

Emergency Stop Devices (MD Annex I 1.2.4.3)

Note: this document, as MD WG 2010-03 EN rev.2, has been approved at the Machinery Working Group meeting on 5-6 November 2014.

Background

According to Art. 5 of the MD 2006/42/EC, machinery can be placed on the market or put into service only when it satisfies the relevant EHSR set out in Annex I of the MD. With regard to the applicable EHSR, Annex I section 1.2.4.3 of the MD 2006/42/EC requires for most machinery¹ to be fitted, with one or more emergency stop devices as shown for example in Fig. 1.



Fig. 1: Emergency stop device

This document deals only with the design of the emergency stop device, primarily with the mushroom type push button with regard to section 1.2.4.3. The document at hand

¹ The second paragraph of section 1.2.4.3 of Annex I of the MD 2006/42/EC sets out two exceptions where emergency stop devices are not required.

is not concerned with the location of the devices to be fitted, because this is dependent, for example on the size and configuration of the machinery, the number of operators, the location of the danger zones and the operation positions and maintenance points.

With reference to the third paragraph of section 1.2.4.3, which sets out requirements for the design of emergency stop devices, such device must have clearly identifiable, clearly visible and quickly accessible control devices. Quoting the Guide to application of the MD, this is important because, in an emergency situation, a split-second reaction may be crucial. The requirement of the quick accessibility has consequences for both the choice of the type of control device and the number and location of control devices to be fitted.

Harmonised standards, applicable to emergency stop devices

The following harmonised standards substantiate the design and functioning of the emergency stop device.

EN ISO 13850:2006, “Safety of machinery – emergency stop – principles for design”, specifies functional requirements and design principles for the emergency stop function on machinery, independent of the type of energy used to control the function. It is applicable to all machinery except for machines, in which the provision of emergency stop would not lessen the risk, and hand-held portable machines and hand-guided machines. It does not deal with functions such as reversal or limitation of motion, deflection, shielding, braking or disconnecting, which can be part of the emergency stop function.

Concerning the color scheme of the red push button against a yellow background standardized in EN ISO 13850:2006 section 4.4.5, also standard EN 60073, “Basic and safety principles for man-machine interface, marking and identification - Coding principles for indicators and actuators (IEC 60073:2002)” can be used. This standard establishes general rules for assigning particular meanings to certain visual, acoustic and tactile indications.

The standard EN 60947-5-5 1997 + A1:2005, “Low-voltage switchgear and control-gear - part 5-5: control circuit devices and switching elements - electrical emergency stop device with mechanical latching function” is applicable to electrical control circuit

devices and switching elements which are used to provide an emergency stop signal. Where electrical switches are used, they should have direct opening action in accordance with EN 60947-5-1, Annex K. Such devices may be either provided with their own enclosure, or installed according to the manufacturer's instructions.

Emergency stop devices

An emergency stop device as shown in Figure 1 comprises a specific control device linked to the control system that gives a stop command and the components or systems necessary to stop the hazardous functions of machinery as quickly as possible, without creating any further risks. The device fulfills the design requirement of clearly identifiable regarding the color scheme of the red push button against a yellow background, as well as the requirement of clearly visible and quickly accessible.

Emergency stop devices with protection measures to prevent unintended activation or damage

At a certain type of machinery, mainly mobile machinery or machinery in the construction sector, emergency stop devices are used with protective measures, such as collars or shrouding as shown in Fig. 2, in order to assure its proper function also under demanding conditions. Those measures are sometimes provided to prevent unintentional activation, debris or process materials accumulating on the device and preventing its operation.



Fig. 2: Emergency stop device with protection against unintended activation or damage

A protective collar must not have any sharp corners or edges or rough surfaces which could lead to injury. Corners and edges should be rounded and surfaces smooth to the touch.

The protection collar must not impair the accessibility of the emergency stop device. A full protection collar is in principle not acceptable with regard to Annex I section 1.2.4.3 of the MD 2006/42/EC. However, its particular suitability could be demonstrated by testing. Requirements concerning the acceptable design of protective collars of emergency stop devices are not yet available in the relevant standards. However, it should be noted that the proposed amendment to EN ISO 13850 includes a test method to ensure that the collar does not impair accessibility.

Disconnecting device as emergency stop

According to market observations, also the disconnecting device as shown in Fig. 3 is used as emergency stop device.



Fig. 3: Disconnecting device as emergency stop

The supply disconnecting device is sometimes being locally operated to serve the function of emergency stop with regard to EN 60204-1 “Safety of machinery – Electrical equipment of machines Part 1: General requirements” in which it is stated under section 10.7.4 “Local operation of the supply disconnecting device to effect emergency stop”:

The supply disconnecting device may be locally operated to serve the function of emergency stop when:

- it is readily accessible to the operator; and
- it is of the type:
 - a) switch-disconnector, with or without fuses, in accordance with IEC 60947-3, utilization category AC-23B or DC-23B;
 - b) disconnector, with or without fuses, in accordance with IEC 60947-3, that has an auxiliary contact that in all cases causes switching devices to break the load circuit before the opening of the main contacts of the disconnector;
 - c) a circuit-breaker suitable for isolation in accordance with IEC 60947-2;
 - d) any other switching device in accordance with an IEC product standard for that device and which meets the isolation requirements of IEC 60947-1 as well as a utilization category defined in the product standard as appropriate for on-load switching of motors or other inductive loads;

When also intended for such use, the supply disconnecting device shall be coloured red. If a background exists immediately around the actuator, then this background shall be coloured yellow. See also ISO 13850.

This allows supply disconnecting devices that meet these requirements to provide the emergency stop function. Nevertheless, it should be noted, that the supply disconnecting device is regarded as an exception and the normal emergency stop device should be used whenever possible.

Stop devices covering the start and the stop-contact

Stop devices covering the start and the stop-contact such as the flap stop (Fig. 4), is a special kind of "stop device" produced normally outside the EU, and used as a normal emergency stop for different machinery, in particular for smaller machines, such as bench drilling machines.



Fig. 4: Flap stop device (taken from the original Danish document MD ADCO 2005-19)

The flap-stop is a start and stop contact, which is equipped with a yellow flap and a red mushroom-type push button (Fig. 4), covering both the start and the stop-contacts. When the mushroom push button is activated, the flap will press the stop button into a stop command position. The flap can be kept in an open position which cannot assure the availability at all times. The flap stop can therefore not provide the emergency stop function as required in Annex I section 1.2.4.3 of the MD 2006/427EC.

Other stop devices

Sometimes, Emergency stop device are designed as padlockable stop devices to make the isolation secure. More typically padlocks will be used with devices that can directly isolate equipment from the supply of electricity, such as disconnectors, switch-disconnectors, circuit-breakers etc.

Other devices to interrupt the machine movement, such as mats, light curtains, laser scanners etc.) cannot be considered to be an emergency stop device. Those devices are protective devices (as required by EHSR 1.3.7 with 1.4.3 specifying their characteristics). They are part of the safety system for the machine operation and are not an emergency stop device that should be provided in addition.