中華民國國家標準 CNS	低壓盤及控制盤－具機械閂鎖功能之電氣緊急停止裝置	總號	
		類號	C4

Low-voltage switchgear and controlgear - Part 5-5: Control circuit devices and switching elements - Electrical emergency stop device with mechanical latching function

編訂說明：本草案建議案號為「建-制 1000435」，草案編號為「CNS 草-制 1030415」，係行政院勞工委員會勞工安全衛生處所提之建議案，並參照 IEC 60947-5-5:2005 編擬而成。本案依程序辦理徵求意見，敬請　惠賜卓見。

1 Scope

This section of IEC 60947-5 provides detailed specifications relating to the electrical and mechanical construction of emergency stop devices with mechanical latching function and to their testing.

This standard is applicable to electrical control circuit devices and switching elements which are used to initiate an emergency stop signal. Such devices may be either provided with their own enclosure, or installed according to the manufacturer's instructions.

This standard does not apply to:

– emergency stop devices for non-electrical control circuit, for example hydraulic, pneumatic;
– emergency stop devices without mechanical latching function.

An emergency stop device may also be used to provide an emergency switching off function (see annex A).

1. 適用範圍

本標準對緊急停止裝置之電氣及機械結構及其試驗供詳細規範。

本標準適用於啟動緊急停止訊號之電氣控制電路裝置及切換元件，這些裝置有些連同其外罩一起提供，有些則依製造廠商之說明書安裝。

此標準不適用於

－　非電氣控制電路之緊急停止裝置，例：液壓、氣動。

－　無機械閂鎖功能之緊急停止裝置。

緊急停止裝置亦可用於提供緊急關閉功能(參照附錄 A)。

2. 引用標準

下列標準因本標準所引用，成為本標準之一部分。有加註年分者，適用該年分之版次，不適用於其後之修訂版(包括補充增修)。無加註年分者，適用該最新版(包括補充增修)。

IEC 60050(441):1984 International Electrotechnical Vocabulary (IEV) – Chapter 441: Switchgear, controlgear, fuses

公布日期 年 月 日　經濟部標準檢驗局印行　修訂公布日期 年 月 日
印行年月

Amendment 1 (2000)

IEC 60068-2-1:1990 Environmental testing – Part 2: Tests – Test A: Cold
Amendment 1 (1993)
Amendment 2 (1994)

IEC 60068-2-2:1974 Environmental testing – Part 2: Tests – Test B: Dry heat
Amendment 1 (1993)
Amendment 2 (1994)

IEC 60068-2-6:1995 Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)

IEC 60068-2-11:1981 Environmental testing – Part 2: Tests – Test Ka: Salt mist

IEC 60068-2-27:1987 Environmental testing – Part 2: Tests – Test Ea and guidance: Shock

IEC 60068-2-30:1980 Environmental testing – Part 2: Tests – Test Db and guidance: Damp heat, cyclic (12+12-hour cycle)
Amendment 1 (1985)

IEC 60073:2002 Basic and safety principles for man-machine interface, marking and identification – Coding principles for indicators and actuators

IEC 60204-1:1997 Safety of machinery – Electrical equipment of machines – Part 1: General requirements
Amendment 1 (1999)

IEC 60721-3-3:1994 Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 3: Stationary use at weather protected location
Amendment 1 (1995)
Amendment 2 (1996)

CNS 14816-1(IEC 60947-1:2004) 低電壓開關裝置及控制裝置－第 1 部：通則 (Low-voltage switchgear and controlgear – Part 1: General rules)

CNS 14816-5-1(IEC 60947-5-1:2003) Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices

IEC 61310-1:1995 Safety of machinery – Indication, marking and actuation – Part 1: Requirements for visual, auditory and tactile signals

ISO 3864:1984 Safety colours and safety signs

ISO 13850:1996 Safety of machinery – Emergency stop – Principles for design

3 Definitions

For the purpose of this section of IEC 60947-5, the following definitions apply in addition to those given in IEC 60947-1 and in IEC 60947-5-1.

3.用語及定義

CNS 14816-1(IEC 60947-1)、CNS 14816-5-1(IEC 60947-5-1)所規定及下列用語及定義適用於本標準。

3.1
emergency stop (function or signal)
function or signal which is intended:

– to avert or to reduce hazards to persons, damage to machinery or to work in progress;
– to be initiated by a single human action.

[ISO/IEC 13850:3.1, modified]

3.1 緊急停止(功能或訊號) (emergency stop (function or signal))

預定用於以下用途之功能或訊號。

－ 避免或降低人員之危害及機器或在製器之損壞。

－ 以 1 個人為動作啟動。

[ISO/IEC 13850 之 3.1，修訂]

3.2
emergency stop device
a manually operated control circuit device used to initiate an emergency stop function

[ISO/IEC 13850:3.2, modified]

NOTE An emergency stop device may also provide auxiliary functions, for example for redundancy and/or for signalling through additional contact element(s). Such additional contact(s) may be normally open and/or normally closed.

3.2 緊急停止裝置(emergency stop device)

由人工操作用於啟動緊急停止功能之控制電路裝置。

[ISO/IEC 13850 之 3.2，修訂]

備考：緊急停止裝置亦可提供輔助功能，例：備援及/或透過額外接觸元件傳送訊號。這些額外之觸點可能為常開及/或常閉。

3.3
actuating system (of an emergency stop device)
the mechanical parts which transmit the actuating force to the contact elements

[IEV 441-15-21 modified]

3.3 (緊急停止裝置)之致動系統(actuating system (of an emergency stop device))

將致動力傳送至接觸元件之機械零件。

[IEV 441-15-21，修訂]

3.4
actuator (of an emergency stop device)
the part of the actuating system which is actuated by a part of the human body

[IEV 441-15-22 modified]

NOTE 1 Examples of an actuator may be a button, a wire, a rope, a bar, a foot pedal.

3.4 (緊急停止裝置之)致動器(actuator (of an emergency stop device))

致動系統中由人體某個部位啟動之部分。

[IEV 441-15-22，修訂]

備考 1. 致動器之範例包括按鈕、拉線、拉繩、拉桿、腳踏板。

3.5
rest position
the position of an emergency stop device, or of a part of it, which has not been actuated

NOTE In rest position, the machine (or equipment) may work.

3.5 靜止位置(rest position)

緊急停止裝置或其某個部位未被致動之位置。

備考：機器(或設備)之靜止位置可能在運轉中。

3.6
actuated position
the position of an emergency stop device, or of a part of it, after it has been actuated

NOTE In the actuated position of the emergency stop device the machine (or equipment) remains at rest.

3.6 致動位置(actuated position)

緊急停止裝置或其某個部位致動後之位置。

備考：當緊急停止裝置在致動位置時，機器(或設備)仍保持靜止。

3.7
latching (of an emergency stop device)
function or means which engages and maintains the actuating system in the actuated position until reset by a separate manual action

3.7 (緊急停止裝置之)閂鎖(latching (of an emergency stop device))

將致動系統嚙合並使其保持在致動位置之功能或裝置，直到另以手動重置。

3.8
resetting (of an emergency stop device)
manual action to return the actuating system of the emergency stop device from the actuated position to the rest position

NOTE Examples of resetting include the rotation of a key, or of the actuator, pulling the actuator or pushing a special reset button.

3.8 (緊急停止裝置之)重置(resetting (of an emergency stop device))

手動將緊急停止裝置之致動系統從啟動位置設回靜止位置。

備考：重置之範例包括轉動鑰匙或致動器、拉致動器或推專用之重置按鈕。

3.9
direct opening action (positive opening action) (of a contact element)
the achievement of contact separation as a direct result of a specified movement of the switch actuator through non-resilient members (e.g. non dependent upon springs)
[K.2.2 of IEC 60947-5-1]

3.9 (接觸元件之)直接斷開動作(正向斷開動作) (direct opening action (positive opening action) (of a contact element))

觸點分離直接由開關致動器透過非彈性構件(如不依賴彈簧之構件)執行之特定動作完成。

[CNS 14816-5-1 之 K.2.2]

3.10
trip wire switch
rope pull switch
pull cord operated switch
emergency stop device in which the actuator is a rope, a wire or similar means

3.10 拉線開關(trip wire switch)

拉繩開關；拉線操作開關；1 種緊急停止裝置，其致動器為 1 條拉繩、拉線或其

他類似工具。

4 Marking and product information

4. 標示及產品資訊

4.1 General

Information for installation, operation, maintenance and/or periodic testing shall be provided when necessary on or with the emergency stop device.

The verification of clause 4 shall be conducted according to 7.2.1.

NOTE 1 In certain circumstances, it may be necessary to provide additional information, for example:

- by labels,
- by marker flags attached to wires or ropes to improve their visibility,
- by the graphical symbol 60417-IEC-5638 (see Table 6 of IEC 61310-1).

NOTE 2 See also 9.2.5.4 of IEC 60204-1.

4.1 一般

視緊急停止裝置之需要，應提供安裝、操作、保養及/或定期檢測等資訊。

應依 7.2.1 進行第 4 節之查證。

備考 1. 在某些情況下可能需要提供更多資訊，舉例如下。

- 利用標籤。
- 在拉繩或拉線上附掛旗標，提高其可見性。
- 使用 60417-IEC 5638 之圖形符號(參照 IEC 61310-1 表 6)。

備考 2. 另參照 IEC 60204-1 之 9.2.5.4。

4.2 Indications on buttons

4.2.1 Buttons used as actuators of an emergency stop device shall be coloured red. When a background exists behind the actuator, and as far as it is practicable, it shall be coloured yellow.

4.2.2 The direction of unlatching shall be clearly identified when resetting is achieved by rotation of the button.

NOTE See also IEC 60073 and ISO 3864.

4.2 按鈕說明

4.2.1 當成緊急停止裝置之致動器使用的按鈕應為紅色。若致動器有背景色，則應在可行情況下採用黃色。

4.2.2 若必須轉動按鈕才能進行重置，則應清楚標示解鎖方向。

備考：亦可參照 IEC 60073 及 ISO 3864。

4.3 Additional requirements for trip wire switches

Information provided by the manufacturer shall include:

- the maximum length of wire or rope;
- the correct tension of wire or rope;
- the distances between supports;
- recommendation to use only straight runs of wire or rope;
- if applicable, guidance on maintenance for pulleys and eyelets, and the measures necessary to ensure that the wire or rope remains in proper position.

4.3 拉線開關之其他要求

製造廠商提供之資訊應包含下列項目。

－ 拉線或拉繩之最大長度。

－ 拉線或拉繩之正確張力。

－ 支架間之距離。

－ 有關只使用直接拉線或拉繩之建議。

－ 若可行則應明訂滑輪及眼孔之保養準則，以及確保拉線或拉繩保持在正確位置所需採取之措施。

4.4 Additional requirements for colour coding

A resetting button, for example where applicable with a trip wire switch, shall be coloured blue.

When a colour coding is used for setting a trip wire switch:

– green shall indicate the correct setting of the rest position; and
– yellow shall indicate the correct setting of the actuated position.

4.4 色碼之其他要求

重置按鈕(例：附加拉線開關之按鈕)應為藍色。

當使用色碼設定拉線開關之時，

－ 應使用綠色表示靜止位置設定正確。

－ 應使用黃色表示致動位置設定正確。

5 Electrical requirements

5.1 The utilization categories shall be AC-15 and/or DC-13 and/or DC-14 in accordance with IEC 60947-5-1.

5.2 All normally closed contact elements of an emergency stop device shall have a direct opening action (positive opening action), according to annex K of IEC 60947-5-1.

The tests shall be conducted according to annex K of IEC 60947-5-1.

5.3 The degree of protection provided by the emergency stop device shall be stated by the manufacturer in accordance with annex C of IEC 60947-1.

5.4 Tests for electrical characteristics shall be conducted according to IEC 60947-5-1.

NOTE Subclause 7.2.7 of IEC 60947-5-1 only applies to control switches suitable for isolation.

5. 電氣要求

5.1 依 CNS 14816-5-1，使用類別應為 AC-15 及/或 DC-13 及/或 DC-14。

5.2 依 CNS 14816-5-1 附錄 K，緊急停止裝置之所有常閉接觸元件皆應有 1 個直接斷開動作(正向斷開動作)。

試驗應依 CNS 14816-5-1 附錄 K 進行。

5.3 製造廠商應依 CNS 14816-5-1 附錄 C 之規定，說明緊急停止裝置之保護程度。

5.4 電氣特性之試驗應依 CNS 14816-5-1 進行。

備考：CNS 14816-5-1 之 7.2.7 僅適用於適合隔離用之控制開關。

6 Mechanical requirements

6.1 General requirements

6. 機械要求

6.1 一般要求

6.1.1 Means shall be provided to enable the emergency stop device to be securely installed in its intended mounting position.

The test shall be conducted according to 7.2.1.

6.1.1 應提供啟用緊急停止裝置之工具，緊急停止裝置應正確安裝在預定之安裝位置。

試驗應依 7.2.1 進行。

6.1.2 The emergency stop device shall meet the requirements of 7.3, 7.4, 7.5, 7.6 and, where applicable, of 7.7.5.

6.1.3 It shall be possible to operate and reset the emergency stop device under all normal service conditions.

The test shall be conducted according to 7.2 to 7.4.

6.1.4 Vibration or shocks shall not cause the opening of the contacts in the closed position or the closing of the contacts in the open position, nor operation of the latching mechanism.

The tests shall be conducted according to 7.5 and 7.6.

6.1.2 緊急停止裝置應符合 7.3、7.4、7.5 及 7.6 之要求，若可行時亦應符合 7.7.5。

6.1.3 緊急停止裝置應能在所有正常營運條件下操作及重置。

試驗應依 7.2 至 7.4 進行。

6.1.4 振動或衝擊不可使觸點從閉路位置變成開路，或從開路位置變成閉路，亦不可造成閂鎖機構作動。

試驗應依 7.5 及 7.6 進行。

6.2 Latching

6.2.1 In accordance with 4.4.4 of ISO 13850*, when the emergency stop signal has been generated during actuation of the emergency stop device, the emergency stop function shall be maintained by latching of the actuating system. The emergency stop signal shall be maintained until the emergency stop device is reset (disengaged). It shall not be possible for the emergency stop device to latch-in without generating the emergency stop signal.

In case of failure in the emergency stop device (including the latching means), the generation of the emergency stop signal shall have priority over the latching function.

The tests shall be conducted according to 7.2, 7.7.2 and 7.7.3.

* Corresponds to 4.1.11 of EN 418.

6.2.2 The latching shall operate correctly when the emergency stop device is used under conditions, specified either in 7.4 or by the manufacturer, whichever is more severe.

The test shall be conducted according to 7.3, 7.4, 7.5, 7.6 and 7.7.

6.2 閂鎖

6.2.1 依 ISO 13850* 4.4.4，若因致動緊急停止裝置而產生緊急停止訊號時，致動系統之閂鎖作用應能維持緊急停止功能。緊急停止訊息應持續維持至緊急停止裝置重置(斷電)為止。應確保緊急停止裝置在未產生緊急停止訊號時不可能鎖住。

註* 相當於 EN 418 之 4.1.11。

緊急停止裝置(包括閂鎖裝置)故障時，緊急停止訊號之產生應優先於閂鎖功能訊號。(看原文位置)

試驗應依 7.2、7.7.2 及 7.7.3 進行。

6.2.2 因發生 7.4 或製造廠商規定之情況(以較嚴重者優先)而用到緊急停止裝置時，閂鎖應能正確操作。

試驗應依 7.3、7.4、7.5、7.6 及 7.7 進行。

6.3 Additional requirements for button type emergency stop device

6.3.1 The resetting of the latching means shall be by turning a key, by rotation of the button in the designated direction, or by a pulling motion.

The test shall be conducted according to 7.2.1 and 7.2.2.1.

6.3.2 The emergency stop device shall be so designed that removal of the actuator is from the inside of the enclosure only, or from the outside of the enclosure by use of a tool intended for that purpose.

This shall be verified by inspection.

6.3 按鈕型緊急停止裝置之其他要求

6.3.1 閂鎖裝置之重置應利用轉動鑰匙、依指定方向旋轉按鈕或拉扯動作完成。

試驗應依 7.2.1 及 7.2.2.1 進行。

6.3.2 緊急停止裝置之設計應確保只能從機殼內部取出致動器，若從機殼外部取出，則必須使用專用工具。

應以檢驗進行查證。

6.4 Additional requirements for trip wire switches

6.4.1 The construction of the emergency stop device shall be such that:

- the setting of the wire or rope, and subsequent adjustment, can be carried out without causing malfunction; and
- the installation of the emergency stop device can fulfil the requirements of 4.5.1 and 4.5.2 of ISO/IEC 13850.

The tests shall be conducted according to 7.2 and 7.3.

6.4 拉線開關之其他要求

6.4.1 緊急停止開關之構造應確保

－ 拉線或拉繩之設定及後續調整不會造成功能異常。及

－ 緊急停止裝置之安裝符合 ISO/IEC 13850 之 4.5.1 及 4.5.2 的要求。

試驗應依 7.2 及 7.3 進行。

6.4.2 When the actuator is installed according to the instructions:

- the perpendicular pulling force applied to the wire or rope necessary for generating the emergency stop signal (opening of the contacts) shall be less than 200 N;
- the wire or rope shall resist a tension force 10 times higher than the perpendicular pulling force necessary for generating the emergency stop signal;
- the perpendicular deflection of the wire or rope necessary for generating the emergency stop signal shall be less than 400 mm;
- the breaking or disengagement of the wire or rope shall generate the emergency stop signal;

6.4.2 依安裝說明書安裝致動器時

－ 為產生緊急停止訊號(觸點斷開)而對拉線或拉繩施加之垂直力應小於 200 N。

－ 拉線或拉繩抵抗之張力，應比產生緊急停止訊號所需施加之垂直拉力多 10

倍。

－ 拉線或拉繩為產生緊急停止訊號而出現之垂直偏移應小於 400 mm。

－ 應在拉線或拉繩斷裂或脫離時產生緊急停止訊號。

The pulling force shall be applied at the mid-point of the length of the wire or rope.

The tests shall be conducted according to 7.8.1.

拉力應施加在拉線或拉繩全長之中點位置。

試驗應依 7.8.1 進行。

6.4.3 Changes in the length of the rope (for example temperature, age etc.) shall be taken into account.

The tests shall be conducted according to 7.2.1.

6.4.3 拉線之長度變化(例：溫度、老化等)應納入考量。

試驗應依 7.2.1 進行。

6.5 Additional requirement for footswitches

A pedal (footswitch) type emergency stop device shall have no cover.

The test shall be conducted according to 7.2.1.

6.5 腳踏開關之其他要求

踏板(腳踏開關)型緊急停止裝置不可裝設蓋板。

試驗應依 7.2.1 進行。

7 Testing of the mechanical design

7.1 General

In accordance with 8.1.1 and 8.1.2 of IEC 60947-1, type tests shall be made to prove compliance with the requirements of clauses 4, 5 and 6.

An emergency stop device may have combinations of both main and auxiliary contacts. The tests given in 7.5 and 7.6 are to verify that all these contacts are not adversely affected by mechanical shocks.

Some tests, for example based on visual inspection, or by checking the literature provided with the emergency stop device, require only one sample.

For the tests described in 7.3.3, 7.4, 7.5, 7.6 and 7.7, three identical samples of emergency stop device shall be selected, and each sample shall be subjected successfully to the sequence of tests, in the order given in this clause.

When more than one type of emergency stop device is manufactured to the same basic design, less than three identical samples may be tested, providing that more than three products of the same family are tested. Such an acceptance shall be fully documented.

7. 機械設計之試驗

7.1 一般

依 IEC 60947-1 8.1.1 及 8.1.2，應進行型式試驗，以證明符合第 4 節、第 5 節及第 6 節之要求。

1 個緊急停止裝置可能有 1 組由主要及輔助觸點構成之機構，7.5 及 7.6 之試驗係用於查證這些觸點不會因機械衝擊而受到負面影響。

有些試驗(例：依目視檢查或依緊急停止裝置附隨文件進行之試驗)只需要 1 個樣品。

7.3.3、7.4、7.5、7.6 及 7.7 所述之試驗需要 3 個相同之緊急停止裝置樣品，每個樣品皆應依序通過本節規定之一系列試驗。

若以相同設計為基礎製造 1 種以上之緊急停止裝置，則可使用 3 個以下之相同樣品進行試驗，但同一家族必須試驗 3 個以上之產品；此驗收試驗必須進行完整記錄。

7.2 General design inspection

7.2.1 The requirements of 4.1, 6.1.1, 6.4.1 and, where applicable, of 6.3, 6.4.3 and 6.5 are verified by inspection of the mechanical structure of the emergency stop device.

7.2.2 Button type emergency stop device.

7.2.2.1 The requirement of 6.3.1 is checked by latching and resetting the actuator manually.

7.2.2.2 The requirement of 6.3.2 is verified by inspection of the fastening parts, and by pulling and turning the button and other parts of the device by hand.

7.2 一般設計檢驗

7.2.1 4.1、6.1.1、6.4.1 及 6.3、6.4.3 及 6.5(若可行)係透過檢查緊急停止裝置之機械結構進行查證。

7.2.2 按鈕型緊急停止裝置

7.2.2.1 6.3.1 之要求係透過手動閂鎖及重置致動器之方式檢查。

7.2.2.2 6.3.2 之要求係透過檢驗固定零件、手動拉動與轉動按鈕及其他零件之方式查證。

7.3 Operating tests

7.3.1 General

The purpose of the operating tests is to verify the durability of the latching parts (springs, balls, pins etc.) in normal use.

The test verifies the requirements of 6.1.2, 6.2.2 and 6.3.

The operating tests described in this subclause may be carried out in conjunction with the electrical tests (see clause 5).

7.3.2 Robustness of a button actuator

A button actuator shall withstand:

- a force as specified in Table 1, applied in the three mutually perpendicular axes; and
- a torque as specified in Table 1, in both directions of rotation, in each of the latched and unlatched positions, where the resetting action requires rotation of the push-button.

7.3 操作試驗

7.3.1 一般

操作試驗之目的在於查證閂鎖零件(例：彈簧、滾球、插銷等)在正常使用中之耐久性。

此試驗查證 6.1.2、6.2.2 及 6.3 之要求。

本節所述之操作試驗可和電氣試驗(參照第 5 節)一起進行。

7.3.2 按鈕致動器之堅固性

按鈕致動器應能抵抗

－ 施加在 3 個相互垂直軸上之力(表 1)。及

－ 若必須轉動按鈕開關才能完成重置動作，則應能抵抗施加在兩個旋轉方向(分別為閂鎖及解鎖)上之扭力(表 1)。

Table 1 – Robustness of a button type actuator

Mounting hole diameter mm	Force N	Torque N·m
16	80	1,6
22	110	2,2
30	150	3,0

表 1　按鈕型致動開關之堅固性

裝設孔直徑 mm	力 N	扭力 N・m
16	80	1.6
22	110	2.2
30	150	3.0

7.3.3 Durability test

The three samples (see 7.1) shall be subjected to the following test:

The actuator of an emergency stop device shall be moved through its full travel, then it shall be reset in a manner to imitate human operation as closely as possible.

The test shall consist of 6 050 cycles in which latching and resetting of the actuator occurs during each cycle. The movement and actuating forces shall be consistent throughout the test. Monitoring of these parameters shall be carried out to ensure consistency.

The durability test is passed if each emergency stop device completes the 6 050 cycles without failure.

7.3.3 耐久性試驗

3 個樣品(參照 7.1)應進行下列試驗。

緊急停止裝置之致動器應完成整個移動行程，然後以儘可能仿效人工操作之方式重置。

此試驗應進行 6,050 次循環，每次循環都應完成致動器之閂鎖及重置，且在整個試驗期間移動及致動力皆應保持一致。必須監視試驗參數以確保試驗之一致性。

若各緊急停止裝置皆完成 6,050 次循環且未發生故障，即應認為通過耐久性試驗。

7.4 Conditioning procedures

The purpose of the following procedures is to expose the emergency stop devices to various environmental conditions in order to verify their functioning after such exposure.

The three emergency stop devices successfully tested in 7.3.3 shall be subjected to the following exposures:

7.4 調適程序

以下程序目的為讓緊急停止裝置暴露於不同之環境條件，並查證暴露後之功能作用。

應以 3 個通過 7.3.3 試驗之緊急停止裝置進行以下暴露試驗。

- 96 h at +70 °C in dry atmosphere (see test Ba of IEC 60068-2-2 and IEC 60721-3-3 class 3K7)
- 96 h at changing moist and warm atmosphere (see IEC 60068-2-30 and IEC 60721-3-3 class 3K7):

  +25 °C/+55 °C 97 % / 93 % RH
- 96 h at –40 °C (see IEC 60068-2-1: test Aa and IEC 60721-3-3 class 3K7)
- 96 h at +35 °C in a solution of 5 % NaCl (see IEC 60068-2-11 and IEC 60721-3-3 class 3C3).

Following the environmental exposures and after the devices have been restored to room temperature, the sequence of tests in 7.5, 7.6 and 7.7 shall be conducted.

- 在+70°C 之乾空氣條件下試驗 96 h(參照 IEC 60068-2-2 之試驗 Ba 及 IEC 60721-3-3 之 3K7 類)。
- 在改變中之濕度及溫暖空氣下試驗 96 h(參照 IEC 60068-2-30 及 IEC 60721-3-3 之 3K7 類)：

  +25 °C/+55 °C 97 % / 93 % RH
- –40°C 試驗 96 h (參照 IEC 60068-2-1：試驗 Aa 及 IEC 60721-3-3 之 3K7 類)。
- +35°C 在 5%NaCl 溶液中試驗 96 h (參照 IEC 60068-2-11 及 IEC 60721-3-3 之 3C3 類)。

完成環境暴露及裝置恢復至室溫後，應進行 7.5、7.6 及 7.7 之系列試驗。

7.5 Shock test

7.5.1 The three emergency stop devices which have been conditioned in accordance with 7.4 shall be tested each on one of the three mutually perpendicular axes.

7.5.2 Each emergency stop device is tested in the rest position and shall withstand 15 *g* shock in both directions of the corresponding axis (see IEC 60068-2-27:11 ms: 15 *g*).

During the test, the closed contacts shall not open, the open contacts, if applicable, shall not close and the latching mechanism shall not latch.

The checking means shall be able to detect any opening or closing of contacts longer than 0,2 ms.

7.5.3 The procedure is repeated in the actuated position (actuator latched).

During the test, the open contacts shall not close; the closed contacts, if applicable, shall not open; and the latching mechanism shall not unlatch.

7.5 衝擊試驗

7.5.1 完成 7.4 調適程序之 3 個緊急停止裝置，應分別用 3 個垂直軸之其中 1 個軸進行試驗。

7.5.2 每個緊急停止裝置分別在其靜止位置進行試驗，且應能抵抗作用於相關軸兩個方向之 15 g 衝擊(參照 IEC 60068-2-27:11 ms: 15 g)。

在試驗期間，閉路觸點不應開路，開路觸點(若適用時)不應閉路，且閂鎖機構不應鎖定。

檢查裝置應能偵測任何超過 0.2 ms 之觸點斷開或閉合。

7.5.3 在致動位置(致動器鎖定)重複此程序。

在試驗期間，開路觸點不應閉路，閉路觸點(若適用時)不應開路，且閂鎖機構不應鎖定。

7.6 Vibration tests

7.6.1 The three samples used for 7.5 shall be tested, one for each of the three mutually perpendicular axes.

7.6 振動試驗

7.6.1 應對 7.5 所使用之 3 個樣品進行試驗，每個樣品分別用 3 個垂直軸之其中 1 個軸進行試驗。

7.6.2 Each emergency stop device is tested in the rest position as per the following specifications (see IEC 60068-2-6):

- frequency range: 10 Hz to 500 Hz, logarithmic ramp and return;
- duration 2 h: 10 sweep cycles, 1 oct/min;
- maximum peak amplitude: 0,35 mm (0,7 mm from peak to peak);
- maximum acceleration: 50 m/s²;
- crossover frequency between 58 Hz and 62 Hz.

During the test, the closed contacts shall not open, the open contacts, if applicable, shall not close, and the latching mechanism shall not latch.

The checking means shall be able to detect any opening or closing of contacts longer than 0,2 ms.

7.6.2 每個緊急停止裝置皆依下列規定於其靜止位置進行試驗(參照 IEC 60068-2-6)：

－ 頻率範圍：10 Hz 至 500 Hz，對數坡道(Ramp)與返回(Return)。

－ 持續期間 2 h：10 次掃描循環，1 oct/min。

－ 最大峰值振幅：0.35 mm(峰至峰 0.7mm)。

－ 最大加速：50 m/s^2。

－ 交叉頻率(crossover frequency)介於 58 Hz 至 62 Hz 之間。

在試驗期間，閉路觸點不應開路，開路觸點(若適用時)不應閉路，且閂鎖機構不應鎖定。

檢查裝置應能偵測任何超過 0.2 ms 之觸點斷開或閉合。

7.6.3 The procedure is repeated in the actuated position (actuator latched).

During the test, the open contacts shall not close, the closed contacts, if applicable, shall not open, and the latching mechanism shall not unlatch.

7.6.3 在致動位置(致動器鎖定)重複此程序。

在試驗期間，開路觸點不應閉路，閉路觸點(若適用時)不應開路，且閂鎖機構不應鎖定。

7.7 Latching, resetting and impact tests

7.7.1 General

The three sample emergency stop devices which have successfully completed the tests of 7.6 shall be used for the following tests.

The requirements of 6.2.1 are verified by testing each sample in accordance with 7.7.2, 7.7.3 and 7.7.4. The sample shall also be tested in accordance with 7.7.5 where applicable.

7.7 閂鎖、重置及撞擊試驗

7.7.1 一般

3 個完成 7.6 試驗之緊急停止裝置應進行下列試驗。

每個樣品依 7.7.2、7.7.3 及 7.7.4 進行試驗以完成 6.2.1 之查證，若適用則樣品

亦應依 7.7.5 進行試驗。

7.7.2 Opening test

The actuator of the emergency stop device shall be moved slowly just to the point where latching occurs.

The normally closed contacts shall then be open. This shall be verified by an impulse voltage test at 2 500 V (see details in K.8.3.4.4.1 of IEC 60947-5-1).

7.7.2 斷開試驗

緊急停止裝置之致動器應緩慢移動至剛好鎖定之位置。

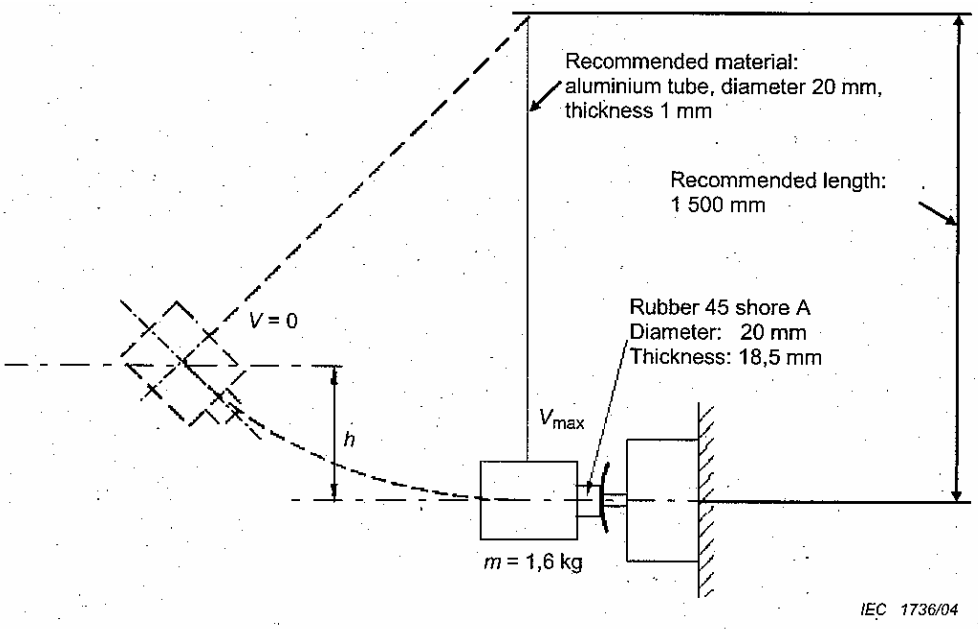
到達此位置時常閉觸點應變成開路。應以 2,500 V 之脈衝電壓查證此結果(參照 CNS 14816-5-1 之 K.8.3.4.4.1 的詳細說明)。

7.7.3 Latching test

To simulate the typical human actuation of a button-type switch, the emergency stop device and its actuator shall be mounted and tested by a pendulum-type hammer as shown in Figure 1.

7.7.3 閂鎖試驗

為了模擬按鈕式開關之典型手動致動操作，緊急停止裝置及其致動器應在安裝後用鐘擺式撞錘(pendulum-type hammer)進行試驗(圖 1)。



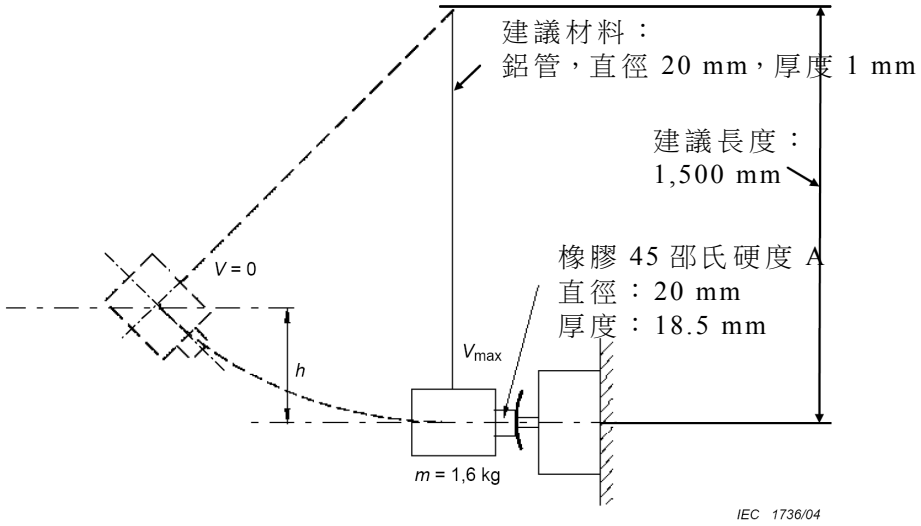
NOTE The 1,6 kg mass does not include the mass of the aluminium tube.

Figure 1 – Hammer for tests

The relationship between the emergency stop mounting hole and the hammer height (*h*) is given in Table 2.

Table 2 – Relationship between the emergency stop mounting hole and the hammer height

Mounting hole diameter mm	Hammer height (*h*) mm
16	60 if the actuator diameter is < 30 mm 75 if the actuator diameter is ≥ 30 mm
22	75
30	75



備考：1.6 kg 之質量不包括鋁管質量。

圖 1　撞錘試驗

緊急停止安裝孔與撞錘高度(h)之關係如表 2 所示。

表 2　緊急停止安裝孔與撞錘高度之關係

裝設孔直徑 mm	撞錘高度 (h) mm
16	若致動器直徑 < 30mm：60 若致動器直徑 ≥ 30mm：75
22	75
30	75

The actuator shall be unlatched prior to each strike.

The hammer shall be released whilst stationary.

To ensure that the hammer is released whilst stationary, it is recommended that a magnetic or other holding mechanism is used.

This test shall be performed three times.

After each strike, the actuating system shall be latched.

Other types are under consideration.

致動器應在每次撞擊前解鎖。

撞錘在應靜止不動時釋放。

建議使用磁性或其他抓握機構確保撞錘在靜止不動時釋放。

此試驗應進行 3 次。

致動系統在每次撞擊後皆應鎖定。

正在考慮使用其他方法。

7.7.4　Resetting test

a) if the resetting is by pulling, the pulling force shall be less than 50 N;

b) if the actuator is reset by turning, the torque shall be less than 1 N·m;

c) for other types: under consideration.

7.7.4 重置試驗

(a) 若以拉動方式重置，則拉力應小於 50 N。

(b) 若以轉動方式重置致動器，則扭力應小於 1 N•m。

(c) 以其他方法重置：正在考量中。

7.7.5 Impact test for button type actuators

In order to verify 6.1.2 and 6.1.3 where applicable, the three sample emergency stop devices are tested by striking the actuator three times with the hammer shown in Figure 1, where h = 310 mm ± 2 mm.

The actuator shall be unlatched prior to each strike.

After each strike, the emergency stop device shall be latched and break contacts shall be open.

After three strikes, the actuator shall not be damaged.

After the third strike, the opening contact element shall meet the requirements of K.8.3.6 of IEC 60947-5-1.

7.7.5 按鈕型致動器之撞擊試驗

使用 3 個緊急停止裝置樣品進行試驗，並在試驗時撞擊致動器 3 次以查證 6.1.2 及 6.1.3；所使用之撞錘如圖 1 所示，其中 h = 310 mm±2 mm。

在每次撞擊前致動器皆應解鎖。

緊急停止裝置在每次撞擊後皆應鎖定，且斷路觸點應變成開路。

致動器在 3 次撞擊後不應損壞。

在第 3 次撞擊後，開路接觸元件應符合 CNS 14816-5-1 之 K.8.3.6 的要求。

7.8 Miscellaneous tests

7.8.1 Disengagement of wire or rope

In order to verify 6.4.2 where applicable, one emergency stop device is installed with the wire or rope according to the manufacturer's instructions.

The rope is disengaged.

The main contact(s) shall open and the actuating system shall latch in the active position.

7.8.2 Effect of foreign matter

Special tests are under consideration.

7.8 其他試驗

7.8.1 拉線或拉繩之脫離

為了查證 6.4.2，1 個緊急停止裝置依照製造廠商之說明書安裝拉線或拉繩。

拉繩脫離。

主觸點應斷開，且致動系統應鎖定在作用位置。

7.8.2 正在研究專用之試驗方法。

相對應國際標準

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

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由中華民國國家標準之英文代號「CNS」及中文符號「㊣」組成

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