



Machine Guards

White Paper 9 Trapped Key Interlocking

1st edition – November 2018

PD ISO/TS 19837:2018 recommendations for trapped key interlocks

Steve Allen CMSE, a Member of BSI's MCE/3 committee, Certified Machinery Safety Expert and National Sales Manager for Procter Machine Safety, considers PD ISO/TS 19837:2018 'Safety of Machinery – Trapped key interlocking devices – Principles for design and selection' and its implications in relation to machine guarding.

Background

Trapped key interlocking is widely used for controlling access to dangerous parts of machinery. While some systems are straightforward, others can be complex, with multiple locks and keys requiring actions to be completed in a defined order before access can be obtained in a safe manner. Furthermore, a properly implemented trapped key system will also prevent the machine from being restarted until all personnel have left the danger zone. Trapped key interlocking can be used in a variety of hazardous situations but this white paper only considers their application in relation to machine guards.

Manufacturers and suppliers of trapped key interlocking devices have always provided advice on their correct use. Furthermore, international standard ISO 14119:2013 *Safety of machinery - Interlocking devices associated with guards - Principles for design and selection* covers the design and manufacture of such devices (the equivalent in the UK is BS EN ISO 14119:2013). More recently, however, it was felt that better recommendations were required for the application of trapped key interlocking devices on machine guards, so ISO Technical Committee ISO/TC 199 *Safety of machinery* was tasked with preparing guidance. This has been published as a Technical Specification (which does not carry the same weight as a standard) ISO/TS 19837:2018 *Safety of machinery – Trapped key interlocking devices – Principles for design and selection*. This has been adopted in the UK and published by BSI as a Published Document PD ISO/TS 19837:2018.

Is ISO/TS 19837:2018 a standard?

ISO/TS 19837:2018 (and PD ISO/TS 19837:2018) is not a standard, so it is unlikely to be harmonised to the Machinery Directive 2006/42/EC. At the time of writing there is only one international technical specification that has been harmonised, namely EN 15811:2014 *Agricultural machinery – Fixed guards and interlocked guards with or without guard locking for moving transmission parts* (ISO/TS 28923:2012 modified). Nevertheless, complying with standards is not mandatory, whereas machines placed on the market in Europe must meet the Essential Health and Safety Requirements of the Machinery Directive, taking into account the state of the art. Machine builders are therefore strongly advised to follow the recommendations in ISO/TS 19837:2018 when designing and specifying trapped key interlocking systems on machine guards.

We will now consider the contents of PD ISO/TS 19837:2018 in more detail.

Clause 1 - Scope

ISO/TS 19837:2018 makes it clear in the *Scope* that it is to be used in conjunction with ISO 14119 (EN ISO 14119 in Europe and BS EN 14119 in the UK) and that ISO 14119 always applies except where an exception is given in ISO/TS 19837. For the avoidance of doubt, EN ISO 14119:2013 is currently harmonised to the Machinery Directive.

Clause 2 - Normative references

As you would expect, ISO 14119:2013 is included in the list of normative references. Others listed are ISO 13849-1, ISO 13849-2 and IEC 60947-1:2008 (NB although the date of this last standard is stated as 2008, the IEC website shows the latest version to be IEC 60947-1:2007+A1:2010+A2:2014).

Although ISO 12100, IEC 60204-1 and IEC 62061 are not in the list of normative references, they can be found in the bibliography. Interestingly, ISO 14120 is not mentioned anywhere in ISO/TS 19837.

Clause 3 - Terms and definitions

As this Technical Specification covers a specific topic in detail, Clause 3, *Terms and definitions*, is extensive. While some of these terms might be considered to be obvious (eg 3.5 **access lock** – trapped key interlocking device used to lock movable guards), other terms are defined in detail and will be very helpful when specifying complex trapped key interlocking systems.

Clause 4 - Symbols and abbreviated terms

The Symbols and abbreviated terms in Clause 4 will be invaluable for creating unambiguous diagrams to show the logical flow of events when, typically, key exchange devices are used to isolate equipment and allow access to safeguarded areas.

Clause 5 - Operating principles and typical forms of trapped key interlocking system

The contents of Clause 5 may well be known already to those who are familiar with implementing trapped key interlocks but, for newcomers to the topic, this clause provides a good primer; indeed, running to more than eight pages, the text and illustrations form a substantial portion of the overall document.

Clause 6 - General requirements for the design of trapped key interlocking device

This clause relates more to the design of interlocking devices than their application, so is likely to be of less interest to machine builders, guard designers and specifiers of trapped key interlocking systems. Nevertheless, there are some details worth noting. For instance: subclause 6.3.3 states that the mechanical life shall be at least 200,000 switching cycles;

subclause 6.3.4 states the torques to be withstood by a rotary actuator; and subclause 6.3.5 gives the minimum pull-out force for a trapped key.

Subclause 6.6, *Validating Performance Level*, contains information that will assist in the design of a safety-related control system (SRCS) to achieve the required Performance Level (PLr) when a trapped key system is incorporated. In addition, subclause 6.7, *Design to minimise defeat*, makes recommendations that will aid system specification and design to prevent misuse by operatives and maintenance technicians.

Clause 7 – System configuration

Machine builders, guard designers and specifiers of trapped key interlocking systems will find Clause 7 essential reading. This clause provides recommendations for system configuration, covering key coding, the key transfer plan and system selection.

Clause 8 – Information for use

This clause refers to the information for use that should be provide as per the requirement in ISO 14119 and states that, in addition, a key transfer plan and list of fault exclusions shall be provided.

Annexes

After the main body of the Technical Specification there are four annexes. The first presents examples of trapped key interlock devices, complete with illustrative diagrams, together with an example of a machine safeguarded with trapped key interlocks. Annex B concerns failure modes for trapped key systems and is intended for use when undertaking an FMEA (failure modes and effects analysis). Annex C shows how safety functions and sub-systems in a trapped key application can be divided to allow validation in accordance with ISO 13849-1 and ISO 13849-2. Finally, Annex D contains a flow diagram for selecting trapped key interlocking devices.

Conclusion

If you are responsible for specifying, designing, installing or maintaining trapped key interlocking systems on machine guards, PD ISO/TS 19837:2018 is an important document, though some parts of it will be more useful than others. While there is no legal requirement to comply with the recommendations, doing so would be viewed as applying the 'state of the art' and 'best practice' – and is undoubtedly the wisest approach to take.

As always, a risk assessment should be undertaken before implementing a trapped key interlocking system and appropriate measures taken to reduce risks to an acceptable level. This may well involve developing safe systems of work (safe operating procedures) to ensure that, for example, only authorised personnel have access to appropriate keys, and persons entering dangerous areas always take a key with them to prevent the machine being restarted until everyone has exited to a safe area and returned all of the keys to their respective locations.

If you need assistance with implementing trapped key interlocking systems, contact Procter Machine Safety with your questions. Procter Machine Safety is the UK's leading machinery guarding specialist and has published numerous White Paper, guides and calculators relating to machine guarding and machinery safety standards, all of which can be downloaded free of charge from the website at <https://www.machinesafety.co.uk/free-downloads>. Alternatively, contact Procter Machine Safety to discuss specific machine guarding requirements by telephoning 02920 855758 or emailing info@machinesafety.co.uk.

Published by

Procter Machine Safety
Pantglas Industrial Estate
Bedwas
Caerphilly
CF83 8XD

Tel: 02920 855758
Email: info@machinesafety.co.uk
Website: www.machinesafety.co.uk

The information contained in this publication is intended as a guide only and is believed to be correct at the time of going to press. However, it is the reader's responsibility to ensure that all applicable legislation is complied with when specifying, designing or modifying machinery guarding and interlocking systems.

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