achieve safety requirements.EN ISO 12100 recommends that the designer follow these procedures for adequate risk reduction:Specify the limits and intended use of the machineIdentify possible hazardous situations, machinery hazards and control measures to mitigate risksEstimate the risk entailed for each hazard and hazardous situation identified, including any foreseeable inappropriate behaviour and misuse by operatorsAssess each individual risk and determine whether or not a reduction in risk is necessaryEndeavour to eliminate or reduce risk through mitigation measures. If this is not possible, then:Reduce the risk by using protective machinery safety devices (such as rigid guards or covers, or by using electro-sensitive protective equipment such as safety light curtains)Inform and warn the machine operator about any residual risk present in respect of the machine via notices on the machine and in instructions for useThe first four steps describe risk analysis and risk assessment. It is also critical that risk analysis and assessment are carried out methodically and documented understandably.In addition to the protective measures selected by the machine designer, the machine operator may need to take additional measures to mitigate any residual risk.These measures may include but are not limited to:Organisational measures (e.g. safe working procedures, regular inspections)Personal protective equipmentTraining and instruction of all operatorsMachinery Safety and Risk AnalysisMachinery safety regulations aim to ensure that machines are manufactured and operated in such a way that, when used as intended, they will not cause injury or damage.Accident statistics show that a hazard present on a machine will cause damage or injury sooner or later unless protection measures are adopted.Protection measures are a combination of measures taken by the designer and implemented by the operator. In particular, measures adopted during the construction phase are preferred since they are generally more effective than measures implemented by the operator.Warning - the recommendations in this guide are not exhaustive!Installing, operating, and maintaining products requires following the latest standards and instructions. Failure to follow these warnings could cause serious injury or property damage.© RS Components Ltd. Birchington Road, Corby, Northants, NN17 9RS, UK As an employer, you should consider how your workers use machinery. You should also have adequate maintenance arrangements in place to ensure it remains safe to use. Moving machinery can cause injuries when: people can be struck by moving parts or ejected material body parts can be drawn in or trapped between rollers, belts and pulley drives sharp edges can cause cuts and severing injuries, sharp-pointed parts can cause stabbing or puncture the skin. rough surface parts can cause friction or abrasion people can be crushed, between parts moving together or towards a fixed part of a machine, wall or other object, or 2 parts moving past one another can cause shearing parts, materials and emissions (such as steam or water) can be hot or cold enough to cause burns or scalds electricity can cause electrical shock and burns. Injuries may be more likely to occur when: machinery becomes unreliable and develops faults machines are used improperly through inexperience or lack of training Assessing and managing the risk Before you or your workers use any machine, you should think about what risks may occur and how these can be managed. Check the machine is complete, with all safeguards fitted, and is free from defects. The term 'safeguarding' includes guards, interlocks, two-hand controls, light guards and, pressure-sensitive mats. By law, the supplier must provide the right safeguards and inform buyers of any risks ('residual risks') that could not be designed out. Users need to be aware of these and manage them. Make sure you identify and manage risks from badly designed safeguards. These may be inconvenient to use or easily overridden, which could encourage your workers to risk injury and break the law. If they are doing this, find out why and take appropriate action to manage this. Produce a safe system of work for using and maintaining the machine. Maintenance may require the inspection of critical features where deterioration would cause a risk. Look at any residual risks listed in the information provided with the machine. Make sure they are included in the safe system of work. Ensure every static machine has been installed properly and is stable (usually fixed down). Choose the right machine for the job Do not put machines where customers or visitors may be exposed to risk. Make sure you identify and manage risks from electrical, hydraulic or pneumatic power supplies. Make sure the machine is: safe for any work that has to be done when setting up, during normal use, when clearing blockages, when carrying out repairs for breakdowns, and during planned maintenance properly switched off, isolated or locked off before taking any action to remove blockages, clean or make adjustments Use control measures Preventing access to dangerous parts Think about how you can make a machine safe, it may be necessary to use a combination of measures. The measures you use to prevent access to dangerous parts should be in the following order: Use fixed guards (for example secured with screws or nuts and bolts) to enclose the dangerous parts, whenever practical. Use the best material for these guards – plastic may be easy to see through but can be damaged easily. Where you use wire mesh or similar materials, make sure the holes are not large enough to allow access to moving parts. If fixed guards are not practical, use other methods, like interlocking the guard so the machine cannot start before the guard is closed and it cannot be opened while the machine is still moving. In some cases, trip systems such as photoelectric devices, pressure-sensitive mats or automatic guards may be used if other guards are not practical. Where guards cannot give full protection, use jigs, holders or push sticks if it is practical to do so. Control any remaining risk by providing the operator with the necessary information, instruction, training, supervision and appropriate safety equipment. Other control measures If machines are controlled by programmable electronic systems, changes to any programmes should be carried out by a competent person (someone who has the necessary skills, knowledge and experience to carry out the work safely). Keep a record of such changes and check they have been made properly. Ensure control switches are clearly marked to show what they do. Have emergency stop controls where necessary, for example mushroom-head push buttons, within easy reach. Make sure operating controls are designed and placed to avoid accidental operation and injury, for example by using two-hand controls where necessary and shrouding start buttons and pedals. Do not let unauthorised, unqualified or untrained people use machinery – never allow children to operate or help at machines. Some vulnerable workers, such as new starters, young people or those with disabilities, may be particularly at risk. Everyone who uses the machine requires adequate instruction, training and supervision. Adequate training should ensure that those who use the machine are competent to use it safely. This includes ensuring they have the correct skills, knowledge and experience. Sometimes formal qualifications are needed, for example for chainsaw operators. Supervisors must also be properly trained and competent to be effective. They may need extra specific training and there are recognised courses for supervisors. Ensure the work area around the machine is kept clean and tidy, free from obstructions or slips and trips hazards, and is well lit. Machinery safety for workers Ensure machinery is safe To ensure machinery is safe you should check the machine is well maintained and fit to be used. Make sure it is appropriate for the job, working properly and that all the safety measures are in place. Examples of safety measures include guards, isolators, locking mechanisms and emergency off switches. Use the machine properly and in accordance with the manufacturer's instructions. Make sure you are wearing the appropriate protective clothing and equipment required for that machine, such as safety glasses, hearing protection and safety shoes. Prevent accidents and injuries Don’t use a machine or appliance that has a danger sign or tag attached to it. These signs should only be removed by an authorised person who is satisfied that the machine or process is now safe. Never wear dangling chains, loose clothing, rings or have loose, long hair that could get caught up in moving parts. Don’t distract people who are using machines. Never remove any safeguards, even if they seem to make the job more difficult. Examples of accidents involving machinery A company were prosecuted after a worker received horrific injuries, almost severing their left arm when using a cross-cut saw. What caused the accident? The nose guard had not been set correctly because training was inadequate. The worker had no previous experience and had only 5 minutes' training on the saw. This did not include any instruction about the saw guards and how to adjust them properly. The saw was also unsuitable for training purposes. A company were prosecuted after a worker was killed when they were crushed in the rollers of a rubber and cloth inspection machine. What caused the accident? The company had not assessed the risks associated with using the machine. They had not checked that it was safe to use following modifications when the nip guards were removed and an unguarded roller was inserted. The law The aim of the Provision and Use of Work Equipment Regulations (PUWER) is to ensure that work equipment is safe to use, regardless of its age, condition or origin. PUWER places duties on employers and others who control how work equipment is used. This includes those who hire it out to be used by others. The Lifting Operations and Lifting Equipment Regulations (LOLER) apply to the safe use of lifting equipment. The manufacturer of machinery, as well as the user, should apply all technical and organisational measures available in order to ensure the safety of machine operators. This article outlines the general rules for approaching safety issues that should be taken into account by machinery designers in the design process e.g. inherently safe design, safeguarding and complementary protective measures, information for use, etc. Safety measures to be implemented by the user are also discussed.Common accidentsEUROSTAT statistics demonstrate that in 2021 around 300 fatal accidents occurred at work related to the use of machinery and equipment[1]. These figures show that safety of machinery and work equipment is a key component of managing occupational safety and health (OSH) in many workplaces. According to standard EN ISO 12100:2010[2], both the manufacturers and users of the machinery should implement all the available measures to reduce risks entailed by machine operation.Placing on the market and putting into serviceDirective 2006/42/EC on machinery[3] lays down health and safety requirements for the design and construction of machinery, placed on the European market. Directive 2006/42/EC has been repealed by Regulation (EU) 2023/1230 on machinery[4]. This Regulation applies from 14 January 2027. The key points of the Directive and the Regulation are similar. The Directive (and also the Regulation) defines the mandatory essential health and safety requirements that machinery products must fulfil to be placed on the European market, as well as the procedures for assessing their conformity (see figure 1), while the technical details are mainly provided through European harmonised standards elaborated by European standards organisations. The CE marking indicates that the machinery product meets the health and safety requirements in place and can be traded without restriction in the internal market.Figure 1: Conformity assessment procedures according to Directive 2006/42/ECSafety measures should be applied by machinery manufacturers, according to the results of risk assessment taking into account both the intended use of machinery and any reasonably foreseeable misuse. More detailed guidelines for the implementation of safety measures can be found in the standards. The updates of the list of standards harmonised with Directive 2006/42/EC are published in the Official Journal of the European Union. To prove that safety measures have been applied in a proper way during the design and manufacturing processes, machine manufacturers should apply one of the conformity assessment procedures presented in figure 1 prior to marketing any new product[3].Implementation of safety measures by the manufacturerThe manufacturer’s obligations are specified in Machinery Directive 2006/42/EC, which imposes the requirement that the manufacturer of machinery should eliminate hazards or reduce risks associated with these hazards by applying safety measures in the following order:inherently safe design;safeguarding and implementation of complementary protective measures (see below Complementary protective measures);informing user about the residual risk.Inherently safe designTaking the inherently safe design approach is the most efficient risk-reducing safety measure, which consists of:hazard elimination or reduction to the furthest extent possible through the right choice of the machine design features,minimising personal exposure to hazards, through reduction of the number of necessary interventions within the danger zones.The fundamental principle in machine design stipulates that, where feasible given the intended use of the machine, all accessible parts should have no sharp edges, sharp corners, rough surfaces, protruding parts, etc. Many hazards of the machine can be eliminated by means of choosing proper shapes and employing proper arrangement of mechanical parts. For example, injuries caused by a moving part can be eliminated by placing that part out of the machine operator’s reach.SafeguardingThe hazards that cannot be eliminated using the inherently safe design approach should be reduced by means of the application of guards or protective devices (safeguarding).GuardsAll types of devices of all types that create a physical barrier between a person and a hazardous mechanical part of a machine and are specifically fitted to ensure the safety of the operator are classified as guards. Therefore, covers, doors, fences, etc. also perform guarding functions. Guards should:be of robust construction,be difficult to remove or switch off,be situated at a proper distance from the danger zone,pose the least possible number of obstacles to the working process,allow performance of required operations like installation, tool changing or maintenance, providing only limited access to the area where the operations are to be performed, and without the necessity for removal, if possible.Generally, guards can be classified in view of the way they are mounted, their working concept and adjustability. There are two ways of installing guards:securing by means of inseparable connection or with the use of separable connections that prevent opening or removal without (special) tools; often referred to as fixed guards.mounting with the use of mechanical elements, which allows them to be opened without any tools. Guards of this type are called movable guards.The working principle of the guard may consist of:independent operation of the guard, however the guard is effective only when closed. It should be noted that for a fixed guard, the term “closed" means “connected to the area of its installation",working in combination with an interlock, supplied or not with guard locking.Guard locking refers to protective measures preventing any operations of the machine that may pose mechanical hazards while the guard is open. Opening of the guard during machine operations results in the stoppage of the machine’s dangerous motions. These functions can be performed when the guard is closed, however the singular action of closing the guard does not actuate those functions. Guards of that type are called interlocking ones.In all cases where operator’s access to the danger zone in the course of normal working is not required, fixed guards should be used. Movable guards are employed when there is the necessity for the operator to enter the danger zone frequently.Protective deviceWhen it is impossible to apply guards, sensitive protective devices are used to reduce risk. There are several types of these devices. Optoelectronic protective devices (light curtains, scanning devices like laser scanners) and pressure-sensitive devices (mats, trip bars, trip wires etc.) are often used.Protective devices that do not create actual physical barriers perform their protective functions by means of generating a signal that stops a dangerous motion of a given machine component after having detected that a part of the operator’s body is too close to the danger zone. In this way, they ensure that a dangerous motion (e.g. that of press slide) will be stopped before the operator could potentially enter the danger zone. For this reason, guards of this type can be used only in machines in which the structure allows for automatic stop of a dangerous motion within a short time frame, sufficient to perform this automatic stop. Besides only stopping, the devices also perform the function of interlocking the dangerous motion of a machine component when the presence of a human has been detected within the protected zone.When implementing protective devices, consideration should be given to:size, characteristics and positioning of the detection zone,reaction of the device to fault conditions,possibility of circumvention, anddetection capability and its variation in time.Sensitive protective equipment should be integrated into the machine’s operations and associated with the control system so that:a command is given as soon as a person or part of a person is detected,withdrawal of the person or part of a person detected does not, by itself, restart the hazardous machine function(s), and the control system maintains the command given by the sensitive protective equipment until a new command is given,restarting the hazardous machine function(s) is a result of voluntary actuation by the operator of the control device placed outside the hazard zone where this zone can be observed by the operator,the machine cannot operate during interruption of the detection function of the sensitive protective equipment, except during muting phases, andthe position and the shape of the detection field prevents, possibly together with fixed guards, a person or part of a person from entering or being present in the hazard zone without being detected.Functional safety of machinery control systemIf failure of a control function performed by a control system can result in an immediate increase in risk, then this function is named a “safety function". Generally, safety functions can be implemented for the reduction of risk associated with the following three groups of hazards:improper machine operation;failure of technological processes caused by a substantial change or deviation in physical parameters from standard values due to unexpected events;mechanical hazards.The following safety functions are most common:safety-related stop function initiated by a safeguard;manual reset function;start/restart function;local control function;muting function;monitoring of parameterisation of safety-related input values;response time;monitoring of safety-related parameters such as speed, temperature or pressure;reaction to fluctuations, loss and restoration of power sources.Fault of these functions can increase risk. Therefore designers of the safety related control systems should apply structures that improve their resistance to fault. Control system resistance to fault can be improved through reduction of the probability of fault appearance, or by taking steps to ensure that a possible fault would not be a dangerous one. Improvements can be achieved by applying good practice tools and principles (examples can be found in standard EN ISO 13849-2:2012 Safety of machinery – safety-related parts of control systems – part 2: Validation[5]), and by including additional safety systems that detect faults.Basic rules for improving control system resistance to fault were formulated in standard EN 954-1:1995 “Safety of machinery. Safety-related parts of control systems – Part 1: General principles for design"[4], where, depending on their behaviour under fault conditions, devices were classified into 5 categories. This standard has been repealed and replaced by EN ISO 13849-1:2023. In this standard, system categories, depending on their resistance to faults, remained the same as those defined in EN 954-1:1995. Additionally, a specified architecture is designated for each category. Each system is characterised by the following parameters: Mean time to failure (MTTF), Diagnostic coverage (DC) and Common cause failure factor (CCF). The 5 performance levels (PL) represent the system resistance to faults.Standard EN IEC 62061:2021 Safety of machinery - functional safety of safety-related control systems should be applied to machine control systems. The standard classifies safety related systems into 3 safety integrity levels (SILs). Complementary protective measuresProtective measures not covered by the categories of inherently safe design, safeguarding (implementation of guards and/or protective devices) and information for use, may still have to be implemented as required by the intended use and reasonably foreseeable misuse of the machine. Such measures include, but are not limited to:components and elements to achieve emergency stop function;measures for escape and rescue of trapped persons;measures for isolation and energy dissipation;provisions for easy and safe handling of machines and their heavy component parts;measures for safe access to machinery.Information for useWhen risks persist despite the adoption of measures for inherent safe design, safeguarding and complementary protection, the user should be informed about residual risk.Depending on the risk and the point at which information is required for the user and the machine design, it shall be decided whether the information – or parts thereof – are to be given:on the machine itself,in accompanying documents,on the packaging,by other means, such as signals and warnings outside the machine.Information and warnings on machinery should preferably be provided in the form of readily understandable symbols or pictograms. Warning signals must be unambiguous and easily perceived. The operator must have facilities to check the operation of the warning devices at all times.Visual signals, such as flashing lights and audible signals such as sirens may be used to warn of an impending hazardous event, such as machine start-up or over-speed. Such signals may also be used to warn the operator before the triggering of automatic protective measures. Machinery shall bear all the necessary markings:for unambiguous identification,in order to indicate compliance with mandatory requirements,for safe use.The instruction handbook or other written instructions shall contain all information necessary for safe commissioning, operating, adjusting and maintenance of the machine.Implementation of safety measures by the user of machinery and work equipmentBased on the information for use provided by the designer, the machine user should implement safety measures for reducing residual risks that remain despite inherent safe design measures, safeguarding and complementary protective measures adopted.The requirements on the use of work equipment (including machinery) are laid down in Directive 2009/104/EC[6]. The main obligation consists in taking measures to ensure that the work equipment is suitable for the work to be carried out. If necessary, work equipment should be properly adapted to the work in such a way that workers can use it without impairment to their safety or health.Additional safeguardingThe employer should ensure that work equipment is installed, located and used in a way that the risks to the operators and other workers have been reduced. In particular, sufficient space between moving parts of work equipment and fixed or moving parts should be allowed. Very often, the application of additional safeguarding is necessary, which might result from a particular location or way of machine installation. In such a case, the application of fixed guards should be considered first. However, if for technological reasons access to danger zones is required, movable guards or protective devices should be applied. The same rules as those formulated for the machinery manufacturer apply when installing additional safeguards.Work organisation and proceduresProper work organisation is of crucial importance in ensuring safe operation of the work equipment. All operations should be performed according to established safe working procedures. When the use of work equipment is likely to involve a specific risk to the safety or health of workers, the employer should take necessary measures to ensure that the use of work equipment is restricted solely to persons given the task of using it. In the case of high risk (e.g. high voltage), work should be performed by at least two persons. Written permission for conducting such work should be issued (work permits). In the case of repairs, modifications, maintenance or servicing, specifically designated workers should carry out such works.Use of personal protective equipmentPersonal protective equipment (PPE) must be used when the risks cannot be avoided or sufficiently limited by technical or organisational measures. PPE are devices or equipment designed to be carried or held by a worker to protect him/her against single or multiple risks that may affect his/her health or safety at work.TrainingThe employer must ensure that workers receive appropriate training on the risks of using machinery. It is especially important in the case of workers carrying out repairs, modifications, and maintenance or servicing tasks.Inspection of work equipmentLong-term results of using a machine usually consist in constant degradation of its sub-assemblies, due to both material deterioration and mechanical wear. The aforementioned phenomena, if not investigated in a proper way, may cause machine failure. If safety-related elements fail, accidents may happen. Therefore, work equipment should be periodically inspected. The frequency and scope of the inspection should be determined based on the manufacturer’s information enclosed in the “Information for use”. One should also consider the intensity of machine exploitation and the risk level arising in operation of the machine. Directive 2009/104/EC[6] specifies the following types of inspection:initial inspection (after installation and before first being put into service) and an inspection after assembly at a new site or in a new locationperiodic inspections and, where appropriate, testing within the means of national laws and/or practicesspecial inspections each time exceptional circumstances that are liable to jeopardise the safety of the work equipment have occurred, such as work modification, accidents, natural phenomena or prolonged periods of inactivity.The main goal of those inspections consists in ensuring that health and safety conditions are maintained and that deterioration liable to result in dangerous situations can be detected and remedied in good time.ConclusionsUsing machinery and work equipment exposes workers to multiple risks. Ensuring machine operator safety requires application of safety measures as effective as possible. Technological development allows for designing more and more effective protective devices. The role of control systems as applied to risk reduction becomes more and more significant. Both manufacturers and users of the machine should apply the aforementioned measures. The only way to reduce accident rates in machine operations is through proper application of technical safety means by the machine manufacturer and proper monitoring of them by the user, combined with adequate organisational procedures. Why do we have the EU Machinery Regulation, when does it come into force? What are the changes and what are the implications for machine manufacturers? An overview of the key facts: What is the correct name of the Machinery Regulation? The official title of the Machinery Regulation is: Regulation (EU) 2023/1230 of the European Parliament and of the Council on machinery. What is in force until application of the Machinery Regulation becomes mandatory? The Machinery Directive (2006/42/EC) is the current and final version of the Machinery Directive. Application has been mandatory in the European Union since 2009 and continues to apply until the Machinery Regulation comes into force. Why do we have the Machinery Regulation? If you compare today’s technical requirements of automation and engineering with those of 2009, it is clear that the revision of the directive was inevitable. Digitisation and networking, as well as the new related issues of Industrial Security and Artificial Intelligence (AI), are in the process of significantly changing factory halls and the plant and machinery within them. To take account of these changes, the provisions have been brought in line with technical developments. What is the aim of the Machinery Regulation? The Machinery Regulation aspires to maintain the high level of safety that was achieved with the implementation of the specifications from the Machinery Directive and to bring it up to date with state-of-the-art technology. The aim is to design safe interaction between human and machine, and to guarantee the standardisation of fundamental and mandatory European Machinery Safety requirements. To whom does the EU Machinery Regulation apply and what does it cover? The new regulation continues to cover machinery and related products that are to be operated within the European Union, but safety components now also include software. From when does the Machinery Regulation apply and what are the transition periods? The EU Machinery Regulation 2023/1230 was published in the Official Journal of the EU on 29 June 2023. The Machinery Regulation becomes legally binding in all EU states from 20 January 2027 (key date regulation). What does the Machinery Regulation say? The new European Machinery Regulation (EU) 2023/1230 contains comprehensive rules on machinery health and safety, including new technologies such as Artificial Intelligence. Key points are safety requirements, new conformity assessment procedures and stricter market surveillance. What are the most important changes and new developments in the Machinery Regulation? Machines subject to inspection The list of machines subject to inspection, which was previously in Annex IV of the Machinery Directive 2006/42/EC, has “moved” to Annex I. In Section A it contains a list of high risk machines, for which mandatory inspection and certification through a third party is required. In future, six machine categories will be subject to inspection; application of a harmonised standard does not remove the inspection obligation. This is due to the current developments in Artificial Intelligence. For the six listed product groups, machine manufacturers can no longer self-declare compliance in conjunction with a harmonised standard, as previously. Instead, a named accreditation body must be involved. Substantial modification The regulation has been extended to include a definition of a substantial modification of machinery and the legal consequences of such a modification. A conformity assessment procedure is required for Machinery Safety if a machine undergoes major modifications or when changes are made that affect the machine’s compliance with the statutory provisions for CE marking. If a substantial modification has taken place, the operator becomes the manufacturer – with all the obligations that entails. Safety components The definition of safety components now includes not only physical, digital and/or mixed-type components, but also software. Digital technologies The emergence of new digital technologies such as Artificial Intelligence, the Internet of Things and robotics present new challenges for product safety. Industrial Security In a new section entitled “Protection against corruption”, the Machinery Regulation now also establishes requirements for the cybersecurity of machinery. Cybersecurity threats must not be allowed to compromise the machine’s safety functions. So measures to counteract these threats are no longer open to the interpretation of the person placing the machine on the market, but are a mandatory component. Manufacturers must review their existing safety concepts in this regard! Digital instructions Manufacturers shall be allowed to supply instructions in digital form. Should the customer request it, the manufacturer must supply the instructions in paper format. The EU Declaration of Conformity can also be provided in digital form. Partly completed machinery can be delivered with digital assembly instructions as well as with a digital Declaration of Incorporation. What does the new Machinery Regulation mean for harmonised standards? It is still unclear how the process will run with the existing harmonised standards under the Machinery Directive. As it currently stands, these will need to be relisted. With over 750 directly listed standards alone, that means a significant effort over several years. It is currently unclear whether the relevant standards will be available as harmonised standards by the time the EU Machinery Regulation comes into force – on 20 January 2027. Share — copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt — remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. 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