

WHITE PAPER: BS EN ISO 14122 Safety of machinery – permanent means of access

2nd edition – June 2021



Overview

Steve Allen CMSE, a member of standards committee BSI MCE/3 (Safeguarding of machinery) and National Sales Manager at Procter Machine Safety, explains the requirements laid down in the 2016 edition of BS EN ISO 14122, Safety of machinery – Permanent means of access to machinery, Parts 1 to 4.

Introduction

It may seem strange that permanent means of access to machinery are related to machine guarding but, in fact, they are. Means of access, as with guarding, help to control access to machine-related hazards under different circumstances – such as operation, cleaning and maintenance – and should not themselves introduce significant new risks.

As with guards, when considering means of access the first approach should be to design-out the risks. For example, rather than require an access so point so that lubrication pointsequipment can be lubricated can be reached, lubrication points should be made accessible from ground level or a lubrication circuit and pump could be installed. Annex A of BS EN ISO 14122-1 provides examples of changes that can be made in a machine or system to improve access.

The status of the standard

BS EN ISO 14122 is in four parts, all of which are Harmonised to the European Machinery Directive 2006/42/EC and listed as designated standards for the UK's Supply of Machinery (Safety) Regulations. The four parts are all B-Type standards, meaning they deal with specific aspects of machinery safety and can be applied to a wide range of categories of machinery:

- **BS EN ISO 14122-1:2016 Safety of machinery** - *Permanent means of access to machinery - Part 1: Choice of fixed means and general requirements of access*
- **BS EN ISO 14122-2:2016 Safety of machinery** - *Permanent means of access to machinery - Part 2: Working platforms and walkways*
- **BS EN ISO 14122-3:2016 Safety of machinery** - *Permanent means of access to machinery - Part 3: Stairs, stepladders and guard-rails*
- **BS EN ISO 14122-4:2016 Safety of machinery** - *Permanent means of access to machinery - Part 4: Fixed ladders*

The BS prefix indicates that these are published by BSI as British standards and the EN indicates they are Euronorms. All four parts are technically identical to the international standards (indicated by ISO). The UK's stated intention is that the Supply of Machinery (Safety) Regulations will continue to align with the European Machinery Directive, and the corresponding designated British standards will remain aligned with the European harmonised standards.

Note that the standard is sometimes incorrectly referred to as, for example, BS 14122, EN 14122 or BS EN 14122, but the correct usage in the UK is BS EN ISO 14122.

Compliance with any individual part of the standard on its own cannot provide a presumption of conformity to the Essential Health and Safety Requirements (EHSRs); a presumption of conformity can only be claimed by complying with part 1 and one of the 'access-specific' Parts 2, 3 or 4. The EHSRs with which BS EN ISO 14122 provides a presumption of conformity are stated in Annex ZA, and this is the same for all four parts:

- 1.5.15 Risks of slipping, tripping or falling
- 1.6.2 Access to operating position and service points

As with other Type-B standards, if there is a Type-C standard for the class of machine in question, then that standard will take precedence over BS EN ISO 14122.

...The status of the standard

Remember that compliance with standards is not mandatory but is strongly recommended. For a new machine that is being UKCA marked to the Supply of Machinery (Safety) Regulations or CE marked to the Machinery Directive, working to the standard gives a presumption of conformity to the relevant EHSRs; without the standard, it is necessary to demonstrate that the EHSRs have been fulfilled by some other means. Similarly, for an existing permanent means of access, an HSE (Health and Safety Executive) inspector would consider compliance with the standard to be demonstrating that 'best practice' has been applied, even though the standard states that it is not applicable to machinery manufactured before the date of publication.

A final point to note is that ISO 14122 Part 5 is in preparation, which will deal with permanent means of access on mobile machinery.

What is a permanent means of access?

A permanent means of access is fixed to the machine or an adjacent structure in such a way that it cannot be removed without the use of tools. As well as applying to rigidly attached means of access, the standard also applies to non-powered adjustable or movable parts such as sliding or folding ladders.

Furthermore, the standard applies to parts of the building or civil construction if the main function of these is to provide access to the machine. For the purposes of BS EN ISO 14122, permanent means of access are working platforms, walkways, stairs, stepladders, guard rails and fixed ladders. However, the scope of the standard specifically excludes powered means of access (lifts, escalators or other devices designed to move persons between levels).

BS EN ISO 14122 Part 1: Choice of fixed means and general requirements of access

Part 1 contains useful definitions, such as those for fixed ladder, stepladder, stair and ramp (essentially the differences relate to the angle of pitch, and ladders have rungs whereas stepladders and stairs have steps). When most people refer to stepladders they probably mean a short ladder with folding legs that enable it to be free-standing. However, BS EN ISO 14122 defines stepladder as a *fixed means of access with an angle of pitch from more than 45° up to 75°, whose horizontal elements are steps*.

Clause 4 of Part 1 lists the most significant hazards to consider when determining the type and location of the means of access. An additional note draws attention to other possible hazards, and the reader is also reminded of ISO 12100 relating to risk assessments. Where there are hazards not covered by the standard, such as moving parts of machinery, extreme temperatures or hazards caused by the environment, the standard says these should be considered and addressed by, for example, preventing unauthorised access. In other words, when designing and specifying means of access, consideration should be given to preventing unauthorised access.

One issue that is not addressed particularly well in the standard is the question of under what circumstances a permanent means of access is required, though an ISO 12100 risk assessment will help. A good starting point is the HSE's *Working at height – A brief guide* (ref INDG401 rev2), which states that ladders and stepladders can be used for tasks of low risk and short duration (less than 30 minutes). Furthermore, three-point contact needs to be maintained except for very brief periods (eg starting a screw), heavy objects should not be carried, leaning ladders should be secured and, if stepladders are used and side loads are imposed, then the stepladder should be secured. In general, if it is anticipated that regular access will be required for machine operation, cleaning or maintenance, then a permanent means of access should be given due consideration (see also Clause 5 below). Furthermore, a permanent means of access can prove to be very cost-effective compared with erecting scaffolding on multiple occasions.

Clause 5 lists the general requirements for design and construction of means of access. As well as covering all the obvious points, including selection of components and use of compatible materials, this clause also states clearly that 'wherever practicable, a fixed installation shall be provided.'

BS EN ISO 14122 Part 1: Choice of fixed means and general requirements of access

Clause 6, *Requirements for the selection of the fixed means of access*, states that there shall be a 'safe and convenient means of access to all of the intervention zones and points of the machine where the need for access can be foreseen during the whole life cycle of the machine.' While it gives the examples of setting, feeding and maintenance, strictly speaking the whole life cycle includes installation, commissioning and also end-of life decommissioning, dismantling and disposal. However, the use of 'where practicable' could be interpreted as meaning a fixed means of access is not necessary if it is only to be used for these phases at the beginning and end of the machine's life cycle.

Note that subclause 6.2, *Preferred means of access*, provides a hierarchy to be followed 'as far as practicable': access directly from ground level or from a floor; ramps or stairs; stepladders or fixed ladders. References are made to other subclauses that help in determining which type of access should be selected, but the point to note is that there must be good reasons for using any means of access other than those listed higher up the hierarchy.

Following on from the above, subclause 6.3.2 states that the choice of means of access must take into account ergonomics and risk – and if an ISO 12100 risk assessment shows the risk to be too great, the machine design must be changed.

Annex A gives examples of changes that can be made to the machine or system to make better access possible. As mentioned above, this includes useful suggestions such as making lubrication points accessible from ground level or installing a lubrication circuit and pump, but it also includes more significant changes – for example, 'consider the position of pillars, beams, pipelines, cable trays, platforms, storage tanks, etc.'

Annex B lists the significant technical changes between ISO 14122-1:2016 and the previous edition, which will be helpful to readers who have been working to the earlier edition.

BS EN ISO 14122 Part 2: Working platforms and walkways

This is the first of the ‘*access-specific*’ parts of BS EN ISO 14122 and, as mentioned above, must be used in conjunction with Part 1. However, it is almost inevitable that Part 3 will also be required, because this covers the guard-rails that are usually necessary with platforms and walkways.

Subclause 4.2, *Specific requirements*, provides ample detail to aid the specification and design walkways and platforms. Interestingly, a pragmatic approach is adopted, with several exceptions allowed under particular circumstances. For example, ‘for a short distance of less than 2000 mm, the clear width, *w*, may be reduced from 600 mm to 500 mm.’

Subclause 4.2.4.7, *Slip hazards*, refers to floorings being designed and manufactured to reduce the risk of slipping and ramps of pitch angles between 10° and 20° to which ribs can be attached with widths between 10 and 20 mm and heights of 10 to 20 mm. However, great care should be taken with ribbed ramps, bearing in mind that subclause 4.2.4.4, *Trip hazards*, states that ‘the greatest difference between the tops of neighbouring floor surfaces shall not exceed 4 mm in height.’

Unlike Parts 3 and 4 of the standard, BS EN ISO 14122-2 has no clause relating to verification of the safety requirements. Nevertheless, it would be prudent to verify the safety requirements either by calculation or testing.

Annex A relates to methods for determining slip resistance and starts by stating that no international standard currently exists. However, Annex A refers to four French, one German and three UK documents, details for which are listed in the Bibliography.

Annex B lists the significant technical changes between ISO 14122-2:2016 and the previous edition, which will be helpful to readers who have been working to the earlier edition.

BS EN ISO 14122 Part 3: Stairs, stepladders and guard-rails

As with Part 2, this second ‘access-specific’ part of BS EN ISO 14122 must be used in conjunction with Part 1. If guard-rails are being installed alongside platforms or walkways, Part 3 will have to be used in conjunction with Part 2 as well.

Clause 3, *Terms and Definitions*, provides a common definition for both stairs and stepladders, but readers are referred to the relevant subclauses in Part 1 of the standard for details of the angle of pitch (essentially stairs have an angle of pitch of more than 20° up to 45°, while stepladders have an angle of pitch from more than 45° up to 75°).

Another point to note from the definitions is that handrails must be rigid, which precludes the use of ropes, chains or cables.

Clause 4 presents the *General requirements* for stairs, stepladders and guard-rails, including the loadings to be used in strength and deflection calculations when designing these structures.

Clause 5, *Specific requirements* applicable to stairs, provides further information for designing stairs. Some leeway is provided for designers, as shown by this example from subclause 5.8: *Due to the design of the machine, the environment or occasional use, eg less than 30 days/year and less than two hours/day, the clear width, w, may be reduced from 800 mm to 600 mm.*

Clause 6, *Specific requirements applicable to step ladders*, provides similar details to those in Clause 5. [NB Clause 6 refers to ‘step ladders’ whereas ‘stepladders’ is used elsewhere in this and the other parts of BS EN ISO 14122.]

Clause 7, *Specific requirements* applicable to guard-rails, states that guard-rails shall be installed when the height of the possible fall exceeds 500 mm, if the gap between the platform and machine structure exceeds 180 mm or if the protection provided by the structure is not equivalent to a guard-rail.

Subclause 7.1.3 states that the height of the handrail shall be less than or equal to 1100 mm. However, the same subclause states that the minimum height of the guard-rail shall be 1100 mm, so it appears that the former is a typographical error and the height of the handrail should be greater than or equal to 1100 mm.

As well as providing requirements for guard-rails on platforms, stairs and stepladders, Clause 7 also gives details for toe plates, self-closing gates and mezzanine gates. to the earlier edition.

...BS EN ISO 14122 Part 3: Stairs, stepladders and guard-rails

Clause 8, *Verification of safety requirements*, gives a choice of testing or calculation. The clause goes on to provide details of how to test guard-rails and the steps of a stair. For testing stepladders, the reader is referred to EN 131-2, *Ladders. Requirements, testing, marking*. If the designer chooses to verify the safety requirements by calculation, the information relating to the test methods must be taken into account so that the two verification methods are comparable.

According to Annex A, which lists the significant technical changes between ISO 14122-3:2016 and the previous edition, Clause 8 has been completely modified. Designers should therefore check the revised Clause 8 with care to ensure that their designs' safety requirements are being correctly verified.

Annex B lists the significant technical changes between ISO 14122-3:2016 and the previous edition, which will be helpful to readers who have been working to the earlier edition.

BS EN ISO 14122 Part 4: Fixed ladders

As with Parts 2 and 3, this third ‘access-specific’ part of BS EN ISO 14122 must be used in conjunction with Part 1, and Part 4 only provides a presumption of conformity with the Essential Health and Safety Requirements 1.5.15 (risks of slipping, tripping or falling) and 1.6.2 (access to operating points and service points) when used in conjunction with Part 1.

Clause 3, *Terms and definitions*, introduces ‘ladder systems’ that comprise at least one ladder, fall protection (where appropriate) and landings and/or platforms.

Clause 4, *Selection and design of ladder systems*, provides some of the information required by the designer, but more is contained in Clause 5. Subclause 4.2, *Choice of a type of fall protection device*, states that a fall protection device is required when the overall falling height is 3000 mm or more. Subclause 4.2.2 then states that the ‘main alternatives’ are safety cages and guided type fall arrestors, with the former being preferred because safety cages are not reliant on the operator’s actions (notes under subclauses 4.3.2 and 4.3.3 also state that fall arrestors are intended to be used only by well-trained persons). Subclause 4.2.2 states that a combination of safety cage and fall arrestor shall not be applied. While these two types of fall protection are presented as the ‘main alternatives’, this subclause says nothing about further alternatives. However, subclause 4.3.1, *Limits of space*, states that surrounding structures such as walls or parts of the machine can provide protection equivalent to a safety cage when they provide a containment area with dimensions similar to those given for safety cages.

Clause 5, *Specific requirements of ladder systems*, provides extensive information relating to ladder design, including the profiles and dimensions of rungs (round rungs are not permitted). Subclause 5.2.2.4, which considers the shape of rungs, also states that ‘the surface of the rung shall have a slip resistant walking surface which causes no injuries to hands.’ However, it goes on to refer readers to ISO 14122-2 Annex A (*Different methods of determining levels of slip resistance*) because there is currently no international standard on enhanced slip resistance.

Earlier this White Paper mentioned the need to prevent unauthorised access. Subclause 5.4, *Departure and arrival areas*, considers this and states that an ‘anti-climb’ device shall be applied (see also Annex A below). If an anti-climb device is fitted to a ladder, a written warning or audible signal is not adequate for access control.

...BS EN ISO 14122 Part 4: Fixed ladders

Unlike BS EN ISO 14122-3, which permits verification of safety requirements by calculation or testing, BS EN ISO 14122-4 subclause 5.5.1.1, *Strength*, states that the strength verification of a safety cage shall be made by testing – with no option for calculation permitted. However, see Clause 6 below.

Clause 6, *Verification of safety requirements*, appears to contradict subclause 5.5.1.1, as subclause 6.1.1, *General requirements*, states that assessment shall be by measurement, visual inspection and calculation and/or load test.

Annex A, Requirements for the design of anti-climb devices, is normative and should therefore be complied with (often an Annex to a standard is informative only). Under A.1, *General*, there is a note stating that an anti-climb device is considered to be a guard, so readers are referred to ISO 14120, *Safety of machinery. Guards. General requirements for the design and construction of fixed and movable guards*.

Subclause A.2.3, *Testing*, explains the tests required for door-type anti-climb devices and hatch covers. There is no option in the Annex for verifying the safety requirements by calculation.

Annex B (informative) illustrates the main dimensions on a fixed ladder equipped with a safety cage.

Annex C lists the significant technical changes between ISO 14122-4:2016 and the previous edition, which will be helpful to readers who have been working to the earlier edition.

Compliance surveys

Procter Machine Safety offers **Machine Guarding Compliance Surveys** of standalone machinery and assemblies of machines, old or new, and can also assess permanent means of access.

After an initial telephone consultation, Procter's safety engineers can make an appointment to undertake a site visit and assess the machinery or means of access.

As part of the survey, the safety engineers provide a short written report that identifies areas of non-compliance and actions that can be taken to reduce risk, improve safety and comply with PUWER. Importantly, rather than just leaving a list of 'problems', the company can also provide 'solutions' in the form of a quote and, if requested, can carry out the work to make the machinery or means of access compliant.

Useful resources

These are all available free of charge on request or to download.

Email: info@machinesafety.co.uk

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

Risk Assessment Calculator

Based on the requirements of BS EN ISO 12100 and designed to be simple to use.

Safety Distance Calculator

Establishes machine guard safety distances and heights in accordance with BS EN ISO 13857.

On Your Guard: A Designer's Guide to Machine Guarding Standards

A list of current machine guarding standards and advice for designing standards-compliant machine guards.

Guide to the New Machinery Directive 2006/42/EC

To help companies comply with the Directive that came into force on 29 December 2009.

White paper: Machinery Directive and Fixings for Fixed Guards

Explains the recently amended requirements for fixings for fixed guards. Note that the requirements for guard fixings are the same under the UK's Supply of Machinery (Safety) Regulations.

White paper: CE Marking of Machine Guards

Explains the requirements relating to CE marking of guards under the European Machinery Directive. Note that the technical requirements are the same for UKCA marking guards under the UK's Supply of Machinery (Safety) Regulations.

White paper: EN 349, Minimum Gaps to Avoid Crushing

Explains the requirements in the standard for minimum gaps to prevent crushing.

Note: EN 349 has been superseded by EN ISO 13854 but the contents of this white paper are still valuable.

White paper: Conveyor Guarding

Outlines the hazards associated with conveyors, the relevant regulations and standards, and provides advice for guarding.

White paper: Differences Between BS EN 953 and BS EN ISO 14120

Explains what changes were introduced in BS EN ISO 14120 when it replaced BS EN 953. White paper: The 2014 Edition of PD 5304

Explains the changes in the 2014 edition of BSI's Guidance on safe use of machinery.

White paper: The 2014 Edition of PD 5304

Explains the changes in the 2014 edition of BSI's Guidance on safe use of machinery.

White paper: Machine Guards for PUWER

Explains the requirements for machine guarding with respect to the Provision and Use of Work Equipment Regulations.

Guide to Workshop Safety

Advice for guarding small machine tools typically used in workshops.

Machine Accident Investigation Kit

Helps companies meet their statutory obligations and prevent future accidents.

Ergonomics guidance

European Commission publication Guidance on the application of the essential health and safety requirements on ergonomics. Note that the guidance is equally applicable to the UK's Supply of Machinery (Safety) Regulations.

Download: <https://ec.europa.eu/growth/sectors/mechanical-engineering/machinery>

Working at height – A brief guide (ref INDG401 rev2)

HSE guidance on compliance with the Work at Height Regulations 2005 (WAHR).

Download: <https://www.hse.gov.uk/pubns/indg401.htm>

Safe use of ladders and stepladders – A brief guide (INDG455)

HSE guidance on simple, sensible precautions to take when using ladders and stepladders.

Download: <https://www.hse.gov.uk/pubns/indg455.htm>

Further information

- **Procter Machine Safety**
(bespoke guards, modular perimeter guards, Nelsa standard machine shop guards and custom designed permanent means of access)
Tel: 02920 855 758
Email: info@machinesafety.co.uk — Website: <https://www.machinesafety.co.uk>
- **BSI**
Tel: 0345 086 9001
Email: cservices@bsigroup.com — Website: <https://shop.bsigroup.com>
- **Health and Safety Executive**
Tel: 0300 003 1747
Website: <https://www.hse.gov.uk>
- **HSE Books**
Note: most publications are now available to download for free as PDF files.
Tel: 0333 202 5070
Email: hseorders@tso.co.uk — Website: <https://books.hse.gov.uk>
- **Department for Business, Energy & Industrial Strategy (BEIS)**
Tel: 020 7215 5000
Email: enquiries@beis.gov.uk — Website: www.gov.uk/beis
Designated standards: <https://www.gov.uk/government/publications/designated-standards-machinery>
- **European Commission**
List of standards harmonised to the Machinery Directive 2006/42/EC, official guide to the application of the Machinery Directive and guidance on ergonomics and safety fences used as safety components.
Website: <https://ec.europa.eu/growth/sectors/mechanical-engineering/machinery>

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