



On Your Guard

A Designer's Guide to Machinery Guarding Standards

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Machine Safety

The UK's leading machine guarding specialist



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Introduction

There is no hiding from the fact that guarding is a crucial element of a machine or production line, yet the guarding design is often left until last and not given as much thought as the aspects that are seen to relate directly to productivity. Nevertheless, guards usually control the interaction between operator and machine, so it should be remembered that their design can be a significant factor in optimising a machine's performance.

A perceived difficulty with designing guards is that there are numerous regulations and standards that must be complied with. In fact, as the designer becomes more familiar with the 'rules', the 'game' becomes easier. Alternatively, specialists such as [Procter Machine Safety](https://www.machinesafety.co.uk) can be employed to undertake the complete design, manufacture and installation, including electrical aspects.

This guide seeks to direct the reader towards the main standards for machine guarding and machinery safety in general, as well as providing some advice on how the standards can be applied. At the end there are lists of useful resources and sources of additional information.



Machine guarding is a matter of life and death...

- In 2017/18 there were 15 fatal injuries in manufacturing industries.
- In 2017/18, across all industries, contact with machinery caused 13 fatal injuries.
- Between 2013/4 and 2015/16, in the manufacturing industries there were an average of 66,000 self-reported non-fatal workplace injuries, of which 12% (approximately 8000) were due to contact with machinery.

Source: HSE

The importance of guarding

Most employers today have at least a basic understanding of safety issues and accept that their employees are one of the company's biggest assets. But many still see machine guarding expenditure as a necessary evil rather than a key investment that can really help deliver improved productivity.

If guards are well designed they will not interfere with efficient operation; ill-considered guards invariably do. Worse than that, poorly designed guards encourage operators, maintenance staff and management to bypass them, which can compromise quality and significantly increase risks.

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Machinery safety regulations

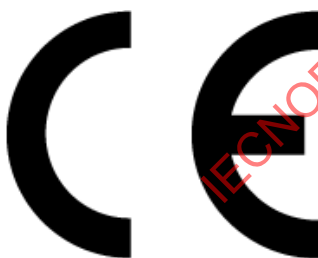
Machinery safety in the UK is driven by two main sets of [regulations](#): The Supply of Machinery (Safety) Regulations 2008 as amended (the UK implementation of the European Machinery Directive 2006/42/EC, requiring all machines placed on the market in the European Economic Area (EEA), Switzerland and Turkey to carry a CE mark) and The Provision and Use of Work Equipment Regulations 1998 (PUWER 98). In addition, there are The Health and Safety at Work etc Act 1974 and The Management of Health and Safety at Work Regulations 1999.

To comply with the requirements of The Supply of Machinery (Safety) Regulations 2008, a machine needs to pass these tests:

- The machine must comply with the EHSRs (Essential Health and Safety Requirements) of the Supply of Machinery Safety Regulations.
- The machine must have been assessed as complying with the EHSRs.
- There must be a Declaration of Conformity.
- The supplier must assemble a Technical File.
- The supplier must provide the information necessary to operate the machinery safely, such as instructions.
- The supplier must have followed one of the prescribed conformity assessment procedures.
- The machine must carry a CE mark.
- The machine must 'in fact' be safe.

For partly completed machinery, the requirements are simpler:

- The supplier must prepare the technical documentation.
- The supplier must prepare the assembly instructions.
- There must be a Declaration of Incorporation.



Unlike The Supply of Machinery Safety Regulations 1992, and the 1994 and 2005 amendments, the new Regulations (which came into force on 29 December 2009 to implement the Machinery Directive 2006/42/EC) stipulate that safety components must also be CE marked. In certain circumstances, therefore, machine guards need to be CE marked. See 'Useful Resources' below for a *Guide to the New Machinery Directive*, a White Paper *CE Marking of Guards*, and the European Commission has published both a *Guide to application of the Machinery Directive 2006/42/EC* and a report *Safety fences as safety component under the Machinery Directive 2006/42/EC*. Alternatively, contact Procter Machine Safety if in doubt whether or not there is a need to CE mark guards or, indeed, other components for which guarding is a secondary function such as covers, lids and acoustic enclosures.

Guarding standards

In practice, the way suppliers and users of machines can most easily meet their legal obligations is to ensure that their machines, guards and other safety devices conform to harmonised European standards (Euronorms). These standards have been developed to ensure an equally high standard of machine safety across the EU. The good news for users of machines in the UK is that these standards incorporate most of the principles of BS 5304:1975 and 1988 (the Code of practice for safety of machinery), which served British industry well for a long period and, although no longer current, is now available from BSI as a Published Document, PD 5304:2014.

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The main standards and published documents applying to machine safety and machine guarding are shown in the tables below. Machinery Directive Harmonised Standards are classed as A-type, B-type and C-type standards, so the list below has been divided the same way, with non-harmonised standards and other documents shown at the end. The list below focuses on the main standards; readers should use the 'Useful resources' section of this present guide to check whether any other standards need to be applied to the machinery or equipment in question. In the tables below the 'BS' designation is for the [British Standard](#), which is the UK implementation of the European (EN) or International (ISO or IEC) standard where applicable.

A-type standard: this specifies basic concepts, terminology and design principles applicable to all categories of machinery.

BS EN ISO 12100:2010	Safety of machinery. General principles for design. Risk assessment and risk reduction
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B-type standards: these deal with specific aspects of machinery safety or specific types of safeguard that can be used across a wide range of categories of machinery (NB the following list is not exhaustive).

BS EN 349:1993+A1:2008	Safety of machinery - Minimum gaps to avoid crushing of parts of the human body
BS EN 547-1:1996+A1:2008	Safety of machinery. Human body measurements. Principles for determining the dimensions required for openings for whole body access into machinery
BS EN 547-2:1996+A1:2008	Safety of machinery. Human body measurements. Principles for determining the dimensions required for access openings
BS EN 547-3:1996+A1:2008	Safety of machinery. Human body measurements. Anthropometric data
BS EN 574:1996+A1:2008	Safety of machinery. Two-hand control devices. Functional aspects. Principles for design
BS EN 614-1:2006+A1:2009	Safety of machinery. Ergonomic design principles. Terminology and general principles
BS EN 614-2:2000+A1:2008	Safety of machinery. Ergonomic design principles. Interactions between the design of machinery and work tasks
BS EN 842:1996+A1:2008	Safety of machinery. Visual danger signals. General requirements, design and testing
BS EN 894-1:1997+A1:2008	Safety of machinery. Ergonomics requirements for the design of displays and control actuators. General principles for human interactions with displays and control actuators
BS EN 894-2:1997+A1:2008	Safety of machinery. Ergonomics requirements for the design of displays and control actuators. Displays



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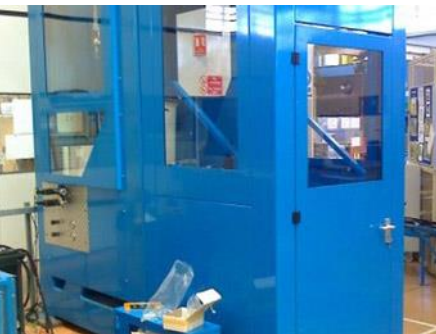


BS EN 894-3:2000+A1:2008	Safety of machinery. Ergonomics requirements for the design of displays and control actuators. Control actuators
BS EN 894-4:2010	Safety of machinery. Ergonomics requirements for design of displays and control actuators. Location and arrangement of displays and control actuators
BS EN 981:1996+A1:2008	Safety of machinery. System of auditory and visual danger and information signals
BS EN 1005-1:2001 +A1:2008	Safety of machinery. Human physical performance. Terms and definitions
BS EN 1005-2:2003 +A1:2008	Safety of machinery. Human physical performance. Manual handling of machinery and component parts of machinery
BS EN 1005-3:2002 +A1:2008	Safety of machinery. Human physical performance. Recommended force limits for machinery operation
BS EN 1005-4:2005 +A1:2008	Safety of machinery. Human physical performance. Evaluation of working postures and movements in relation to machinery
BS EN 1672-2:2005 +A1:2009	Food processing machinery. Basic concepts. Hygiene requirements
BS EN 1837:1999+A1:2009	Safety of machinery. Integral lighting of machines
BS EN ISO 3744:2010	Acoustics. Determination of sound power levels and sound energy levels of noise sources using sound pressure. Engineering methods for an essentially free field over a reflecting plane
BS EN ISO 4413:2010	Hydraulic fluid power. General rules and safety requirements for systems and their components
BS EN ISO 4414:2010	Pneumatic fluid power. General rules and safety requirements for systems and their components
BS EN ISO 4871:2009	Acoustics. Declaration and verification of noise emission values of machinery and equipment
BS EN ISO 7010:2012 +A7:2017	Graphical symbols. Safety colours and safety signs. Registered safety signs
BS EN ISO 7731:2008	Ergonomics. Danger signals for public and work areas. Auditory danger signals
BS EN ISO 9614-1:2009	Acoustics. Determination of sound power levels of noise sources using sound intensity. Measurement at discrete points

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BS EN ISO 9614-3:2009	Acoustics. Determination of sound power levels of noise sources using sound intensity. Precision method for measurement by scanning
BS EN ISO 11161:2007 +A1:2010	Safety of machinery. Integrated manufacturing systems. Basic requirements
BS EN ISO 11200:2014	Acoustics. Noise emitted by machinery and equipment. Guidelines for the use of basic standards for the determination of emission sound pressure levels at a work station and at other specified positions
BS EN ISO 11201:2010	Acoustics. Noise emitted by machinery and equipment. Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections
BS EN ISO 11202:2010	Acoustics. Noise emitted by machinery and equipment. Determination of emission sound pressure levels at a work station and at other specified positions applying approximate environmental corrections
BS EN ISO 11203:2009	Acoustics. Noise emitted by machinery and equipment. Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level
BS EN ISO 11204:2010	Acoustics. Noise emitted by machinery and equipment. Determination of emission sound pressure levels at a work station and at other specified positions applying accurate environmental corrections
BS EN ISO 11205:2009	Acoustics. Noise emitted by machinery and equipment. Engineering method for the determination of emission sound pressure levels in situ at the work station and at other specified positions using sound intensity
BS EN ISO 11688-1:2009	Acoustics. Recommended practice for the design of low-noise machinery and equipment. Planning
BS EN 12198-1:2000 +A1:2008	Safety of machinery. Assessment and reduction of risks arising from radiation emitted by machinery. General principles
BS EN 12198-2:2002 +A1:2008	Safety of machinery. Assessment and reduction of risks arising from radiation emitted by machinery. Radiation emission measurement procedure

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BS EN 12198-3:2002 +A1:2008	Safety of machinery. Assessment and reduction of risks arising from radiation emitted by machinery. Reduction of radiation by attenuation or screening
BS EN ISO 13732-1:2008	Ergonomics of the thermal environment. Methods for the assessment of human responses to contact with surfaces. Hot surfaces
BS EN ISO 13732-3:2008	Ergonomics of the thermal environment. Methods for the assessment of human responses to contact with surfaces. Cold surfaces
BS EN ISO 13849-1:2015	Safety of machinery. Safety related parts of control systems. General principles for design
BS EN ISO 13849-2:2012	Safety of machinery. Safety-related parts of control systems. Validation
BS EN ISO 13850:2015	Safety of machinery. Emergency stop. Principles for design
BS EN ISO 13855:2010	Safety of machinery. Positioning of safeguards with respect to the approach speeds of parts of the human body
BS EN ISO 13856-1:2013	Safety of machinery. Pressure-sensitive protective devices. General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors
BS EN ISO 13856-2:2013	Safety of machinery. Pressure-sensitive protective devices. General principles for design and testing of pressure-sensitive edges and pressure-sensitive bars
BS EN ISO 13856-3:2013	Safety of machinery. Pressure-sensitive protective devices. General principles for design and testing of pressure-sensitive bumpers, plates, wires and similar devices
BS EN ISO 13857:2008	Safety of machinery. Safety distances to prevent hazard zones being reached by upper and lower limbs
BS EN ISO 14118:2018	Safety of machinery - Prevention of unexpected start-up
BS EN ISO 14119:2013	Safety of machinery. Interlocking devices associated with guards. Principles for design and selection
BS EN ISO 14120:2015	Safety of machinery. Guards. General requirements for the design and construction of fixed and movable guards
BS EN ISO 14122-1:2016	Safety of machinery. Permanent means of access to machinery. Choice of a fixed means of access between two levels
BS EN ISO 14122-2:2016	Safety of machinery. Permanent means of access to machinery. Working platforms and walkways
BS EN ISO 14122-3:2016	Safety of machinery. Permanent means of access to machinery. Stairways, stepladders and guard-rails

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BS EN ISO 14122-4:2016	Safety of machinery. Permanent means of access to machinery. Fixed ladders
BS EN ISO 14123-1:2015	Safety of machinery. Reduction of risks to health from hazardous substances emitted by machinery. Principles and specifications for machinery manufacturers
BS EN ISO 14123-2:2015	Safety of machinery. Reduction of risk to health from hazardous substances emitted by machinery. Methodology leading to verification procedures
BS EN ISO 14159:2008	Safety of machinery. Hygiene requirements for the design of machinery
BS EN ISO 14738:2008	Safety of machinery. Anthropometric requirements for the design of workstations at machinery. Anthropometric requirements for the design of workstations at machinery
BS EN 60204-1:2018	Safety of machinery. Electrical equipment of machines. General requirements
BS EN 61310-1:2008	Safety of machinery. Indication, marking and actuation. Requirements for visual, auditory and tactile signals
BS EN 61310-2:2008	Safety of machinery. Indication, marking and actuation. Requirements for marking
BS EN 61310-3:2008	Safety of machinery. Indication, marking and actuation. Requirements for the location and operation of actuators
BS EN 61496-1:2013	Safety of machinery. Electro-sensitive protective equipment. General requirements and tests
BS EN 62061:2005 +A2:2015	Safety of machinery. Functional safety of safety-related electrical, electronic and programmable electronic control systems

C-type standards: these deal with safety requirements for particular types of machine or groups of machine. When a C-type standard deviates from an A-type or B-type standard, the C-type standard takes precedence. NB the following list is not exhaustive.

BS EN 415-1:2014	Safety of packaging machines. Terminology and classification of packaging machines and associated equipment
BS EN 415-3:1999 +A1:2009	Safety of packaging machines. Form, fill and seal machines
BS EN 415-5:2006 +A1:2009	Safety of packaging machines. Wrapping machines
BS EN 415-6:2013	Safety of packaging machines. Pallet wrapping machines

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BS EN 415-7:2006 +A1:2008	Safety of packaging machines. Group and secondary packaging machines
BS EN 415-8:2008	Safety of packaging machines. Strapping machines
BS EN 415-10:2014	Safety of packaging machines. General Requirements
BS EN 618:2002 +A1:2010	Continuous handling equipment and systems. Safety and EMC requirements for equipment for mechanical handling of bulk materials except fixed belt conveyors
BS EN 619:2002 +A1:2010	Continuous handling equipment and systems. Safety and EMC requirements for equipment for mechanical handling of unit loads
BS EN 620:2002 +A1:2010	Continuous handling equipment and systems. Safety and EMC requirements for fixed belt conveyors for bulk materials
BS EN 1010-1:2004 +A1:2010	Safety of machinery. Safety requirements for the design and construction of printing and paper converting machines. Common requirements
BS EN 1034-1:2000 +A1:2010	Safety of machinery. Safety requirements for the design and construction of paper-making and finishing machines. Common requirements
BS EN ISO 10218-1:2011	Robots and robotic devices. Safety requirements for industrial robots. Robots
BS EN ISO 10218-2:2011	Robots and robotic devices. Safety requirements for industrial robots. Robot systems and integration
BS EN ISO 11553-1:2008	Safety of machinery. Laser processing machines. General safety requirements
BS EN 12622:2009 +A1:2013	Safety of machine tools. Hydraulic press brakes
BS EN 12717:2001 +A1:2009	Safety of machine tools. Drilling machines
BS EN 13736:2003 +A1:2009	Safety of machine tools. Pneumatic presses
BS EN ISO 16089:2015	Machine tools. Safety. Stationary grinding machines
BS EN ISO 16090-1:2018	Machine tools safety. Machining centres, Milling machines, Transfer machines. Safety requirements
BS EN ISO 16092-1:2018	Machine tools safety. Presses. General safety requirements
BS EN ISO 16092-3:2018	Machine tools safety. Presses. Safety requirements for hydraulic presses
BS EN ISO 16093:2017	Machine tools. Safety. Sawing machines for cold metal
BS EN ISO 23125:2015	Machine tools. Safety. Turning machines

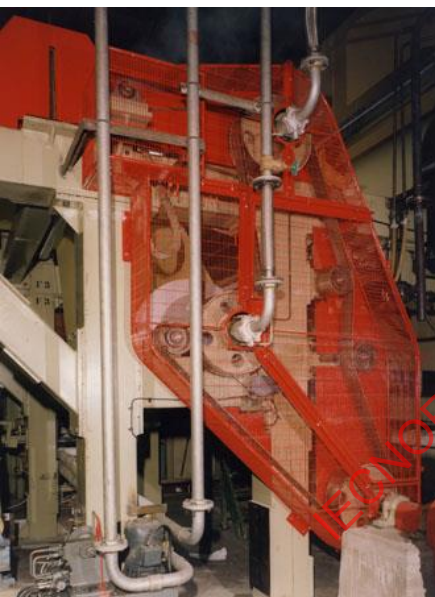
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Non-harmonised standards and other documents

BS EN 415-2:2000	Safety of packaging machines. Pre-formed rigid container packaging machines
BS EN 415-4:1998	Safety of packaging machines. Palletizers and depalletizers
BS EN 1005-5:2007	Safety of machinery. Human physical performance. Risk assessment for repetitive handling at high frequency
BS 4163:2014	Health and safety for design and technology in schools and similar establishments. Code of practice
BS 4531:1986	Specification for portable and mobile troughed belt conveyors
BS 5667-1:1979 (ISO 1819-1977)	Specification for continuous mechanical handling equipment - safety requirements. General
BS 6753:1986	Specification for shotbolts (solenoid operated) for guarding machinery
BS EN ISO 9614-2:1997	Acoustics. Determination of sound power levels of noise sources using sound intensity. Measurement by scanning
BS EN ISO/TR 11688-2:2001	Acoustics. Recommended practice for the design of low-noise machinery and equipment. Introduction to the physics of low-noise design
BS EN 13861:2011	Safety of machinery. Guidance for the application of ergonomics standards in the design of machinery
PD ISO/TR 18569:2004	Safety of machinery. Guidelines for the understanding and use of safety of machinery standards
PD ISO/TS 19837:2018	Safety of machinery. Trapped key interlocking devices. Principles for design and selection
PD ISO/TR 23849:2010 PD IEC/TR 62061-1:2010	Guidance on the application of ISO 13849-1 and IEC 62061 in the design of safety-related control systems for machinery
BS EN 61496-2:2013	Safety of machinery. Electro-sensitive protective equipment. Particular requirements for equipment using active opto-electronic protective devices (AOPDs)
PD IEC/TR 61496-4:2007	Safety of machinery. Electro-sensitive protective equipment. Particular requirements for equipment using vision based protective devices (VBPD)
PD IEC/TS 61496-4-2:2014	Safety of machinery. Electro-sensitive protective equipment. Particular requirements for equipment using vision based protective devices (VBPD). Additional requirements when using reference pattern techniques (VBPDPP)



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PD IEC/TS 61496-4-3: 2015	Safety of machinery. Electro-sensitive protective equipment. Particular requirements for equipment using vision based protective devices (VBPD). Additional requirements when using stereo vision techniques (VBPDEST)
17/30356573 DC (BS IEC 62046, draft for public comment)	Safety of machinery. Application of protective equipment to detect the presence of persons

Other types of machinery, from cranes to sewing machines, also have their own requirements. A full list of standards harmonised to the Machinery Directive is available on the European Commission's website (see 'Useful Resources' below).

Additional information is also available from the HSE's website: from the *I am interested in...* menu select *More topics* then select *Work equipment and machinery*; and from the *I work in...* menu select *More industries* then select *Engineering and Manufacturing*.



Do you have questions about machine guarding standards? Contact us:

02920 855 758 info@machinesafety.co.uk <https://www.machinesafety.co.uk/contact-us>

Risk assessment and reduction

Today the accepted approach to the design of any machine guarding system is based on [risk assessment](#). BS EN ISO 12100:2010 (which replaced BS EN ISO 14121-1, which itself replaced BS EN 1050) sets out different methods; these must take account of the probability and degree of possible harm relating to any foreseeable injury. More guidance on Risk Assessment can be found in the HSE's leaflet *Risk Assessment - A brief guide to controlling risks in the workplace* INDG163 (rev4), which has replaced the previous publication *Five steps to risk assessment*. Most HSE publications can be downloaded for free, or hard copies can be purchased.

A free *Risk Assessment Calculator* is also available from Procter Machine Safety. This is based on the requirements of the A-type harmonised standard BS EN ISO 12100:2010 and is designed to be simple to use, making extensive use of checklists (see 'Useful Resources' below).

Once a machine has been assessed, if the resultant risk is considered unacceptable, measures should be applied to reduce the risk rating — which often includes guarding. This iterative process is repeated until the measures applied reduce the risk to an acceptable level.

Risk reduction measures should be implemented in a hierarchical, three-step process:

1. Inherently safe design (ie design-out the hazards)
2. Safeguarding and complementary protective measures
3. Information for safe use

Additional measures may also be required such as training, safe working procedures, permit-to-work systems and personal protective equipment.



Contact us if you need help with Risk Assessments, PUWER Assessments or Machine Guarding Compliance Surveys

02920 855 758 info@machinesafety.co.uk <https://www.machinesafety.co.uk/contact-us>

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Working with the standards

BS EN ISO 14120, which is the main guarding standard (replacing BS EN 953), covers all machinery from simple drive couplings to very complex installations involving robots, conveyors and processing machinery. The standard lists those aspects of machinery, people and the design and construction of guards that need to be considered.

Machine aspects to be considered are, of course, the functions of the machine and the hazards arising from these. Obvious ones include entanglement or impact from moving parts, and less obvious ones are, for example, the potential for ejection of broken tools, hazardous materials and invisible emissions including noise and radiation. Guards should minimise exposure to these hazards by the selection of appropriate materials, construction methods and correct safety distances — as specified in BS EN ISO 13857.

Before starting the design

The successful design of machine guards needs a clear understanding of all the ways in which people interact with the machine at all phases of its life including commissioning, production and maintenance. Before designing any guarding, the designer should talk to the operators and maintenance staff who will use the machine; if the machine operates for more than one shift per day, the designer needs to talk to the operators and maintenance staff from all shifts because the working practices may not be the same.

Well-designed guards should permit machines to be loaded, unloaded, cleaned and maintained efficiently without exposing people to hazards (remember that around 25-30 per cent of fatal injuries in the manufacturing industries occur while maintenance is being carried out).

Design guidelines

Machine guarding can be constructed from a variety of materials and the skill of the designer lies in creating a system that will be fully compliant with the regulations and standards, yet will also be user-friendly, cost-effective and aesthetically pleasing. The main choice of infill materials is between sheet steel, welded wire mesh and clear polycarbonate — though sheet steel guards can also be provided with mesh or polycarbonate windows.

On machines where process viewing is necessary, adequate lighting must be provided to ensure compliance with BS EN 1837, *Safety of machinery. Integral lighting of machines*, and to discourage operatives from attempting to bypass the guarding.

If ejected parts are an issue, sheet steel or polycarbonate are typically chosen, while welded wire mesh (weldmesh) is cost-effective for many other applications. In corrosive environments or where frequent washdowns are required, stainless steel is preferred. If heavy use or abuse is anticipated, robust materials and methods of construction should be employed.

Noise reduction is increasingly important today, so acoustic foam or other sound-deadening material can be added to sheet metal panelling. Sealing around guards can also help to reduce noise levels, and sealing is highly beneficial if fluids or dust are present. In some cases the best option is to construct an acoustic enclosure around the machine.



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BS EN ISO 14120:2015 requires fixings for fixed guards to remain attached to the guard or the machinery when the guard is removed. While this appears to make the situation clear, in fact designers need to decide whether or not a guard (or other component with a secondary safety function) is a 'fixed guard' and whether or not it is foreseeable that the guard will be removed for maintenance, cleaning or other reasons (if not, then there is no need to use retained/captive fasteners). More information about fixings for fixed guards is available in a free White Paper from Procter Machine Safety, *How to specify fixings for machine guards* (see 'Useful Resources' below).

When designing either fixed or moving guarding, the designer should refer to the standard that covers safety distances to prevent hazard zones being reached, namely BS EN ISO 13857. A free *Safety Distance Calculator* is available from Procter Machine Safety for establishing the required safety distances and heights of machine guards in accordance with BS EN ISO 13857 (see 'Useful Resources' below).

The new Machinery Directive 2006/42/EC is more explicit in its requirements relating to ergonomics — and there are currently some 20 relevant Harmonised standards. Not all of these standards are required when designing machine guards, but it is clear that ergonomics cannot be ignored. Helpful information is available in a European Commission publication *Guidance on the application of the essential health and safety requirements on ergonomics*.

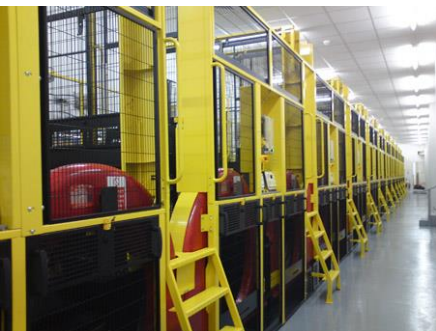
Access control

The section of BS EN ISO 14120 covering human aspects addresses the human/machine interaction, including reducing the need for frequent access and ensuring that, where the need for access cannot be eliminated, [access is controlled](#) so that the machine can only be approached when it is in a safe condition. This is usually achieved by interlocking the access guards/gates. The need for non-essential access can be reduced by, for example, designing guards with good process viewing and locating lubrication points outside the guarding.

If interlocks are required, it is vital to select components that are suitable for the machine's risks and safety-related control system, depending whether the designer is working to functional safety standard BS EN ISO 13849-1 or BS EN 62061. Typically the interlocks will be of the mechanical type using roller plungers or metal tongues, switches incorporated within hinges, or non-contact types utilising coded magnetic or electronic technologies.

Whichever type is selected, the switches must be installed correctly if they are to perform properly and not start to fail (either to a safe or unsafe condition) when the guard hinges or runners begin to wear. BS EN ISO 14119 gives more information about interlock selection.

For perimeter guards and machinery where whole-body access is possible, key exchange systems are often the most appropriate, as the person entering the guarded area can take a key with them to prevent the machine from being restarted (assuming the safe system of work is followed). If frequent access is required and the machine has a short stopping time, photo-electric guards can be very effective, though care must be taken to observe the correct distance between the guard and hazard (see BS EN ISO 13855). Other options are laser area scanners and pressure-sensitive mats.



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Conventional opening guards can be manually operated or powered. In the case of powered guards, it may be necessary to install 'safe edges' on the leading edges of the guards to prevent them becoming hazards themselves.

Two of the changes introduced when BS EN ISO 14120 replaced BS EN 953 relate to the choice of fixed or movable guards *where access is required only for machine setting, process correction or maintenance*.

- first, EN 953 states that movable guards should be used if the frequency of access is 'high (e.g. more than once per shift)' but now ISO 14120 defines 'high' as 'e.g. more than once per week';
- second, in EN 953 fixed guards should only be used 'if the foreseeable frequency of access is low, its replacement is easy, and its removal and replacement are carried out under a safe system of work', with no definition provided for 'low', so users were left to assume that 'low' is any frequency that falls outside the scope of 'high'. In contrast, ISO 14120 defines 'low' as 'e.g. less than once per week'.

There is an ambiguity here regarding whether fixed or movable guards should be used if access is required once per week (not more, not less), as this is a foreseeable situation (maintenance, calibration and checks/adjustments might be scheduled to take place weekly). It could be argued that the machine designer should err on the side of safety and specify (interlocked) movable guards rather than fixed guards that are removed and replaced under a safe system of work. On the other hand, the designer may be tempted to save costs by installing fixed guards that do not require hinges or linear bearings, or the interlock, wiring and additional inputs on the safety-related control system.

The other issue here is that under EN 953 the frequency of access was considered to be high if access was required more than once per shift; in contrast, ISO 14120 redefines 'high' as once per week, which could result in many more machines meeting this criterion and therefore having to be equipped with movable guards rather than fixed guards. The implications for design and manufacturing costs could be considerable.



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<https://www.machinesafety.co.uk/free-downloads>