BS EN ISO 13850:2015

BSI Standards Publication

Safety of machinery — Emergency stop function — Principles for design

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN ISO 13850:2015. It supersedes BS EN ISO 13850:2008 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/3, Safeguarding of machinery.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2015

ISBN 978 0 580 79267 0

ICS 13.110

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2015.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 13850

November 2015

ICS 13.110

Supersedes EN ISO 13850:2008

English Version

Safety of machinery - Emergency stop function - Principles for design (ISO 13850:2015)

Sécurité des machines - Fonction d'arrêt d'urgence - Principes de conception (ISO 13850:2015)

Sicherheit von Maschinen - Not-Halt - Gestaltungsleitsätze (ISO 13850:2015)

This European Standard was approved by CEN on 5 September 2015.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN ISO 13850:2015 E

European foreword

This document (EN ISO 13850:2015) has been prepared by Technical Committee ISO/TC 199 "Safety of machinery" in collaboration with Technical Committee CEN/TC 114 “Safety of machinery” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2016, and conflicting national standards shall be withdrawn at the latest by May 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 13850:2008.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 13850:2015 has been approved by CEN as EN ISO 13850:2015 without any modification.

Annex ZA
(informative)

Relationship between this International Standard and the Essential Requirements of EC Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements 1.2.4.3 of the New Approach Directive Machinery 2006/42/EC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EC Directives may be applicable to the product(s) falling within the scope of this standard.

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 199, *Safety of machinery*.

This third edition cancels and replaces the second edition (ISO 13850:2006), which has been technically revised.

Introduction

The structure of safety standards in the field of machinery is as follows.

a) Type-A standards (basic safety standards) give basic concepts, principles for design, and general aspects that can be applied to machinery.

b) Type-B standards (generic safety standards) deal with one or more safety aspect(s) or one or more type(s) of safeguard that can be used across a wide range of machinery:

   — type-B1 standards on particular safety aspects (e.g. safety distances, surface temperature, noise);

   — type-B2 standards on safeguards (e.g. two-hands controls, interlocking devices, pressure sensitive devices, guards).

c) Type-C standards (machinery safety standards) deal with detailed safety requirements for a particular machine or group of machines.

This International Standard is a type-B2 standard as stated in ISO 12100.

When provisions of a type-C standard are different from those which are stated in type-A or type-B standards, the provisions of the type-C standard take precedence.

INTERNATIONAL STANDARD **ISO 13850:2015(E)**

Safety of machinery — Emergency stop function — Principles for design

1 Scope

This International Standard specifies functional requirements and design principles for the emergency stop function on machinery, independent of the type of energy used.

It does not deal with functions such as reversal or limitation of motion, deflection of emissions (e.g. radiation, fluids), shielding, braking or disconnecting, which can be part of the emergency stop function.

The requirements for this International Standard apply to all machines, with exception to:

— machines where an emergency stop would not reduce the risk;

— hand-held or hand-operated machines.

NOTE The requirements for the realization of the emergency stop function based on electrical/electronic technology are described in IEC 60204-1.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4413, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

ISO 4414, *Pneumatic fluid power — General rules and safety requirements for systems and their components*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13849-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

IEC 60204-1:2005, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60947-5-5:2005, *Low-voltage switchgear and controlgear — Part 5-5: Control circuit devices and switching elements — Electrical emergency stop device with mechanical latching function*

IEC 62061, *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100:2010 and the following apply.

3.1
emergency stop (E-stop)
emergency stop function
function which is intended to

— avert arising or reduce existing hazards to persons, damage to machinery or to work in progress, and

— be initiated by a single human action

[SOURCE: ISO 12100:2010, 3.40]

3.2
emergency stop equipment
safety related parts of a control system which perform the emergency stop function

Note 1 to entry: Typically emergency stop equipment is divided into input, processing and output elements.

3.3
emergency stop device
manually actuated control device used to initiate an emergency stop function

[SOURCE: IEC 60947-5-5:2005, 3.2]

3.4
machine actuator
power mechanism of the machine used to effect motion

Note 1 to entry: Example of machine actuators are motor, solenoid, pneumatic or hydraulic cylinder.

3.5
safety function
function of a machine whose failure can result in an immediate increase of risk(s)

[SOURCE: ISO 12100:2010, 3.30]

3.6
span of control of emergency stop device(s)
predetermined section of the machinery under control of specific emergency stop device(s)

3.7
protective shroud
mechanical measure provided to reduce the possibility of unintended actuation of an emergency stop device

3.8
emergency situation
hazardous situation needing to be urgently ended or averted

Note 1 to entry: An emergency situation can arise during normal operation of the machine (for example due to human interaction or as a result of external influences) or as a consequence of a malfunction or failure of any part of the machine.

[SOURCE: ISO 12100:2010, 3.38, modified]

3.9
operator control station
assembly of one or more control actuators fixed on the same panel or located in the same enclosure

Note 1 to entry: Actuator is a part of a device to which an external manual action is to be applied (see IEC 60204-1:2005, 3.1).

[SOURCE: IEC 60204-1:2005, 3.13, modified.]

4 Safety requirements

4.1 General requirements

4.1.1 Emergency stop function

4.1.1.1 The purpose of the emergency stop function is to avert actual or impending emergency situations arising from the behaviour of persons or from an unexpected hazardous event.

The emergency stop function is to be initiated by a single human action.

4.1.1.2 The emergency stop function shall be available and operational at all times. It shall override all other functions and operations in all operating modes of the machine without impairing other protective functions (e.g. release of trapped persons, fire suppression).

When the emergency stop function is activated:

— it shall be maintained until it is manually reset;

— it shall not be possible for any start command to be effective on those operations stopped by the initiation of the emergency stop function.

The emergency stop function shall be reset by intentional human action. Resetting of the emergency stop function shall be operated by disengagement of an emergency stop device (see 4.1.4). The reset shall not initiate machine start up.

NOTE The emergency stop function cannot be considered as measure of prevention of unexpected start up as described in ISO 12100.

4.1.1.3 The emergency stop function is a complementary protective measure and shall not be applied as a substitute for safeguarding measures and other functions or safety functions.

4.1.1.4 The emergency stop function shall not impair the effectiveness of other safety functions.

NOTE For this purpose, it can be necessary to ensure the continuing operation of auxiliary equipment such as magnetic chucks or braking devices.

4.1.1.5 The emergency stop function shall be so designed, that after actuation of the emergency stop device, hazardous movements and operations of the machine are stopped in an appropriate manner, without creating additional hazards and without any further intervention.

NOTE An “appropriate manner” can include:

— choice of an optimal deceleration rate taking into account the necessary design restraints of the machine;

— selection of the stop category (see 4.1.3);

— necessity for a predetermined shutdown sequence.

Depending on the machine and the specific risks, the emergency stop function can initiate other functions other than stopping to minimize the risk of harm (e.g. reversal or limitation of motion, rate of braking) which can be part of the emergency stop function but not dealt with in this International Standard.

4.1.1.6 The emergency stop function shall be so designed that a decision to activate the emergency stop device does not require the consideration of the resultant effects.

4.1.2 Span of control of emergency stop device(s)

The span of control of each emergency stop device shall cover the whole machine. As an exception, a single span of control may not be appropriate when, for example, stopping all linked machinery could create additional hazards or unnecessarily affect production.

Each span of control can cover section(s) of a machine, an entire machine or a group of machines (see Figure 1).

Different spans of control may overlap.

The assignment of spans of control shall be determined taking into account the following:

a) the physical layout of the machine, based on the visible area of the machine;

b) the possibility to recognize hazardous situations (e.g. visibility, noise, odour);

c) any safety implications relating to the production process;

d) the foreseeable exposure to hazards;

e) the possible adjacent hazards.

4.1.2.1 More than one span of control can be applied, if the following requirements are met:

— the spans of control shall be clearly defined and identifiable;

— emergency stop devices shall be readily associated with the hazard requiring an emergency stop;

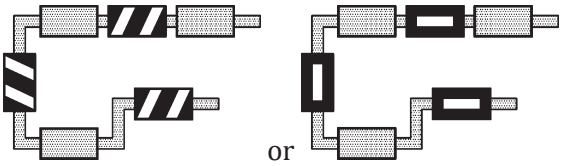
— the span of control of an emergency stop device shall be identifiable at the operating position of each emergency stop device (see also 4.1.1.6).

NOTE The clear identification could be realized by pictogram or by the location itself. Reading text or instructions associated to the emergency stop device or requiring prior knowledge should be avoided.

EXAMPLE Such pictogram could be place next to an emergency stop device and would indicate the span of control of the device itself.


or

(span of control cover all sections of the entire machine)

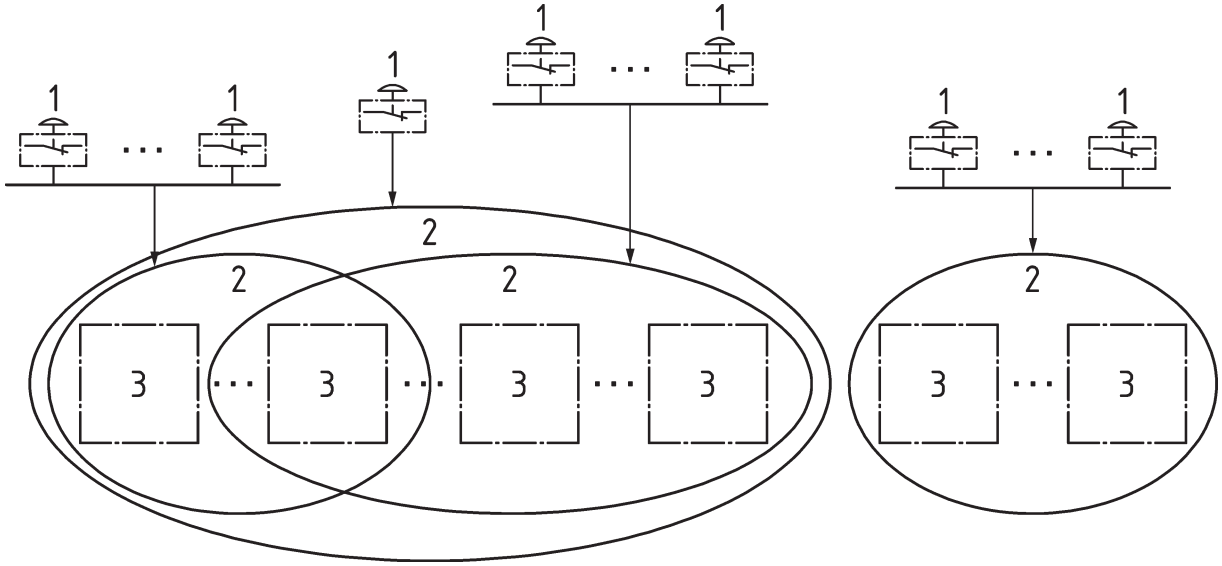

or (span of control of specific sections of the machine)

— actuation of an emergency stop device shall not create additional hazard(s) or increase the risk(s), in any span of control;

— actuation of an emergency stop device in one span of control shall not prevent the initiation of an emergency stop function in another span of control;

— information for use of the machine shall include information on the span of control of emergency stop device.

So far as practicable, emergency stop devices with different spans of control shall not be located near each other.



Key

1 emergency stop device

2 span of control

3 section of machine or machine

Figure 1 — Examples demonstrating the concept of span of control

4.1.3 Stop categories

The emergency stop shall function in accordance with either of the following stop categories (see also IEC 60204-1). The relevant stop category shall be selected by the risk assessment.

Stop category 0

Stopping by immediate removal of power to the machine actuators.

NOTE 1 Additional braking can be necessary.

Examples of stop category 0 are:

— switching off the electrical power to the electric motor(s) of the machine by electromechanical switching devices;

— mechanical disconnection (declutching) between the hazardous elements and their machine actuator(s);

— blocking the fluid power supply to the hydraulic/pneumatic machine actuators;

— removing the power needed to generate a torque or force in an electrical motor using the Safe torque off (STO) function of a power drive system in accordance with IEC 61800-5-2.

Stop category 1

Stopping movements and operations with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved.

Examples of stop category 1 are:

— deceleration of motion then removal of the electrical power to the motor(s) when motion has ceased by electromechanical switching devices;

— using the Safe stop 1 (SS1) function of a power drive system in accordance with IEC 61800-5-2.

NOTE 2 For removal of power, it can be sufficient to remove the power needed to generate a torque or force. This can be achieved by declutching, disconnecting, switching off, or by electronic means (e.g. a Power Drive System (PDS) in accordance with IEC 61800–5-2), without necessarily performing isolation.

4.1.4 Disengagement (e.g. unlatching) of the emergency stop device

The effect of an activated emergency stop device shall be sustained until the actuator of the emergency stop device has been disengaged. This disengagement shall only be possible by an intentional human action on the device where the command has been initiated. The disengagement of the device shall not restart the machinery but only permit restarting.

The instructions for use of the machine shall state that, after actuation and before disengaging the device(s), the machinery shall be inspected in order to detect the reason for actuation.

4.1.5 Emergency stop equipment

4.1.5.1 The safety related parts of the control system or subsystems which perform the emergency stop function shall comply with the relevant requirements of ISO 13849-1 and/or IEC 62061.

Determination of the Performance Level (PL) or SIL required should take into account the purpose of the emergency stop function, but the minimum required is PL_r c or SIL 1.

NOTE The emergency stop function can share safety related parts with other safety functions taking into account the requirements of ISO 13849-1 and/or IEC 62061.

4.1.5.2 Electrical equipment that implements the emergency stop function shall be in accordance with the relevant requirements of IEC 60204-1.

4.1.5.3 Hydraulic equipment that implements the emergency stop function shall be in accordance with the relevant requirements of ISO 4413 for design, construction and modification of systems and their components.

4.1.5.4 Pneumatic equipment that implements the emergency stop function shall be in accordance with the relevant requirements of ISO 4414 for design, construction and modification of systems and their components.

4.2 Operating conditions, environmental influences

The components, devices and elements used to achieve the emergency stop function shall be selected, assembled, interconnected, fixed and protected to operate correctly under the expected operating conditions and environmental influences, taking into account

— the frequency of operation and need for periodic testing, for example, in the case of infrequent operation, and

— the environmental constraints of, for example, vibration, shock, temperature, radiation (e.g. ultraviolet from the sun), rain, snow, freezing water, dust, foreign bodies, moisture, corrosive materials and fluids.

4.3 Emergency stop device

4.3.1 Emergency stop devices shall be designed to be easily identified and actuated by the operator and others who could need to actuate them. The actuator of the emergency stop device may be one of the following types:

a) pushbuttons easily activated by the palm of a hand;

b) wires, ropes, bars;

c) handles;

d) foot-pedals without a protective cover, where other solutions are not applicable.

NOTE For a supply disconnecting device to effect emergency stop, see IEC 60204–1.

4.3.2 An emergency stop device shall be located:

— at each operator control station, except where the risk assessment indicates that this is not necessary;

— at other locations, as determined by the risk assessment, e.g.:

  — at entrance and exit locations;

  — at locations where intervention to the machinery is needed, e.g. operations with a hold-to-run control function;

  — at all places where a man / machine interaction is expected by design (loading / unloading zone for example).

Emergency stop devices shall be positioned so that they are directly accessible and capable of non-hazardous actuation by the operator and others who could need to actuate them.

The actuator of emergency stop device intended to be actuated by hand should be mounted between 0,6 m and 1,7 m above the access level (e.g. floor level, platform level).

Foot-pedals should be mounted in a fixed position directly at access level (e.g. floor level).

4.3.3 An electrical emergency stop device shall apply the principle of direct opening action with mechanical latching. Electrical emergency stop devices shall be in accordance with IEC 60947-5-5.

NOTE An example of the application of the direct opening action principle is an emergency stop device employing electrical contacts that are opened by means of a direct rigid connection with the pushbutton. According to IEC 60947–5-1, direct opening action (of a contact element) is the achievement of contact separation as the direct result of a specified movement of the switch actuator through non-resilient members (for example, not dependent upon springs).

4.3.4 Pneumatic or hydraulic emergency stop devices shall apply the principle of positive (direct) mechanical action (see ISO 12100:2010, 6.2.5) with mechanical latching.

NOTE Pneumatic and hydraulic systems typically actuate direct closing of a valve without relying on springs.

4.3.5 The actuation of the emergency stop device shall generate a stop command even if the emergency stop device actuator does not engage (latch).

4.3.6 The actuator of the emergency stop device shall be coloured RED. As far as a background exists behind the actuator and as far as it is practicable, the background shall be coloured YELLOW.

Emergency stop devices shall be designed and mounted in such a way that the actuation cannot be easily blocked by simple means.

NOTE This can happen when objects fall beneath the actuating surface or when there is an intention of defeating.

Emergency stop device requiring a key on the actuator to be disengaged (unlatched) should be avoided.

When an emergency stop actuator can only be disengaged by using a key, to avoid injuries to hands, instruction for use of the machine shall describe the correct use of the key and provide a warning that the key should only be in the actuator of the device to disengage the actuator.

4.3.7 Neither the actuator nor the background should be labelled with text or symbols. Where a symbol is needed for clarification, the symbol from IEC 60417-5638 shall be used, see Figure 2.

When it is necessary to identify the direction of unlatching of the actuator (button) then this identification shall have the same or nearly the same colour as the actuator (see also IEC 60947-5-5).

NOTE The identification of unlatching (i.e. arrows) could be misinterpreted as direction of actuation.

Figure 2 — Symbol IEC 60417-5638: Emergency stop

4.3.8 When emergency stop devices are installed on detachable or cableless operator control stations (e.g. pluggable portable teaching pendants), at least one emergency stop device shall be permanently available (e.g. in a fixed position) on the machine.

In addition, at least one of the following measures shall be applied to avoid confusion between active and inactive emergency stop devices:

— device colour changing through illumination of the active emergency stop device;

— automatic (self-actuating) covering of inactive emergency stop devices; where this is not practicable, manually-applied covering may be used, provided that the cover remains attached to the operator control stations;

— provision of proper storage for detached or cableless operator control stations.

The instructions for use of the machine shall state, which measure has been applied in order to avoid confusion between active or inactive emergency stop device(s). The correct operation of this measure shall be explained.

4.3.9 Where emergency stop devices are cableless or integrated into cableless operator control stations, the relevant requirements of IEC 60204-1 shall apply in addition to the requirements of this International Standard.

4.3.10 Measures against unintended actuation of an emergency stop device shall not create a risk of obstruction of the actuation or impair access to the emergency stop; such measures shall not impair the visibility of the emergency stop device or its actuator (see also 4.5).

4.4 Use of wires or ropes as actuators

4.4.1 When wires or ropes are used as the actuators of emergency stop devices, they shall be designed and positioned for ease of use. For this purpose, consideration shall be given to

— the amount of deflection necessary for generating the emergency stop command,

— the maximum deflection possible,

— the minimum clearance between the wire or the rope and the nearest object in the vicinity,

— making wires or ropes visible (e.g. by use of marker flags), and

— the force to be applied, and its direction in relation to the wire or rope, to actuate the emergency stop device.

The colour of ropes and wires shall be red.

If marker flags are used to improve visibility of wires and ropes then they shall be coloured red and yellow (e.g. red and yellow striped or alternate red and yellow).

NOTE 1 See also IEC 60947-5-5.

When it is likely that actuation will be attempted by pulling the wire along its axis, pulling the wire in either direction shall generate the emergency stop command.

NOTE 2 The use of Figure 2 could be helpful to identify the marker flags.

4.4.2 An emergency stop command shall be generated when the wire or rope is slack or is broken or disengaged.

4.4.3 The means to disengage the emergency stop device shall be placed so that the whole length of the wire or rope is visible from the location of the disengaging means.

4.4.4 The instructions for use of the machine shall state that, after actuation and before disengaging, the machinery shall be inspected along the whole length of the wire or rope in order to detect the reason for actuation. Information such as the setting of the wire or rope, and subsequent adjustment shall be described.

4.5 Prevention of unintended actuation of an emergency stop device

The emergency stop device shall be designed to avoid unintended actuation.

So far as practicable, unintended actuation shall be prevented by location rather than the use of other application design measures.

The actuation of the emergency stop device shall not be impaired. To prevent unintended actuation of the emergency stop device some precautions can be taken, e.g.:

— locate the emergency stop device away from foreseeable heavily trafficked areas,

— select the type of emergency stop device,

— select appropriate size or shape of the emergency stop device, or

— mount the emergency stop device within a recessed surface of the surrounding control panel.

The use of a protective shroud around the emergency stop device should be avoided, except when necessary to prevent unintended actuation and other measures are not practicable.

A protective shroud shall not have any sharp corners or edges or rough surfaces which could lead to injury. Corners and edges shall be de-burred and surfaces shall be smooth to the touch.

For emergency stop devices intended to be actuated by hand the measures against unintended actuation shall not impede or hinder actuation with the palm of the hand, from any foreseeable position of the machine operator and others who could need to actuate them.

4.6 Portable operator control stations

4.6.1 Emergency stop functions on portable operator control stations

While the portable operator control station is in control of a machine, all emergency stop devices shall be active (see also 4.3.8). The effect of unplugging and plugging in of detachable operator control station(s) shall be considered in the risk assessment.

4.6.2 Emergency stop reset for cableless operator control stations

Restoration of power after an interruption or failure of parts of a cableless control system shall not result in a reset of an emergency stop condition previously initiated by a cableless emergency stop device.

When an emergency stop has been initiated with a cableless control device, reset shall be possible only after the emergency stop device is disengaged from the latched-in position.

Unless the span of control of the emergency stop device can be observed, in addition to the disengaging of the emergency stop actuator on the portable control station, one or more supplementary fixed reset devices on or around the machinery shall be provided to ascertain that the reason for emergency stopping has been cleared.

Bibliography

[1] IEC 60947-5-1, *Low-voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices*

[2] IEC 61800-5-2, *Adjustable speed electrical power drive systems — Part 5-2: Safety requirements — Functional*

[3] IEC 60417-DB:2002, *Graphical symbols for use on equipment (online database)*

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™