中華民國國家標準 CNS	低電壓開關及控制－控制電路裝置及開關操作元件－電機控制電路裝置	總號	
		類號	C4

Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices

編訂說明：本草案建議案號為「建-制 1000434」，草案編號為「CNS 草-制 1030416」，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 60947-5-1:2009 編擬而成。本案依程序辦理徵求意見，敬請　惠賜卓見。

1 General

The provisions of the general rules, IEC 60947-1, are applicable to this standard, where specifically called for. General rules, clauses and subclauses thus applicable, as well as tables, figures and annexes are identified by a reference to IEC 60947-1, for example 1.2.3, Table 4 or Annex A of IEC 60947-1.

1. 一般

有特別需要時，IEC 60947-1 之一般性規定得適用於本標準。因此，通則、節、小節以及表格、附圖與附錄均與所參照之 IEC 60947-1 相同，例：IEC 60947-1 之 1.2.3、表 4 或附錄 A。

1.1 Scope and object

This part of IEC 60947 applies to control circuit devices and switching elements intended for controlling, signalling, interlocking, etc., of switchgear and controlgear.

It applies to control circuit devices having a rated voltage not exceeding 1 000 V a.c. (at a frequency not exceeding 1 000 Hz) or 600 V d.c.

1.1 適用範圍

本標準適用於開關盤及控制盤中，作為控制、信號、互鎖等功能用之控制電路裝置與開關元件。

適用範圍包括額定電壓不超過 1,000 V ac(頻率在 1,000 Hz 以下)，或 600 V dc 之控制電路裝置。

However, for operational voltages below 100 V a.c. or d.c., see note 2 of 4.3.1.1.

This standard applies to specific types of control circuit devices such as:

– manual control switches, for example pushbuttons, rotary switches, foot switches, etc.;
– electromagnetically operated control switches, either time-delayed or instantaneous, for example contactor relays;

至於操作電壓低於 100 V ac 或 dc 者，參照 4.3.1.1 之備考 2。

本標準適用於特定形式之控制電路裝置，包括

－ 手動控制開關，例：按鈕、旋轉開關、腳踏開關等。

－ 延遲式或立即式電磁操作控制開關，例：電磁繼電器(contactor relay)。

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印行年月

- pilot switches, for example pressure switches, temperature sensitive switches (thermostats), programmers, etc.;
- position switches, for example control switches operated by part of a machine or mechanism;
- associated control circuit equipment, for example indicator lights, etc.

NOTE 1 A control circuit device includes (a) control switch(es) and associated devices such as (an) indicator light(s).

NOTE 2 A control switch includes (a) switching element(s) and an actuating system.

NOTE 3 A switching element may be a contact element or a semiconductor element.

It also applies to specific types of switching elements associated with other devices (whose main circuits are covered by other standards) such as:

- auxiliary contacts of a switching device (e.g. contactor, circuit breaker. etc.) which are not dedicated exclusively for use with the coil of that device;
- interlocking contacts of enclosure doors;
- control circuit contacts of rotary switches;
- control circuit contacts of overload relays.

－ 操控開關(pilot switch)，例：壓力開關、溫度感應開關(恆溫器)、程式控制器等。

－ 位置開關，例：以機械零件或機構操作之控制開關。

－ 相關控制電路裝置，如指示燈等

備考 1. 控制電路裝置包含(1 個或多個)控制開關及指示燈等附屬裝置。

備考 2. 控制開關包含(1 個或多個)開關元件及致動系統。

備考 3. 開關元件可為接點元件或半導體元件。

本標準亦適用於附有其他裝置(其主要電路規定於其他標準)之特定形式開關元件，舉例如下。

－ 開關裝置之輔助接點(例：電磁開關(contactor)、斷路器(circuit breaker)等)，該等輔助接點並非專用於連接該裝置之線圈者。

－ 箱門之互鎖接點。

－ 旋轉開關之控制電路接點。

－ 過載繼電器之控制電路接點。

Contactor relays shall also meet the requirements and tests of IEC 60947-4-1 except for the utilization category which shall comply with this standard.

This standard does not include the relays covered in IEC 60255 or in the IEC 61810 series, nor automatic electrical control devices for household and similar purposes.

The colour requirements of indicator lights, pushbuttons, etc., are found in IEC 60073 and also in publication 2 of the International Commission of Illumination (CIE).

除符合本標準之使用分類外，電磁繼電器同時須符合 IEC 60947-4-1 之要求及試驗。

本標準不包含 IEC 60255 或 IEC 61810 系列所述之繼電器，亦不包含家用或類似用途之電氣自動控制裝置。

指示燈、按鈕等之顏色要求，列於 IEC 60073 及國際照明協會(CIE)之中。

The object of this standard is to state:

a) The characteristics of control circuit devices.

b) The electrical and mechanical requirements with respect to:

1) The various duties to be performed.

2) The significance of the rated characteristics and of the markings.

3) The tests to verify the rated characteristics.

c) The functional requirements to be satisfied by the control circuit devices with respect to:

1) Environmental conditions, including those of enclosed equipment.

2) Dielectric properties.

3) Terminals.

本標準旨在陳述

(a) 控制電路裝置之特性。

(b) 有關下列項目之電氣性及機械性要求。

(1) 各種必備之性能。

(2) 額定特性及標示之意義。

(3) 額定特性之驗證試驗。

(c) 控制電路裝置須符合下列項目之功能需求。

(1) 包括密閉設備在內之環境條件。

(2) 介電特性。

(3) 端子。

1.2 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 and fuses

Amendment 1 (2000)

IEC 60050(446):1983 International Electrotechnical Vocabulary (IEV) – Chapter 446: Electrical relays

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

IEC 60068-2-14:1984 Environmental testing – Part 2: Tests – Test N: Change of temperature

Amendment 1 (1986)

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

IEC 60068-2-30:2005 Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)

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

IEC 60112:2003	Method for the determination of the proof and the comparative tracking indices of solid insulating materials
IEC 60255 (all parts)	Electrical relays
IEC 60417	Graphical symbols for use on equipment
IEC 60617 (all parts)	Graphical symbols for diagrams
IEC 60947-1:2007	Low-voltage switchgear and controlgear – Part 1: General rules
IEC 60947-4-1:2000	Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters
Amendment 1 (2002)	
Amendment 2 (2005)	
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 61000-4-2:1995	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test
Amendment 1 (1998)	
Amendment 2 (2000)	
IEC 61000-4-3:2008	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test
IEC 61000-4-4:2004	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test
IEC 61000-4-5:2005	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test
IEC 61000-4-6:2008	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields
IEC 61000-4-8:1993	Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test
Amendment 1 (2000)	
IEC 61000-4-11:2004	Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests
IEC 61000-4-13:2002	Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power

port, low-frequency immunity tests

IEC 61140:2001 Protection against electric shock – Common aspects for installation and equipment

Amendment 1 (2004)

CISPR 11:2003 Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement

Amendment 1 (2004)

Amendment 2 (2006)

2 Definitions

For the purposes of this part of IEC 60947 the definitions of IEC 60947-1 and the following additions apply:

2. 用語及定義

CNS 14816-1 所規定及下列用語及定義適用於本標準。

2.1 Basic definitions

2.1.1
control circuit device
an electrical device intended for the controlling, signalling, interlocking, etc., of switchgear and controlgear

NOTE Control circuit devices may include associated devices dealt with in other standards, such as instruments, potentiometers, relays, in so far as associated devices are used for the purposes specified above.

2.1 基本定義(basic definitions)

2.1.1 控制電路裝置(control circuit device)

在開關盤及控制盤內作為控制、信號、互鎖等功能之電氣裝置。

備考： 控制電路裝置可包含符合其他標準之附屬裝置，例：用於上述功能之儀器、電位器、繼電器。

2.1.2
control switch (for control and auxiliary circuits)
a mechanical switching device which serves the purpose of controlling the operation of switchgear or controlgear, including signalling, electrical interlocking, etc.

NOTE 1 A control switch consists of one or more contact elements with a common actuating system.

NOTE 2 This definition differs from IEV 441-14-46 since a control switch may include semiconductor elements or contact elements (see 2.3.2 and 2.3.3).

2.1.2 控制開關(控制及輔助電路用) (control switch (for control and auxiliary circuits))

一種機械開關裝置，其功能為控制開關盤或控制盤之操作，包括信號、電氣互鎖等。

備考 1. 控制開關包含一或多組接點元件及共用致動系統。

備考 2. 本定義不同於 IEV 441-14-46，因控制開關可包含半導體元件及接點元件(參照 2.3.2 及 2.3.3)。

2.1.3
control switch suitable for isolation
a control switch which, in the open position, complies with the requirements specified for the isolating function (see 2.1.19 and 7.2.3.1 b) of IEC 60947-1)

NOTE Such control switches are intended to provide a higher degree of safety to personnel when working on the equipment controlled. For this reason, they have to be manually actuated relying on the intelligence of instructed persons to react in case they would fail to operate, e.g. in case of insufficiently opened contacts.

2.1.3 適用於隔離之控制開關(control switch suitable for isolation)

其開啟位置符合指定隔離功能需求(參照 IEC 60947-1 之 2.1.19 及 7.2.3.1(b))之控制開關。

備考： 該等控制開關專用於為操作設備之工作人員，提供較高之安全性。因此，在該等開關故障時(亦即接點斷開不充分時)，必須由受過訓練之合格人員判斷，以手動致動。

2.1.4
control station
an assembly of one or more control switches fixed on the same panel or located in the same enclosure

[IEV 441-12-08]

NOTE A control station panel or enclosure may also contain related equipment, e.g. potentiometers, signal lamps, instruments, etc.

2.1.4 控制站(control station)

固定於同一面板或位於同一殼體內之 1 個或多個控制開關之組合體。

備考： 控制站面板或殼體上亦可包含相關設備，例：電壓計、信號燈、儀器等。

2.2 Control switches

2.2.1
automatic control switches

NOTE Automatic control switches are operated by automatic control (see 2.4.5 of IEC 60947-1). They are also designated as *pilot switches* (see 2.2.18 of IEC 60947-1).

2.2.1.1
instantaneous contactor relay
a contactor relay operating without any intentional time delay

[IEV 441-14-36]

NOTE Unless otherwise stated, a contactor relay is an instantaneous contactor relay.

2.2 控制開關(control switches)

2.2.1 自動控制開關(automatic control switches)

備考： 自動控制開關係由自動控制操作(參照 IEC 60947-1 之 2.4.5)，並指派為指示燈開關(參照 IEC 60947-1 之 2.2.18)。

2.2.1.1 立即式電磁繼電器(instantaneous contactor relay)

未經刻意延時操作之電磁開關。

備考： 除非另有說明，電磁開關皆指立即式電磁開關。

2.2.1.2
time-delay contactor relay
a contactor relay with specified time-delay characteristics

[IEV 441-14-37]

NOTE 1 The time-delay may be associated with energization *(e-*delay*)* or with de-energization (*d*-delay) or both.

NOTE 2 A time-delay contactor relay may also incorporate instantaneous contact elements.

2.2.1.2 延遲電磁繼電器(time-delay contactor relay)

具有特定延時特性之電磁開關。

備考 1. 時間延遲可配合通電(e-延遲)或不通電(d-延遲)或兩者。

備考 2. 延遲電磁開關亦可含有立即式接點元件。

2.2.1.3
position switch
A pilot switch the actuating system of which is operated by a moving part of the machine, when this part reaches a predetermined position

[IEV 441-14-49]

2.2.1.3 位置開關(position switch)

附有指示器開關，其致動系統係由機器之運動零件到達預設位置以進行操作。

2.2.1.4
programmer
a control switch having a multiplicity of switching elements which, after initiation, operates in a defined sequence

2.2.1.4 程序控制器(programmer)

具有多組開關元件、致動後可依設定程序操作之控制開關。

2.2.2
manually operated control switches

NOTE Manually operated control switches are operated by manual control (see 2.4.4 of IEC 60947-1).

2.2.2.1
push-button
a control switch having an actuator intended to be operated by force exerted by a part of the human body, usually the finger or palm of the hand, and having stored energy (spring) return

[IEV 441-14-53]

2.2.2 手動操作控制開關(manually operated control switches)

備考： 手動操作控制開關由手動控制操作(參照 IEC 60947-1 之 2.4.4)。

2.2.2.1 按鈕(push-button)

致動器須藉人體(通常為手指或手掌)施壓之控制開關，並具有歸位蓄能彈簧者。

2.2.2.2
pull-button
a control switch having an actuator intended to be operated by manual pull, and having stored energy (spring) return

2.2.2.2 拉拔鈕(pull-button)

致動器須藉人工拉拔之控制開關，並具有歸位蓄能彈簧者。

2.2.2.3
push-pull button
a control switch having an actuator intended to be operated by manual push and returned to its initial position by manual pull, or vice versa

NOTE There are also «push-push» or «push-turn» or other combinations of buttons.

2.2.2.3 壓拔鈕(push-pull button)

須藉人工按壓致動，並須人工拉拔歸位之控制開關；或須藉人工拉拔致動，並須人工按壓歸位者。

備考： 另外還有〝壓-壓〞或〝壓-歸位〞，或他種組合之開關鈕。

2.2.2.4
rotary button (e.g.: selector switch)
a combination of push-button type switching elements having an actuator operated by a manual rotation (see also 2.2.2.15 to 2.2.2.18 inclusive)

NOTE A rotary push-button may have more than two positions; it may or may not have a spring return.

2.2.2.4 旋轉鈕(例：選擇開關) (rotary button (e.g.: selector switch))

具有以人工旋轉之致動器、由按鈕式開關元件聯合組成之機構(參照 2.2.2.15 至 2.2.2.18)。

備考： 旋轉鈕可有 2 個以上位置；彈簧回歸功能則可有可無。

2.2.2.5
latched push-button
a push-button with spring return, but which remains in the actuated position until a latch is released by a separate action

NOTE The latching may be released by subsequent actuation (such as pushing, turning, etc.) of the same or of an adjacent push-button or by the action of an electromagnet, etc.

2.2.2.5 閂鎖按鈕(latched push-button)

附回歸彈簧之閂鎖按鈕，但開關保持在致動位置，直到另一動作解除閂鎖為止。

備考： 該閂鎖功能，可由按鈕本身或相鄰按鈕之隨後啟始動作(例：按壓、轉動等)予以釋放，或以電磁動作釋放之。

2.2.2.6
locked push-button
a push-button which may be secured in one or more of its positions by a separate action

NOTE The locking may be obtained by turning the button, by turning a key, by operating a lever, etc.

2.2.2.6 鎖定按鈕(locked push-button)

可因另一獨立動作，而固定在 1 個或多個位置之按鈕。

備考： 鎖定功能可透過轉動鈕、轉動鑰匙，或操作拉桿等方式達成。

2.2.2.7
key-operated push-button
a push-button which can only be operated as long as a key remains inserted

NOTE Key withdrawal may be provided at any position.

2.2.2.7 鑰匙操作按鈕(key-operated push-button)

必須插入鑰匙方可操作之按鈕。

備考： 鑰匙拔出位置可配置於任一位置。

2.2.2.8
time-delay push-button
a push-button the contacts of which return to the initial position only after a pre-determined interval of time following the release of the actuating force

2.2.2.8 時間延遲按鈕(time-delay push-button)

接點從按鈕釋放致動力起，經過預設時間方回至啟始位置之按鈕。

2.2.2.9
delayed action push-button
a push-button in which the switching operation does not occur until after the force on the button has been maintained for a pre-determined interval of time

2.2.2.9 動作延遲按鈕(delayed action push-button)

施加在按鈕上之致動力必須維持一段預設時間之後，方可啟動開關動作之按鈕。

2.2.2.10
illuminated push-button
a push-button incorporating a signalling lamp in the button
2.2.2.10照明按鈕(illuminated push-button)

內部附有信號燈光之按鈕。

2.2.2.11
covered push-button
a push-button in which the button is protected against inadvertent operation by a lid or a cover
2.2.2.11護蓋按鈕(covered push-button)

有蓋板或護罩保護，以防止不經意作動之按鈕。

2.2.2.12
shrouded push-button
a push button in which the button is protected against inadvertent operation in certain directions
2.2.2.12護罩按鈕(shrouded push-button)

有側板保護，以防止特定方向不經意作動之按鈕。

2.2.2.13
free push-button
a push-button in which the rotation of the actuator around its axis is not limited
2.2.2.13自由按鈕(free push-button)

致動器可繞軸無限制轉動之按鈕。

2.2.2.14
guided push-button
a push-button in which the rotation of the actuator around its axis is prevented

NOTE　Examples of guided push-buttons: the actuators of which are keyed, square or rectangular, etc.
2.2.2.14導引按鈕(guided push-button)

致動器繞軸轉動受限制之按鈕。

備考： 有導引按鈕實例：致動器為有齒、方形或長方形等之按鈕。

2.2.2.15
rotary control switch (abbreviation: rotary switch)
a control switch having an actuator intended to be operated by rotation
2.2.2.15旋轉控制開關(縮寫：旋轉開關) (rotary control switch (abbreviation: rotary switch))

須旋轉操作致動器之控制開關。

2.2.2.16
key-operated rotary switch
a rotary switch where a key is used as the actuator

NOTE　Key withdrawal may be provided at any position.
2.2.2.16鑰匙操作旋轉開關(key-operated rotary switch)

以鑰匙作為致動器之旋轉開關。

備考： 鑰匙拔出位置可配置於任一位置。

2.2.2.17
limited movement rotary switch
a rotary switch with a restricted angular movement of its actuator
2.2.2.17限制動作旋轉開關(limited movement rotary switch)

致動器動作角度受到限制之旋轉開關。

2.2.2.18
unidirectional movement rotary switch
a rotary switch in which the actuating system allows rotation in one direction only

2.2.2.18單一方向轉動之旋轉開關(unidirectional movement rotary switch)

致動系統只能在單一方向轉動之旋轉開關。

2.2.2.19
joy stick
a control switch having an actuator consisting of a pin or stick projecting essentially at a right angle from the panel or enclosure when in one of its positions and intended to be operated by angular displacement

NOTE 1 A joy stick may have more than two positions associated with different directions of the displacement of the stick and operating the contact elements differently: such a joy stick is referred to as a joy stick selector.

NOTE 2 The pin or stick may or may not have a spring return.

2.2.2.19搖桿(joy stick)

控制開關之致動器，由在某一位置上以直角突出面板或箱體之針或桿構成，並以角位移量進行操控者。

備考 1. 搖桿可能以兩個以上之位置連結搖桿位移之不同方向，並以不同方式操作接點元件；此類搖桿稱為〝搖桿選擇器〞。

備考 2. 其針或桿可能附有歸位彈簧，亦可能沒有。

2.2.2.20
wobble stick
a joy stick which operates all contact elements alike, whatever be the direction of the displacement

2.2.2.20全向搖桿(wobble stick)

不論位移方向為何，搖桿之所有接點元件皆以相同方式作動。

2.2.2.21
foot switch (pedal)
a control switch having an actuator intended to be operated by force exerted by a foot

[IEV 441-14-52 modified]

2.2.2.21腳踏開關(踏板) (foot switch (pedal))

致動器須以腳踏施力操作之控制開關。

2.3 Parts of control switches

2.3.1
switching element
a switching element may be a semiconductor element (see 2.3.2) or a contact element (see 2.3.3)

2.3 控制開關之零件(parts of control switches)

2.3.1 開關元件(switching element)

開關元件可為半導體元件(參照 2.3.2)或接點元件(參照 2.3.3)。

2.3.2
semiconductor element
an element designed to switch the current of an electric circuit by means of the controlled conductivity of a semiconductor

2.3.2 半導體元件(semiconductor element)

藉由控制半導體之導電性開關電路電流的一種元件。

2.3.3
contact element (of a control switch)
the parts, fixed and movable, conducting and insulating, of a control switch necessary to close and open one single conducting path of a circuit

NOTE 1 The contact element and the actuating system may form an indivisible unit, but frequently one or more contact elements may be combined with one or more actuating system or systems. The actuating systems may be different.

NOTE 2 Definitions relating to various kinds of contact elements are given in 2.3.3.1 to 2.3.3.10 inclusive.

NOTE 3 This definition does not include control coils and magnet systems.

The following definitions refer to a single contact element of a control switch:

2.3.3 (控制開關之)接點元件(contact element (of a control switch))

控制開關中用以接通與啟斷電路中一組信號通路之基本元件，有固定與可移動者、也有導通及隔離者。

備考 1. 接點元件與致動系統可形成隱蔽之單元，但通常 1 個或多個接點元件，必須與 1 個或多個致動系統聯合。可能有不同之致動系統。

備考 2. 2.3.3.1 至 2.3.3.10 詳述各種接點元件之定義。

備考 3. 本定義不包含控制線圈與電磁系統。

下列定義係針對控制開關中之單一接點元件。

2.3.3.1
single gap contact element (see Figures 4 a) and 4 c))
a contact element which opens or closes the conducting path of its circuit on one location only

2.3.3.1 單間隙接點元件(參照圖 4(a)及圖 4(c)) (single gap contact element (see Figures 4 (a) and 4 (c)))

在單一位置上開啟或關閉其電路導電通路之接點元件。

2.3.3.2
double gap contact element (see Figures 4 b), 4 d) and 4 e))
a contact element which opens or closes the conducting path of its circuit in two locations in series

2.3.3.2 雙間隙接點元件(參照圖 4(b)、4(d)及 4(e)) (double gap contact element (see Figures 4 (b), 4 (d) and 4 (e)))

在兩個串聯位置上，開啟或關閉其電路導電通路之接點元件。

2.3.3.3
make-contact element (normally open)
a contact element which closes a conducting path when the control switch is actuated

2.3.3.3 投入(make)接點元件(常開) (make-contact element (normally open))

起動控制開關時，使導電通路導通之接點元件。

2.3.3.4
break-contact element (normally closed)
a contact element which opens a conducting path when the control switch is actuated

2.3.3.4 啟斷(break)接點元件(常閉) (break-contact element (normally closed))

起動控制開關時，使導電通路斷開之接點元件。

2.3.3.5
change-over contact elements (see Figures 4 c), 4 d) and 4 e))
a contact element combination which includes one make-contact element and one break-contact element

2.3.3.5 切換接點元件(參照圖 4(c)、4(d)及 4(e)) (change-over contact elements (see Figures 4 c), 4 d) and 4 e)))

包含一組投入接點及一組啟斷接點之接點元件。

2.3.3.6
pulse (fleeting) contact element
a contact element which opens or closes a circuit for a part of the travel during the transition of the actuator from one position to another

2.3.3.6 脈衝(瞬間)接點元件(pulse (fleeting) contact element)

當開關從一位置致動至另一位置時，只在行程之局部時間內，啟閉電路之接點元件。

2.3.3.7
electrically separated contact elements
contact elements belonging to the same control switch, but adequately insulated from each other so that they can be connected into electrically separated circuits

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2.3.3.7 電氣隔離接點元件(electrically separated contact elements)

屬於同一控制開關，但彼此絕緣之接點元件，以便分別連接到分離之電路上。

2.3.3.8
independent (snap) action contact element
a contact element of a manual or automatic control device in which the velocity of contact motion is substantially independent of the velocity of motion of the actuator

2.3.3.8 非從動(急斷 snap)接點元件(independent (snap) action contact element)

手動或自動控制裝置中，接點運動速度實質上不依賴致動器運動速度之接點元件。

2.3.3.9
dependent action contact element
a contact element of a manual or automatic control device in which the velocity of contact motion depends on the velocity of motion of the actuator

2.3.3.9 從動接點元件(dependent action contact element)

手動或自動控制裝置中，接點運動速度依賴致動器運動速度之接點元件。

2.3.3.10
contact unit
a contact element or contact element combination which can be combined with similar units operated by a common actuating system

2.3.3.10 接點單元(contact unit)

係指接點元件或接點元件組合；可將受同一致動系統作動之相同單元，聯合成一個接點單元。

2.3.4
button
the external end of the actuator of a push-button, to which the actuating force is applied

2.3.4 按鈕(button)

供施加致動力之按鈕外端。

2.3.4.1
flush-button
a button which is substantially level with the adjacent fixed surrounding surface when in its initial position and is below this surface when it is operated

2.3.4.1 齊平按鈕(flush-button)

這種按鈕之起始位置與安裝平面齊平，致動時之位置則低於安裝平面。

2.3.4.2
recessed button
a button which is below the adjacent fixed surrounding surface in both its initial and operated positions

2.3.4.2 凹入按鈕(recessed button)

此種按鈕之起始位置與致動時之位置，都低於安裝平面。

2.3.4.3
extended button
a button which protrudes above the adjacent fixed surrounding surface both in its initial position and in its operated position

2.3.4.3 凸出按鈕(extended button)

此種按鈕之起始位置與致動時之位置，都高於安裝平面。

2.3.4.4
mushroom button
a button, the protruding end of which has an enlarged diameter

2.3.4.4 香菇頭按鈕(mushroom button)

此種按鈕之突出部分直徑較大。

2.3.5
locating mechanism (of a rotary switch)
that part of the actuating system which retains the actuator and/or the contact elements in their positions

2.3.5 (旋轉開關之)定位機構(locating mechanism (of a rotary switch))

致動系統中，負責將致動器及/或接點元件維持在各位置之零件。

2.3.6
end stop
a device that limits the travel of a moving part

NOTE An end stop may relate either to the actuator or to the contact element.

2.3.6 終端擋子(end stop)

限制運動零件行程之裝置。

備考： 終部擋子可能與致動器及接點元件兩者之一相關聯。

2.4 Operation of control switches

2.4.1 Operation of contactor relays

2.4 操作控制開關(operation of control switches)

2.4.1 電磁繼電器(contactor relay)之操作(operation of contactor relays)

2.4.1.1
e-delay (of a contact element)
a delay in the operation of a contact element of a contactor relay, following the energization of the coil of the electromagnet of this contactor relay

Example: delay to close make-contacts (ON delay).

2.4.1.1 接點元件之 e-延遲(e-delay (of a contact element))

在電磁開關之電磁線圈通電之後，接點元件操作時之延遲。

範例：〝投入接點〞之閉合延遲(ON 延遲)。

2.4.1.2
***d*-delay (of a contact element)**
a delay in the operation of a contact element of a contactor relay, following the de-energization of the coil of the electromagnet of this contactor relay

Example: delay to open make-contacts (OFF delay)

Note for 2.4.1.1 and 2.4.1.2 – The terms '*e*-delay" and "*d*-delay" may be applied to any kind of contact elements (see 2.3.3).

2.4.1.2 接點元件之 d-延遲(d-delay (of a contact element))

在電磁開關之電磁線圈啟斷電源之後，接點元件操作時之延遲。

範例：〝投入接點〞之開啟延遲(OFF 延遲)。

備考：2.4.1.1 及 2.4.1.2 所述〝e-延遲〞及〝d-延遲〞，可應用於任何型式之接點元件(參照 2.3.3)。

2.4.1.3
fixed delay (of a contact element)
a delay in the operation of a contact element of a contactor relay, which is not intended to be adjusted in value

2.4.1.3 (接點元件之)固定延遲(fixed delay (of a contact element))

電磁開關之接點元件操作時之延遲值，為固定不可調整者。

2.4.1.4
adjustable delay (of a contact element)
a delay in the operation of a contact element of a contactor relay, which is intended to be adjusted to different values after the installation of the contactor relay

2.4.1.4 (接點元件之)可調節延遲(adjustable delay (of a contact element))

電磁開關之接點元件操作時之延遲值，可於電磁開關安裝後予以調整為不同數值者。

2.4.2 Operation of pilot switches

2.4.2 指示器開關之操作(operation of pilot switches)

2.4.2.1
actuating quantity
the physical quantity, the value of which is decisive for the actuation or non-actuation of a pilot switch

2.4.2.2
operating value
the value of the actuating quantity which is sufficient to cause a pilot switch to be actuated

2.4.2.3
return value
the value of the actuating quantity which has to be re-established in order to cause an actuated pilot switch to return to its position of rest

2.4.2.4
differential value
the difference between the operating value and the return value

2.4.2.1 致動量(actuating quantity)

決定附指示器開關為致動或非致動之物理量。

2.4.2.2 操作值(operating value)

足以致動附指示器開關之致動量數值。

2.4.2.3 回復值(return value)

要使已被致動之〝附指示器開關〞回復其停留(rest)位置，所需建立之致動量值。

2.4.2.4 差值(differential value)

操作值與回復值之差異值。

2.4.3 Operation of rotary switches

2.4.3.1
definite position (abbreviation: position) (of a rotary switch)
a position into which the locating mechanism pulls the rotary switch and retains it as long as the actuating moment does not exceed a certain value

2.4.3 旋轉開關之操作(operation of rotary switches)

2.4.3.1 (旋轉開關之)明確位置(縮寫：位置) (definite position (abbreviation: position)

(of a rotary switch))

在致動力矩不超過某一定值之狀態下，定位機構可拉住旋轉開關，並使其停留在定位之一個位置點。

2.4.3.2
position of rest
a stable (definite) position into which the locating mechanism tends to move back and retain the rotary switch by stored energy

2.4.3.2 停留位置(position of rest)

定位機構企圖將旋轉開關，移回並停留在該處之一個穩定(明確)位置。

2.4.3.3
transit position
a (definite) position in which the locating mechanism produces an intended marked change in the operating moment, but in which the actuator cannot remain by itself

2.4.3.3 轉換位置(transit position)

在這個穩定(明確)位置，定位機構產生預設之操作力矩變化，但致動器無法自行停留在該處。

2.4.3.4
biased position
a (definite) position of a rotary switch in which the actuator is pulled against a stop from which it will return to a position of rest by means of stored energy (for example, by means of a spring)

NOTE During the transfer from a biased position to the adjacent position of rest, the rotary switch may pass through one or more transit positions.

2.4.3.4 偏壓施加位置(biased position)

旋轉開關在這個穩定(明確)位置，其致動器被儲存能量(例：彈簧力)拉向擋子，而回到停留位置。

備考： 從偏壓施加位置往停留位置之鄰近位置移動時，旋轉開關可能會通過1個或多個〝轉換位置〞。

2.4.3.5
latched position
a biased position in which the return mechanism is held by a latching arrangement

NOTE The latching arrangement may be released manually or otherwise.

2.4.3.5 閂鎖位置(latched position)

以閂鎖裝置固定回復機構之〝偏壓施加位置〞。

備考： 可手動或以其他方式釋放該閂鎖裝置。

2.4.3.6
locked position
a (definite) position in which a rotary switch is secured by separate action

NOTE The locking may be obtained by turning a key, operating a lever, etc.

2.4.3.6 固定位置(locked position)

以獨立動作使旋轉開關保持定位之明確位置。

備考： 固定動作可藉由轉動鑰匙、操作連桿等方式達成。

2.4.3.7
operating diagram
the representation of the intended order in which the contact elements of a rotary switch operate as a result of actuation

2.4.3.7 操作圖(operating diagram)

顯示致動旋轉開關時，其接點元件之設定操作順序。

2.4.4 Operation of mechanically operated control switches

2.4.4.1
pre-travel of the actuator (dimension *a* on Figure 2)
the maximum travel of the actuator which causes no travel of the contact elements

2.4.4.2
over-travel of the actuator
the travel of the actuator after all the contacts have reached their closed (open) position

2.4.4 機械操作控制開關之操作(operation of mechanically operated control switches)

2.4.4.1 致動器前置行程(圖 2 中 a 之尺寸) (pre-travel of the actuator (dimension a on Figure 2))

致動器運動時，接點元件尚未產生行程之最大距離。

2.4.4.2 致動器過行程(over-travel of the actuator)

所有接點到達其閉合(開放)位置時之致動器行程。

2.4.4.3
direct drive
a connection between actuator and contact element that excludes any pre-travel of the actuator

2.4.4.4
positive drive
a connection between actuator and contact element such that the force applied to the actuator is directly transmitted to the contact element

2.4.4.3 直接驅動(direct drive)

致動器與接點元件之間，一種不會使致動器產生前置行程之連接方式。

2.4.4.4 正向驅動(positive drive)

致動器與接點元件之間，將施加於致動器之力量直接傳遞到接點元件上之連接方式。

2.4.4.5
limited drive
a connection between actuator and contact element that limits the force transmitted to the contact element

2.4.4.6
minimum starting force (or moment)
the smallest value of force (or moment) initiating the pre-travel of the actuator

2.4.4.5 限制驅動(limited drive)

致動器與接點元件之間，施加於致動器之力量直接傳遞到接點元件上之連接方式。

2.4.4.6 最小起始力(或力矩) (minimum starting force (or moment))

使致動器產生前置行程所需之最小力量(或力矩)。

2.4.4.7
minimum actuating force (or moment)
the minimum value of the force (or moment) to be applied to the actuator that will cause all contacts to reach their closed (open) position

2.4.4.7 最小致動力(或力矩) (minimum actuating force (or moment))

使所有接點到達閉合(開放)位置，所需對致動器施加之最小力量(或力矩)。

2.4.4.8
pre-travel of the contact element (dimension *b* on Figure 2)
the relative movement which occurs within the contact element before the contacts make (break)

2.4.4.8 接點元件前置行程(圖 2 之尺寸 *b*) (pre-travel of the contact element (dimension b on Figure 2))

接點投入(或斷開)之前，接點元件內所產生之相對運動。

2.4.4.9
over-travel of the contact element (dimension *d* on Figure 2)
the relative movement which occurs within the contact element after the contacts have reached the make (break) position

2.4.4.9 接點元件過行程(圖 2 之尺寸 *b*) (over-travel of the contact element (dimension d on Figure 2))

接點到達投入(或斷開)位置之後，接點元件內所產生之相對運動。

2.4.4.10
bounce time
for a contact which is closing (opening) its circuit, the time interval between the instant when the contact circuit first closes (opens) and the instant when the circuit is finally closed (opened)

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2.4.4.10 作用時間(bounce time)

接點使電路閉合或開啟時，從接點電路剛要開始閉合(開啟)之瞬間，到完成閉合(開啟)之瞬間之間的時間間分級

3 Classification

3.1 Contact elements

Contact elements may be classified as follows:

a) Utilization categories (see 4.4).
b) Electrical ratings based on utilization categories (see Annex A).
c) One of the following form letters (see Figure 4):
   1) Form A – Single gap make-contact element;
   2) Form B – Single gap break-contact element;
   3) Form C – Single gap make-break three terminal change-over contact element;
   4) Form X – Double gap make-contact element;
   5) Form Y – Double gap break-contact element;
   6) Form Z – Double gap make-break four terminal change-over contact element.
d) Other types not included in c).

3. 分級

3.1 接點元件

接點元件可依下列項目分級。

(a) 使用分類(參照 4.4)。

(b) 依據使用分類之電氣額定值(參照附錄 A)。

(c) 下列型式代碼之一(參照圖 4)。

(1) 型式 A－單間隙投入接點元件。

(2) 型式 B－單間隙斷開接點元件。

(3) 型式 C－單間隙投入-斷開三端點切換接點元件。

(4) 型式 X－雙間隙投入接點元件。

(5) 型式 Y－雙間隙斷開接點元件。

(6) 型式 Z－雙間隙投入-斷開四端點切換接點元件。

(d) 未包含於(c)項之其他型式。

NOTE 1 Regarding Figure 4e). the two moving contact elements are electrically separated (see 2.3.3.7).

NOTE 2 Distinction is made between make before break (overlap) change-over contact elements where the two circuits are both closed for a part of the travel of the moving contacts from one position to the other, and break before make (non-overlap) change-over contact elements where the two circuits are both open for a part of the travel of the moving contacts from one position to the other. Unless otherwise stated, change-over contact elements are break before make.

備考 1. 依據圖 4(e)，兩個移動之接點元件為電氣隔離(參照 2.3.3.7)。

備考 2. [先投入後斷開(重疊)切換接點元件，其兩組電路在從一個位置移動到另一位置時之部分行程內都是閉合]，以及[先斷開後投入(非重疊)切換接點元件，其兩組電路在從一個位置移動到另一位置時之部分行程內都是斷開]，這兩者之間有所不同。除非另有指定，切換接點元件都是先啟斷後投入。

3.2 Control switches

Control switches may be classified according to the contact element and the nature of the actuating system, e.g. push-buttons, form X.

3.3 Control circuit devices

Control circuit devices may be classified according to the control switch and the associated control circuit equipment, e.g. push-buttons plus indicator lights.

3.4 Time delay switching elements

Distinction is made according to how the time delay of a switching element is achieved, e.g. electrical delay, magnetic delay, mechanical delay, or pneumatic delay.

3.5 Control switch mounting

The control switch mounting may be classified by the mounting hole size, e.g. D12, D16, D22, D30 (see 6.3.1).

3.2 控制開關

控制開關可依接點元件及致動系統之性質分級，例：型式 X 按鈕開關。

3.3. 控制電路裝置

控制電路裝置可依控制開關及附屬控制電路設備分級，例：按鈕附指示燈。

3.4 延遲開關元件

開關元件之時間延遲依其達成延遲方法而有所不同，例：電氣延遲、電磁延遲、機械延遲或氣動延遲。

3.5 安裝控制開關

控制開關安裝方式可依安裝孔徑分級，例：D12、D16、D22、D30 (參照 6.3.1)。

4 Characteristics

4.1 Summary of characteristics

4. 特性

4.1 特性一覽表

The characteristics of control circuit devices and switching elements should be stated in the following terms, where such terms are applicable:

- type of equipment (see 4.2);
- rated and limiting values for switching elements (see 4.3);
- utilization categories of switching elements (see 4.4);
- normal and abnormal load characteristics (see 4.3.5);
- switching overvoltages (see 4.9).

控制電路裝置與開關元件之特性，應以下列條件擇其適用者陳述。

- 設備型式(參照 4.2)。
- 開關元件之額定值及限制值(參照 4.3)。
- 開關元件之使用分類(參照 4.4)。
- 正常與異常負載特性(參照 4.3.5)。
- 開關過電壓(參照 4.9)。

4.1.1 Operation of a control switch

The principal application of a control switch is the switching of loads as indicated for the various utilization categories in Table 1.

Other applications, e.g. the switching of tungsten filament lamps, small motors, etc., are not dealt with in detail in this standard, but are mentioned in 4.3.5.2.

4.1.1 控制開關之操作

控制開關之主要應用為，切換依表 1 所示使用分類之各種負載。

本標準未對鎢絲燈泡、小型馬達等其他應用詳加敘述，但於 4.3.5.2 中略為提及。

4.1.1.1 Normal conditions of use

The normal use of a control switch is to close, maintain and open circuits in accordance with the utilization category shown in Table 1. Also refer to Table 4.

4.1.1.2 Abnormal conditions of use

Abnormal conditions may arise, for example, when an electromagnet, although energized, has failed to close. Refer to Table 5.

A control switch shall be able to break the current corresponding to such conditions of use.

4.1.1.1 正常使用狀況

控制開關之正常使用，為依據表 1 所示使用分類，使電路閉合、保持及斷開。另參照表 4。

4.1.1.2 異常使用狀況

有時可能產生異常使用狀況，如已經通電之電磁鐵無法閉合等，參照表 5。

控制開關應可啟斷對應於使用條件之電流。

4.2 Type of control circuit device or switching element

The following shall be stated:

4.2 控制電路裝置或開關元件類型

應述明下列項目。

4.2.1 Kind of control circuit device

- manual control switches, e.g. push-buttons, rotary switches, foot switches, etc.;
- electromagnetically operated control switches, either time delayed or instantaneous, e.g. contactor relays;
- pilot switches, e.g. pressure switches, temperature sensitive switches (thermostats), programmers, etc.;
- position switches;
- associated control equipment, e.g. indicator lights, etc.

4.2.1 控制電路裝置種類

- 手動控制開關，例：按鈕、旋轉開關、腳踏開關等。
- 電磁操作控制開關，不論有時間延遲或即時者，例：電磁開關。
- 指示器開關，例：壓力開關、溫度感應開關(溫控開關)、程序控制器等。
- 位置開關。
- 附屬控制設備，如指示燈等。

4.2.2 Kind of switching elements

- auxiliary contacts of a switching device (e.g. contactor, circuit breaker, etc.) which are not dedicated exclusively for use with the coil of that device;
- interlocking contacts of enclosure doors;
- control circuit contacts of rotary switches;
- control circuit contacts of overload relays.

4.2.2 開關元件種類

- 非專供該裝置線圈使用之開關裝置輔助接點(例：電磁開關、斷路器等)
- 箱門互鎖接點
- 旋轉開關之控制電路接點
- 過載繼電器之控制電路接點

4.2.3 Number of poles

4.2.4 Kind of current

Alternating current or direct current.

4.2.5 Interrupting medium

Air, oil, gas, vacuum, etc.

4.2.3 極數

4.2.4 電流種類

交流電或直流電。

4.2.5 阻斷媒介

空氣、油、瓦斯、真空等。

4.2.6 Operating conditions

4.2.6.1 Method of operation

Manual, electromagnetic, pneumatic, electro-pneumatic.

4.2.6 操作條件

4.2.6.1操作方法

手動、電磁鐵、氣壓、電動氣壓。

4.2.6.2 Method of control

– automatic;
– non-automatic;
– semi-automatic.

4.2.6.2控制方式

－ 自動。
－ 非自動。
－ 半自動。

4.3 Rated and limiting values for switching elements

The rated values established for the switching elements of a control circuit device shall be stated in accordance with 4.3.1 to 4.3.5 inclusive but it is not necessary to specify all the values listed.

4.3 開關元件之額定值及極限值

控制電路裝置開關元件之額定值，應依 4.3.1 至 4.3.5 規定項目陳述，但並非所有表列項目皆為必要。

4.3.1 Rated voltages (of a switching element)

A switching element is defined by the following rated voltages:

4.3.1.1 Rated operational voltage (U_e)

Subclause 4.3.1.1 of IEC 60947-1 applies with the following additions:

For three-phase circuits, U_e is stated as r.m.s. voltage between phases.

NOTE 1 A switching elements may be assigned a number of combinations of rated operational voltage and rated operational current.

NOTE 2 Control switches dealt with in this standard are not normally intended to be used at very low voltages and they may not be suitable for such a service. It is therefore recommended to seek the advice of the manufacturer concerning any application with a low value of operational voltage, e.g. below 100 V a.c. or d.c.

4.3.1 (開關元件之)額定電壓

開關元件之額定電壓定義如下。

4.3.1.1額定操作電壓(U_e)

適用 IEC 60947-1 之 4.3.1.1 及下列附加項目。

對於三相電路，額定操作電壓(U_e)係指各〝相〞之間電壓之均方根值(r.m.s)。

備考 1. 開關元件可能指派給數個額定操作電壓及額定操作電流。

備考 2. 本標準所述控制開關非指使用於極低電壓者，亦可能不適用於該等應用。因此，對於操作電壓低於 100V ac 或 dc 之應用，向製造廠商洽詢建議。

4.3.1.2 Rated insulation voltage (U_i)

Subclause 4.3.1.2 of IEC 60947-1 applies.

4.3.1.2額定絕緣電壓(U_i)

適用 IEC 60947-1 之 4.3.1.2。

4.3.1.3 Rated impulse withstand voltage (U_{imp})

Subclause 4.3.1.3 of IEC 60947-1 applies.

4.3.1.3額定衝擊耐電壓(U_{imp})

適用 IEC 60947-1 之 4.3.1.3。

4.3.2 Currents

A switching element is characterized by the following currents:

4.3.2.1 Conventional free air thermal current (I_{th})

Subclause 4.3.2.1 of IEC 60947-1 applies.

4.3.2.2 Conventional enclosed thermal current (I_{the})

Subclause 4.3.2.2 of IEC 60947-1 applies.

4.3.2.3 Rated operational current (I_e)

The first paragraph of 4.3.2.3 of IEC 60947-1 applies.

4.3.2 電流

開關元件具有下列電流特性。

4.3.2.1一般自由空氣熱電流(I_{th})

適用 IEC 60947-1 之 4.3.2.1。

4.3.2.2一般密閉空氣熱電流(I_{the})

適用 IEC 60947-1 之 4.3.2.2。

4.3.2.3額定操作電流(I_e)

適用 IEC 60947-1 之 4.3.2.3 第 1 段。

4.3.3 Rated frequency

Subclause 4.3.3 of IEC 60947-1 applies.

4.3.3 額定頻率

適用 IEC 60947-1 之 4.3.3。

4.3.4 Vacant

4.3.5 Normal and abnormal load characteristics

4.3.5.1 Rated making and breaking capacities and behaviour of switching elements under normal conditions

A switching element shall comply with both requirements given in Table 4 corresponding to the assigned utilization category and the requirements according to the rated operational voltage.

NOTE 1 For a switching element to which a utilization category is assigned, it is not necessary to specify separately a making and breaking capacity.

NOTE 2 A switching element used for the switching of small motors and tungsten filament lamp loads shall be assigned a utilization category given in IEC 60947-4-1 and comply with the appropriate corresponding requirements in that publication.

4.3.4 (空白)

4.3.5 正常及異常負載特性

4.3.5.1額定投入與斷開容量與正常狀況下開關元件之性能

開關元件應同時符合表 4 所列，使用分類與額定操作電壓之要求。

備考 1. 對於已經設定使用分類之開關元件，無須另行指定投入與斷開容量。

備考 2. 供小型馬達與鎢絲燈等負載使用之開關元件，應依 IEC 60647-4-1 指定其使用分類，並須充分符合該應用之對應要求。

4.3.5.2 Making and breaking capacities under abnormal conditions

A switching element shall comply with the requirements given in Table 5 corresponding to the assigned utilization category.

NOTE An example of an abnormal condition of use is one where the electromagnet does not operate and the switching elements have to interrupt the making current.

4.3.5.2 異常狀況下之投入與斷開容量

開關元件應符合表 5 所列，對應於指定使用分類之要求。

備考： 異常應用狀況之實例為電磁鐵無法作動，而使開關元件中斷投入電流。

4.3.6 Short-circuit characteristics

4.3.6.1 Rated conditional short-circuit current

Subclause 4.3.6.4 of IEC 60947-1 applies.

4.3.6 短路特性

4.3.6.1 額定有條件短路電流

適用 IEC 60947-1 之 4.3.6.4。

4.4 Utilization categories for switching elements

The utilization categories as given in Table 1 are considered standard. Any other types of application shall be based on agreement between manufacturer and user, but information given in the manufacturer's catalogue or tender may constitute such an agreement.

4.4 開關元件使用分類

表 1 所列之使用分類為標準使用。其他形式之應用，應依製造廠商與使用者之協議而定，但亦可以製造廠商型錄或標單所載資料構成該等協議。●

Table 1 – Utilization categories for switching elements

Kind of current	Category	Typical applications
Alternating current	AC-12	Control of resistive loads and solid state loads with isolation by optocouplers
	AC-13	Control of solid state loads with transformer isolation
	AC-14	Control of small electromagnetic loads (≤72 VA)
	AC-15	Control of electromagnetic loads (>72 VA)
Direct current	DC-12	Control of resistive loads and solid state loads with isolation by optocouplers
	DC-13	Control of electromagnets
	DC-14	Control of electromagnetic loads having economy resistors in circuit

表 1　開關元件之使用分類

電流種類	分類	典型應用
交流	AC-12	以光耦隔離之電阻式負載及固態負載之控制方式
	AC-13	以變壓器隔離之固態負載的控制方式
	AC-14	小型電磁負載之控制方式(72VA 或以下)
	AC-15	電磁負載之控制方式(72VA 以上)
直流	DC-12	以光耦隔離之電阻式負載及固態負載之控制方式
	DC-13	電磁負載之控制方式
	DC-14	電路中含有節能電阻之電磁負載的控制方式

4.5 Vacant

4.6 Vacant

4.7 Vacant

4.8 Vacant

4.9 Switching overvoltages

Subclause 4.9 of IEC 60947-1 applies.

4.10 Electrically separated contact elements

The manufacturer shall state whether the contact elements of a control circuit device are electrically separated or not (see 2.3.3.7).

4.5 (空白)

4.6 (空白)

4.7 (空白)

4.8 (空白)

4.9 切換過電壓

適用 IEC 60947-1 之 4.9。

4.10 開關元件之電氣隔離

製造廠商應述明控制電路裝置之接點元件，是否具有電氣隔離設計(參照 2.3.3.7)。

4.11 Actuating quantities for pilot switches

The operating value and return value of the actuating quantity are to be determined on uniform rising values and normal falling values of the actuating quantity. Unless otherwise stated, the rate of change shall be regular and such that the operating (or return) value is reached in not less than 10 s.

The operating value and the return value may both be fixed values, or one of them or both may be adjustable (or the differential value may be adjustable).

Where appropriate, the manufacturer shall indicate a withstand value, either a maximum value higher than the highest setting of the operating value or a minimum value lower than the lowest setting of the return value. A withstand value implies no damage to the pilot switch or no change in its characteristics.

4.11 指示器開關之致動量(actuating quantities for pilot switches)

指示器開關致動量之操作值與回復值，應依統一之上升值與下降值決定之。除非另有指定，應調整其變化率，使其能在 10 s 內達到操作(或回復)值。

其操作值與回復值可兩者皆為固定值、或其中之一或兩者，皆為可調整值(或可調整其差值)。

必要時，製造廠商應標示耐受值；耐受值可為高於最高操作設定值之最大值，或低於最低設定回復值之最低值。耐受值之涵義為對附指示器開關不產生傷害，或不改變其特性。

4.12 Pilot switches having two or more contact elements

Pilot switches having two or more contact elements which are not individually adjustable may have different operating and return values for each contact element.

A pilot switch having two or more contact elements which are individually adjusted is considered as a combination of pilot switches.

4.12 具有 2 組以上接點元件之指示器開關

具有 2 組以上不能單獨調整接點元件之指示器開關，其各接點元件可分別具有不同之操作值與回復值。

具有 2 組以上可單獨調整接點元件之指示器開關，視為組合型指示器開關。

5 Product information

5.1 Nature of information

The following information shall be given by the manufacturer:
Identification

a) The manufacturer's name or trade mark.
b) A type designation or serial number that makes it possible to get the relevant information concerning the switching element (or the entire control switch) from the manufacturer or from his catalogue or by selection from Annex A.
c) IEC 60947-5-1 if the manufacturer claims compliance with this standard.

5. 產品資料

5.1 資料性質

製造廠商應提供下列資訊。

辨識

(a) 製造廠商之名稱或註冊商標。

(b) 指定型號或可供從製造廠商處、型錄，或由附錄 A 選項中，取得開關元件(或整體控制開關)相關資訊之序號。

(c) 製造廠商應聲明是否符合 IEC 60947-5-1 標準。

Basic rated values and utilization

d) Rated operational voltages (see 4.3.1.1).
e) Utilization category and rated operational currents at the rated operational voltages of the control circuit device.
f) Rated insulation voltage (see 4.3.1.2).
g) Rated impulse withstand voltage (see 4.3.1.3).
h) Switching overvoltage, if applicable (see 4.9).
i) IP code, in case of an enclosed control circuit device (see 5.1 and Annex C of IEC 60947-1).

基本額定值及其應用

(d) 額定操作電壓(參照 4.3.1.1)。

(e) 在控制電路裝置額定操作電壓下之使用分類與額定操作電流。

(f) 額定絕緣電壓(參照 4.3.1.2)。

(g) 額定衝擊耐電壓(參照 4.3.1.3)。

(h) 開關過電壓(若適用)(參照 4.9)。

(i) 若為密閉式控制電路裝置，則須 IP 代號(參照 IEC 60947-1 之 5.1 及附錄 C)。

j) Pollution degree (see 6.1.3.2).

k) Type and maximum ratings of short-circuit protective device (see 8.3.4.3).

l) Conditional short-circuit current.

m) Suitability for isolation, where applicable, with the symbol 07-13-06 of IEC 60617-7.

n) Indication of contact elements of same polarity.

(j) 汙染程度(參照 6.1.3.2)。

(k) 短路保護裝置之型式與最大額定值(參照 8.3.4.3)。

(l) 有條件短路電流。

(m) 絕緣適用性(若適用)及 IEC 60617-7 之符號 07-13-06。

(n) 相同極性接點元件之標識。

5.2 Marking

5.2.1 General

Marking of data under a) and b) of 5.1 is mandatory on the nameplate of the control circuit device in order to permit the complete information to be obtained from the manufacturer.

Marking shall be indelible and easily legible, and shall not be placed on screws and removable washers.

Whenever space permits, data under c) to n) shall be included on the nameplate, or on the control circuit device or otherwise in the manufacturer's published literature.

5.2 標示

5.2.1 一般

必須在控制電路裝置之銘牌上，依 5.1 中(a)、(b)兩項規定予以標示，以便從製造廠商處取得完整資訊。

標示應持久且明晰可辨，且不得置於螺絲及活動墊片處。

只要空間許可，(c)至(n)相關資訊應納入銘牌或控制電路裝置上；否則應於製造廠商另行出版之文獻中包含之。

5.2.2 Terminal identification and marking

Subclause 7.1.8.4 of IEC 60947-1 applies.

5.2.2 終端識別及標示

適用 IEC 60947-1 之 7.1.8.4。

5.2.3 Functional markings

Actuators may be identified by symbols in the form of engravings. If a stop-button carries any symbol engraved or marked on the actuator, then this symbol shall be a circle or an oval (signifying the value zero). The symbols circle or oval shall be used for stop-buttons only.

Letters or words may be used where the space available is sufficient to ensure a clear identification. In all other cases, identification markings shall be placed on permanent labels surrounding each actuator or closely adjacent to it.

Symbols shall be in accordance with IEC 60417.

5.2.3 功能性標示

致動器可利用凹刻符號辨識之。若停止鈕之致動器上附有凹刻符號或記號，其符號應為圓形或橢圓形(辦表零值)。圓形或橢圓形符號只能用在停止鈕上。

空間足夠時，可使用文字或詞句以確保清楚識別。無論何種方式，應於致動器

周圍或鄰近處，標示永久性識別標示。

符號應符合 IEC 60417 規定。

5.2.4 Emergency stop

Actuator shape and colour, background colour and direction of unlatching for emergency stop devices with mechanical latching function shall be in accordance with 4.2 of IEC 60947-5-5.

5.2.4 緊急停機

附機械式鎖定功能之緊急停機裝置，其致動器形狀與顏色、背景顏色及其解鎖方向等，應符合 IEC 60947-5-5 之 4.2 規定。

5.2.5 Operating diagram

As rotary switches may have a multiplicity of contact elements and a multiplicity of actuator positions, it is necessary that the manufacturer indicates the relationship between the actuator positions and the associated contact element positions.

It is recommended that the relationship be given in the form of an operating diagram, examples of which are shown in Figure 1 together with explanatory notes.

5.2.5 操作圖

旋轉開關可能具有多組接點元件及多處致動器位置，因此製造廠商必須標示致動器位置之間的關係，以及接點元件之相關位置。

建議以操作圖方式標示該等關係。圖 1 顯示標示與所附說明文字之實例。

5.2.5.1 Position indication

The position indication shall be clear, and the associated text or symbols shall be indelible and easily legible.

5.2.5.1 位置之標示

位置之標示必須清晰，其附屬文字或符號須持久且清晰易辨。

5.2.5.2 Terminal markings for operating diagrams

Terminal markings shall be clearly identifiable with respect to the operating diagram. See also Annex M.

5.2.5.2 操作圖之終端標示

終端標示應可依據操作圖清楚分辨。另詳附錄 M。

5.2.6 Time delay markings

For time-delay contactor relays, the markings shall include the value of the time delay in the case of a fixed delay and the range of time delay in the case of an adjustable delay.

In the case of more than one time-delay contact element, the relative delay between the operation of each contact element and the following one may be indicated for contact elements that follow the first delay.

If two or more contact elements have adjustable delays, it shall be indicated whether they are individually adjustable or not.

The manufacturer shall indicate, for each time-delay contact element, the characteristics of the delay, according to 2.4.1.1 or 2.4.1.2.

5.2.6 延時標示

對於有時間延遲之電磁繼電器，應於外殼上標示其固定之時間延遲，或(若為可調整時間延遲之電磁開關)可調整範圍。

若有時間延遲之接點元件不只一個，可就後續接點元件標示其與第一時間延遲動作之間的相對延遲時間。

若有兩個以上接點元件具有可調整時間延遲，應註明其是否可個別調整。

對於有時間延遲之各接點元件，製造廠商應依 2.4.1.1 或 2.4.1.2 標示延遲之特性。

5.3 Instructions for installation, operation and maintenance

Subclause 5.3 of IEC 60947-1 applies.

5.4 Additional information

Additional information necessary for certain types of control circuit devices shall appear according to the relevant rules of the appropriate Annexes J and K.

Such additional information shall be supplied by the manufacturer and may be in the form of a wiring diagram or in the instruction sheet supplied with the control circuit device.

5.3 安裝說明、操作說明及保養說明

適用 IEC 60947-1 之 5.3。

5.4 其他資料

某些控制電路裝置之其他必要資料，應依附錄 J 與 K 之相關規定呈現。

製造廠商應提供該等資料；其供應方式可為接線圖，或附於控制電路裝置之說明型錄中。

6 Normal service, mounting and transport conditions

Clause 6 of IEC 60947-1 applies with the following additions:

6. 正常操作、安裝與運輸條件

適用 IEC 60947-1 第 6 條及下列追加規定。

6.1.3.2 Pollution degree

Unless otherwise stated by the manufacturer, a control circuit device is intended for installation under environmental conditions of pollution degree 3. However, other pollution degrees may apply, depending upon the micro-environment.

6.1.3.2 汙染等級

除非製造廠商另有指定，控制電路裝置應適用安裝於汙染等級 3 之環境條件。

但其他汙染等級亦可能依不同微環境而適用。

6.3.1 Mounting of single hole mounted devices

The single hole mounted push-buttons and indicator lights are located in a circular hole of the panel, which may have a rectangular recess for a key.

The dimensions are indicated in Table 2:

6.3.1 單一安裝孔裝置之安裝

以單一安裝孔裝置安裝之按鈕及指示燈，定位於面板上之圓形孔。該圓形孔可有一長方形鍵槽。

表 2 顯示各部尺寸。

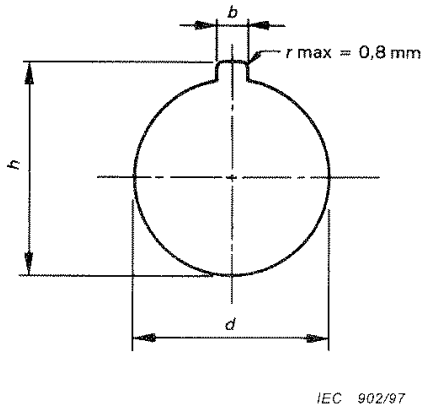


Table 2 – Mounting hole diameter and dimensions of the key recess (if any)

Size	Mounting hole diameter, *d* mm	Key recess (if any)	
		Height, *h* mm	Width, *b* mm
D30	$30{,}5\ ^{+0{,}5}_{0}$	$33{,}0\ ^{+0{,}5}_{0}$	$4{,}8\ ^{+0{,}2}_{0}$
D22	$22{,}3\ ^{+0{,}4}_{0}$	$24{,}1\ ^{+0{,}4}_{0}$	$3{,}2\ ^{+0{,}2}_{0}$
D16	$16{,}2\ ^{+0{,}2}_{0}$	$17{,}9\ ^{+0{,}2}_{0}$	$1{,}7\ ^{+0{,}2}_{0}$
D12	$12{,}1\ ^{+0{,}2}_{0}$	$13{,}8\ ^{+0{,}2}_{0}$	$1{,}7\ ^{+0{,}2}_{0}$

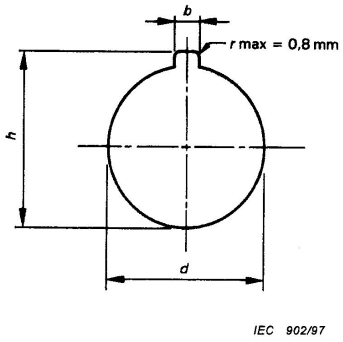


表 2　安裝孔尺寸及鍵槽尺寸(若有)

尺寸	安裝孔直徑 *d* mm	鍵槽(若有)	
		高 *h* mm	寬 *b* mm
D30	$30.5^{+0.5}_{0}$	$33.0^{+0.5}_{0}$	$4.8^{+0.2}_{0}$
D22	$22.3^{+0.4}_{0}$	$24.1^{+0.4}_{0}$	$3.2^{+0.2}_{0}$
D16	$16.2^{+0.2}_{0}$	$17.9^{+0.2}_{0}$	$1.7^{+0.2}_{0}$
D12	$12.1^{+0.2}_{0}$	$13.8^{+0.2}_{0}$	$1.7^{+0.2}_{0}$

6.3.1.1 Location of the key recess (if any)

The standardized position of the key is in the up position (12 o'clock) and associated with the *b* dimension in Table 3.

6.3.1.1 鍵槽位置(若有)

鍵槽之標準位置為上方(12 點鐘方向)，且其尺寸如表 3 之 *b* 所示。

6.3.1.2 Range of panel thickness

The device, with or without the sealing gasket indicated by the manufacturer, shall be capable of being mounted on any thickness of panel between 1 mm and 6 mm, if necessary by the use of packing piece(s) supplied for the purpose.

NOTE The sealing gasket is not standardized.

6.3.1.2 面板厚度範圍

該等裝置，不論製造廠商是否標示有密封墊片，應可安裝於厚度為 1 mm 至 6 mm 之任何面板上。必要時可藉迫緊墊片達此目的。

備考： 密封墊片非標準配備。

6.3.1.3 Grouping of devices

When a number of devices of the sizes given in 6.3.1 are mounted in rows on a panel, the distances *a* between the mounting centres in the same row and *b* between the centre lines of the rows shall be not less than those given in Table 3, unless otherwise stated by the manufacturer.

6.3.1.3 裝置群組

除非製造廠商另有指定，多個裝置(尺寸如 6.3.1 所述)成列安裝在面板上時，其同列安裝孔中心間距 a，及列(中心)間距 b，應小於表 3 所列數據。

Table 3 – Preferred minimum distances between centres of mounting holes

Size	*a* mm	*b* mm
D30	50	65
D22	30	50
D16	25	25
D12	20	20

表 3　安裝孔中心最小間距建議值

尺寸	*a* mm	*b* mm
D30	50	65
D22	30	50
D16	25	25
D12	20	20

Distances *a* and *b* may be interchanged.

These values are intended to guide development; however, when it is intended to mount devices of different manufacture, the user shall establish the compatibility of the devices and ensure the clearances and creepage distances are maintained when the devices are installed and connected.

NOTE Depending on design details, connections, labels, etc., some devices may be capable of being mounted at distances less than those given in Table 3 in accordance with the indication of the manufacturer of the devices. On the other hand, certain types of devices may require distances greater than those given in Table 3.

間距 *a* 與 *b* 可互換。

該等尺寸旨在引導開發。但若須安裝不同製造廠商之裝置，使用者應建立其相容性，並確保裝置安裝與接線時，維持間隔與潛變距離。

備考：依據指示之設計詳圖、接頭、標籤等，有些裝置可能可依廠商指定使用小於表 3 所列之間距安裝。另一方面，亦可能有些裝置需要大於表 3 所列之安裝尺寸。

7 Constructional and performance requirements

7.1 Constructional requirements

Subclause 7.1 of IEC 60947-1 applies except for 7.1.2, 7.1.3, 7.1.7, 7.1.9 and 7.1.13, and with the following additions:

7. 構造及性能要求

7.1 構造要求

除 7.1.2、7.1.3、7.1.7、7.1.9 及 7.1.13 外，適用 IEC 60947-1 之 7.13 及下列追加規定。

7.1.1 Materials

Materials shall be suitable for the particular application and shall enable the equipment to comply with the relevant test requirements.

Special attention shall be called to flame and humidity resisting qualities, and to the necessity to protect certain insulating materials against humidity.

NOTE Requirements are under consideration.

7.1.1 材料

材料應適用於特定應用，並應使設備能符合相關之試驗要求。

應特別注意防火及防潮性能、並應注意某些絕緣材料之防潮保護。

備考： 需求條件為考量標的。

7.1.2 Current-carrying parts and their connections

Current-carrying parts shall have the necessary mechanical strength and current-carrying capacity for their intended use.

For electrical connections, no contact pressure shall be transmitted through insulating material other than ceramic or other material with characteristics not less suitable, unless there is sufficient resiliency in the metallic parts to compensate for any possible shrinkage or yielding of the insulation material.

7.1.2 導電零件及其連接

導電零件應具備用途所需之充分機械強度與導電容量。

對於電氣接頭，除非金屬部分具有足夠彈性，以抵償絕緣材料之可能收縮或變形，其接點壓力不得傳遞到絕緣材料上(陶瓷及其他較佳特性材料除外)。

7.1.3 Clearances and creepage distances

Minimum values are given in Table 13 and Table 15 of IEC 60947-1.

7.1.3 空間距離及沿面距離

最小數值顯示於 IEC 60947-1 之表 13 及表 15 中。

7.1.4.3 Actuating force (or moment)

The force (or moment) required to operate the actuator shall be compatible with the intended application, taking into account the size of the actuator, the type of enclosure or panel, the environment of the installation and the use for which it is intended.

The minimum starting force (or moment) shall be sufficiently large to prevent inadvertent operation; e.g. push-buttons and rotary switches to be used with enclosures complying with degrees of protection IPX5 or IPX6 shall not become actuated when hit by the jet of water applied during the test of the enclosed equipment.

7.1.4.3 致動力(或力矩)

使致動器作動所需力量(或力矩)應符合用途需求，並考量致動器尺寸、外殼或面板型式、安裝環境及其設計用途。

其最小致動力(或力矩)應足以防止不良操作；例：配合防護等級 IPX5 或 IPX6 使用之按鈕或旋轉開關，不可被外殼設備試驗時之噴射水柱所致動。

7.1.4.4 Limitation of rotation (of a rotary switch)

When actuators with limited or unidirectional movement are used, they shall be fitted with robust means of limitation, capable of withstanding five times the actual maximum actuating moment.

7.1.4.4 (旋轉開關之)轉動限制

當使用單一方向或運動受限制之致動器時，應附有堅固之限制裝置，可足以承受 5 倍以上之最大致動力矩。

7.1.4.5 Emergency stop

The actuator shall preferably latch in the actuated position with the control contact open. This latching shall be released by a separate action, e.g. by pulling, rotation, or by means of a key.

NOTE Additional requirements for emergency stop devices with a latching function are given in IEC 60947-5-5.

7.1.4.5 緊急停止

致動器應鎖定於致動位置，且其控制接點應為開啟。該鎖定作用應由一獨立之

動作釋放，例：拉拔、旋轉或使用鑰匙。

備考： IEC 60947-5-5 說明具鎖定功能之緊急停止裝置之其他要求。

7.1.6 Conditions for control switches suitable for isolation

A control switch suitable for isolation shall be manually operated with a direct opening action (see Annex K) and shall comply with the isolating function in the open position (see 2.1.19 and 7.1.7 of IEC 60947-1).

The open position of a control switch suitable for isolation shall be a position in which the switch can remain when no actuating force is applied.

In order to avoid unintentional reclosing, it shall be possible to prevent the operation of the control switches suitable for isolation when the contact elements are in the open position. This may be obtained by padlocking or by a latch which shall only be releasable by a special tool or key.

7.1.6 隔離用控制開關之條件

隔離用之控制開關應直接開啟動作以手動作動(參照附錄 K)，且應符合其開啟位置之隔離功能(參照 IEC 60947-1 之 2.1.19 及 7.1.7)。

隔離用控制開關之開啟位置，應為該開關可在無致動力作用下，保持接點開啟之位置。

為防止不經意之閉合，應可防止隔離用控制開關在接點元件位於開啟位置時經作動。可藉由須使用特殊工具方可開啟之掛鎖或閂鎖，達成此一目的。

7.1.7 Class II control circuit devices

These devices shall not be provided with means for protective earthing (see IEC 61140).

For class II control circuit devices insulated by encapsulation, see Annex F.

7.1.8 Requirements for control devices with integrally connected cables

See Annex G.

7.1.7 第 II 類控制電路裝置

這類裝置不可配置保護接地(參照 IEC 61140)。

有關以封裝絕緣之控制電路裝置，參照附錄 F。

7.1.8 附有整體連接纜線之控制裝置的要求

參照附錄 G。

7.2 Performance requirements

Subclauses 7.2.1.1 and 7.2.2 of IEC 60947-1 apply with the following additions:

7.2 性能要求

適用 IEC 60947-1 之 7.2.1.1 及 7.2.2 及下列追加規定。

7.2.1.2 Limits of operation of contactor relays

The limits of operation for contactor relays shall be in accordance with IEC 60947-4-1.

7.2.1.2 電磁開關之操作限制

電磁開關之操作限制應符合 IEC 60947-4-1 規定。

7.2.3 Dielectric properties

Subclause 7.2.3 of IEC 60947-1 applies with the following addition.

For Class II control circuit devices insulated by encapsulation, see Annex F.

7.2.3 介電性質

適用 IEC 60947-1 之 7.2.3 及下列追加規定。

有關以封裝絕緣之第 II 類控制電路裝置，參照附錄 F。

7.2.4 Ability to make and break under normal and abnormal load conditions

7.2.4.1 Making and breaking capacities

a) *Making and breaking capacities under normal conditions*

The switching elements shall be capable of making and breaking currents without failure under the conditions stated in Table 4, for the required utilization categories and the number of operating cycles indicated, under the conditions specified in 8.3.3.5.2.

During this test the overvoltages generated shall not exceed the impulse withstand voltage values stated by the manufacturer (see 7.2.6).

7.2.4 正常負荷及異常負荷條件下之投入及啟斷能力

7.2.4.1 投入及啟斷容量

(a) 正常負荷條件下之投入及啟斷容量

開關元件應能在表 4 所述條件下，對所需使用分類與操作頻率，以 8.3.3.5.2 所述條件啟閉電流，而不產生故障。

進行此項試驗時，所產生之過電壓不可超過製造廠商所述的耐受電壓(參照 7.2.6)。

b) *Making and breaking capacities under abnormal conditions*

The switching elements shall be capable of making and breaking currents without failure under the conditions stated in Table 5, for the required utilization categories and the number of operating cycles specified in Table 5.

(b) 異常負荷條件下之投入及啟斷容量

開關元件應能在表 5 所述條件下，對所需使用分類與表 5 所述操作頻率投入及啟斷電流，而不產生故障。

7.2.4.2 Vacant

7.2.4.3 Durability

Subclause 7.2.4.3 of IEC 60947-1 applies with the following additions:

7.2.4.2(空白)

7.2.4.3耐受性

適用 IEC 60947-1 之 7.2.4.3 及下列追加規定。

a) *Mechanical durability*

The mechanical durability of a control circuit device is verified, when needed, by a special test conducted at the discretion of the manufacturer. Instructions for conducting this test are given in Annex C.

b) *Electrical durability*

The electrical durability of a control circuit device is verified, when needed, by a special test conducted at the discretion of the manufacturer. Instructions for conducting this test are given in Annex C.

(a) 機械耐受性

控制電路裝置之機械耐受性，由製造廠商視需要以特殊試驗查證。附錄 C 說明該試驗方法。

(b) 電氣耐受性

控制電路裝置之電氣耐受性，由製造廠商視需要以特殊試驗查證。附錄 C 說明該試驗方法。

7.2.5 Conditional short-circuit current

The switching element shall withstand the stresses resulting from short-circuit currents under the conditions specified in 8.3.4.

7.2.5 有條件短路電流

開關元件應可承受 8.3.4 所述條件所產生之短路電流。

7.2.6 Switching overvoltage

Subclause 7.2.6 of IEC 60947-1 applies.

7.2.6 切換過電壓

適用 IEC 60947-1 之 7.2.6。

7.2.7 Additional requirements for control switches suitable for isolation

Control switches suitable for isolation shall be tested according to 8.3.3.4 of IEC 60947-1 with a value of test voltage as specified in Table 14 of IEC 60947-1 corresponding to the rated impulse withstand voltage U_{imp} declared by the manufacturer.

Other additional requirements applicable to such control switches are under consideration.

7.2.7 隔離用控制開關之追加要求

隔離用控制開關應依 IEC 60947-1 之 8.3.3.4 規定試驗。其試驗電壓應依製造廠商所述，對應於 IEC 60947-1 表 14 之脈衝電壓耐受值 U_{imp}。

隔離用控制開關之其他附加要求研擬中。

7.3 Electromagnetic compatibility (EMC)

Subclause 7.3 of IEC 60947-1 applies unless otherwise specified in this standard.

7.3 電磁相容性(EMC)

除本標準另有規定外，適用 IEC 60947-1 之 7.3。

Table 4 – Verification of making and breaking capacities of switching elements under normal conditions corresponding to the utilization categories[1)]

Table 4a

Utilization category	Make[2)]			Break[2)]			Minimum on-time
	I/I_e	U/U_e		I/I_e	U/U_e		
AC			cos φ			cos φ	Cycles (at 50 Hz or 60 Hz)
AC-12	1	1	0,9	1	1	0,9	2
AC-13	2	1	0,65	1	1	0,65	2[3)]
AC-14	6	1	0,3	1	1	0,3	2[3)]
AC-15	10	1	0,3	1	1	0,3	2[3)]
DC			$T_{0,95}$ ms			$T_{0,95}$ ms	Time ms
DC-12	1	1	1	1	1	1	25
DC-13	1	1	$6 \times P$[6)]	1	1	$6 \times P$[6)]	$T_{0,95}$
DC-14	10	1	15	1	1	15	25[3)]

Table 4b

Sequence, number and rate of operations		
Order[7)]	Number	Rate per minute
1	50[4)]	6
2	10	Rapidly[5)]
3	990	60
4	5 000	6

I_e Rated operational current　　I Current to be made or broken

U_e Rated operational voltage　　U Voltage before make

$P = U_e \times I_e$ Steady-state power consumption, in W　　$T_{0,95}$ Time to reach 95 % of the steady-state current

1) See 8.3.3.5.2.

2) For tolerances on test quantities, see 8.3.2.2.

3) Both on-time values (for *I*make and for *I*break) shall be at least equal to 2 cycles (or 25 ms for DC-14).

4) The first 50 operating cycles shall be made with the test voltage raised to $U_e \times 1,1$, the test current I_e having been first set with the voltage at U_e.

5) As rapidly as possible whilst ensuring complete closing and opening of contacts.

6) The value "$6 \times P$" results from an empirical relationship which is found to represent most d.c. magnetic loads to an upper limit of P = 50 W, i.e. $6 \times P$ = 300 ms. Loads having power consumption greater than 50 W are assumed to consist of smaller loads in parallel.
Therefore, 300 ms is to be an upper value, irrespective of the power.

7) For all utilization categories the test sequence shall be in the order given.

表 4　開關元件對應於使用分類(1) 正常負荷條件之投入及啟斷容量的查證

表 4a

使用分類	投入(2)			啟斷(2)			最低致動時間
	I/I_e	U/U_e		I/I_e	U/U_e		
直流			cosφ			cosφ	周波數 (於 50 Hz 或 60 Hz)
AC-12 AC-13 AC-14 AC-15	1 2 6 10	1 1 1 1	0.9 0.65 0.3 0.3	1 1 1 1	1 1 1 1		
交流			$T_{0.95}$ ms			$T_{0.95}$ ms	時間 ms
DC-12 DC-13 DC-14	1 1 10	1 1 1	1 $6 \times P$(6) 15	1 1 1	1 1 1	1 $6 \times P$(6) 15	25 $T_{0.95}$ 25(3)

表 4b

順序、次數及操作率		
次序(7)	次數	每 min 次數
1	50(4)	6
2	10	快速(5)
3	990	60
4	5000	6

I_e	額定操作電流	I	須由投入或啟斷之電流
U_e	額定操作電壓	U	投入前之電壓
$P=U_e \times I_e$	穩態功率消耗，以瓦為單位	$T_{0.95}$	電流達到 95%穩定值之時間

註(1) 參照 8.3.3.5.2。

(2) 試驗數值之許可差，參照 8.3.2.2。

(3) (投入與啟斷)導通時間值須至少等於 2 個周波(DC-14 則為 25 ms)。

(4) 前 50 個周波試驗之試驗電壓應升高到 U_e ×1.1，其試驗電流 Ie 則已於 U_e 電壓時予以設定。

(5) 速度越快越好，但須確保接點完全閉合及開啟。

(6) 來自實驗關係之〝6xP〞結果，可在 P=50 W 上限內，代表多數之直流電磁性負荷，亦即 6 × P=300 ms。功率超過 50 W 之負荷可假設為多個並聯之小功率負荷。因此，不論功率大小，皆以 300 ms 為上限值。

(7) 對於所有使用分類，必須依規定順序試驗

Table 5 – Verification of making and breaking capacities of switching elements under abnormal conditions corresponding to the utilization categories[1)]

Utilization category	Make[2)]			Break[2)]			Minimum on-time	Making and breaking operation	
	I/I_e	U/U_e		I/I_e	U/U_e			Number	Rate per minute
AC			cos φ			cos φ	**Cycles (at 50 Hz or 60 Hz)**		
AC-12	–	–	–	–	–	–	–	–	–
AC-13[3)]	10	1,1	0,65	1,1	1,1	0,65	2[4)]	10	6
AC-14	6	1,1	0,7	6	1,1	0,7	2	10	6
AC-15	10	1,1	0,3	10	1,1	0,3	2	10	6
DC			$T_{0,95}$ ms			$T_{0,95}$ ms	**Time** ms		
DC-12									
DC-13[3)]	1,1	1,1	$6 \times P$[5)]	1,1	1,1	$6 \times P$[5)]	$T_{0,95}$	10	6
DC-14	10	1,1	15	10	1,1	15	25[4)]	10	6

I_e Rated operational current — I Current to be made or broken

U_e Rated operational voltage — U Voltage before make

$P = U_e \times I_e$ Steady-state power consumption, in W — $T_{0,95}$ Time to reach 95 % of the steady-state current

1) The abnormal condition is to simulate a blocked open electromagnet. See 8.3.3.5.3.

2) For tolerances on test quantities, see 8.3.2.2.

3) For semiconductor switching devices an overload protective device specified by the manufacturer should be used to verify the abnormal conditions.

4) Both on-time values (for *I*make and for *I*break) shall be at least equal to 2 cycles (or 25 ms for DC-14).

5) The value "$6 \times P$" results from an empirical relationship which is found to represent most d.c. magnetic loads to an upper limit of P = 50 W, i.e. $6 \times P$ = 300 ms. Loads having power consumption greater than 50 W are assumed to consist of smaller loads in parallel. Therefore, 300 ms is to be an upper value, irrespective of the power consumption value.

For semiconductor switching devices the maximum time constant shall be 60 ms, i.e. $T_{0,95}$ = 180 (3 × time constant).

表 5 開關元件對應於使用分類(1)異常負荷條件之投入及啟斷容量的查證

使用分類	投入(2)			啟斷(2)			最低致動時間	投入及啟斷操作	
	I/I_e	U/U_e		I/I_e	U/U_e			次數	每 min 次數
直流			cosφ			cosφ	周波數 (於 50 Hz 或 60 Hz)		
AC-12	-	-	-	-	-	-	-	-	-
AC-13(3)	10	1.1	0.65	1.1	1.1	0.65	2(4)	10	6
AC-14	6	1.1	0.7	6	1.1	0.7	2	10	6
AC-15	10	1.1	0.3	10	1.1	0.3	2	10	6
交流			$T_{0.95}$ ms			$T_{0.95}$ ms	時間 ms		
DC-12									
DC-13(3)	1.1	1.1	$6\times P$(5)	1.1	1.1	$6\times P$(5)	$T_{0.95}$	10	6
DC-14	10	1.1	15	10	1.1	15	25(4)	10	6

I_e	額定操作電流	I	須由投入或啟斷之電流
U_e	額定操作電壓	U	投入前之電壓
$P= U_e \times I_e$	穩態功率消耗，以瓦為單位	$T_{0.95}$	電流達到 95%穩定值之時間

註(1) 異常條件為模擬經阻斷之開啟電磁鐵。參照 8.3.3.5.3。

(2) 試驗數值之許可差，參照 8.3.2.2。

(3) 對於半導體開關元件，應使用製造廠商指定之過載保護裝置查證異常條件。

(4) (投入與啟斷)導通時間值須至少等於 2 個周波(DC-14 則為 25 ms)。

(5) 來自實驗關係之〝6×P〞結果，可在 P=50 W 上限內，代表多數之直流電磁性負荷，亦即 6 × P=300 ms。功率超過 50 W 之負荷可假設為多個並聯之小功率負荷。因此不論功率消耗值為何，300 ms 為上限值。

對於半導體開關裝置，其最大時間常數應為 60 ms，亦即 $T_{0.95}$ = 180 (3×時間常數)。

8 Tests

8.1 Kinds of test

8.1.1 General

Subclause 8.1.1 of IEC 60947-1 applies.

8. 試驗

8.1 試驗種類

8.1.1 一般

適用 IEC 60947-1 之 8.1.1。

8.1.2 Type tests

Type tests are intended to verify compliance of the designs of the control circuit devices with this standard.

8.1.2 型式試驗(type test)

型式試驗旨在查證控制電路裝置之設計符合本標準。

They comprise the verification of:

a) temperature-rise (8.3.3.3);
b) dielectric properties (8.3.3.4);
c) making and breaking capacities of switching elements under normal conditions (8.3.3.5.2);
d) making and breaking capacities of switching elements under abnormal conditions (8.3.3.5.3);
e) performance under conditional short-circuit current (8.3.4);
f) constructional requirements (8.2);
g) degree of protection of enclosed control circuit devices (8.3.1).

型式試驗包含下述查證項目。

(a) 溫升(8.3.3.3)。

(b) 介電特性(8.3.3.4)。

(c) 正常負荷負荷條件下，開關元件之投入及啟斷容量(8.3.3.5.2)。

(d) 異常負荷負荷條件下，開關元件之投入及啟斷容量(8.3.3.5.3)。

(e) 有條件短路電流下之性能(8.3.4)。

(f) 結構要求(8.2)。

(g) 密封控制電路裝置之保護等級(8.3.1)。

8.1.3 Routine tests

Routine tests are the responsibility of the manufacturer and are usually limited to a mechanical inspection and a verification of the mechanical operation.

In certain cases specified in Annexes J and K, the inspection is supplemented by a dielectric test.

When performed, the dielectric test is carried out according to 8.3.3.4 with the following amendments: the required minimum duration of voltage application is reduced to about 1 s and the metal foil and external terminal connections are unnecessary.

Additional routine tests for the control switch or the control circuit device may be specified as appropriate. A sampling plan may be accepted.

8.1.3 例行試驗

製造廠商須負責例行試驗，通常限於機械檢驗與機械操作之查證。

附錄 J 與 K 所述某些狀況下，另行補充介電試驗。

介電試驗應依 8.3.3.4 配合下列追加規定進行：施加電壓之最小所需時間縮短為 1 s 左右，無須使用金屬箔或外部端子連接。

可視需要指定控制電路裝置之控制開關之其他例行試驗。可使用取樣計畫。

8.1.4 Sampling tests

Sampling tests shall be performed on time delay devices to verify the time delay or range of time delay as stated by the manufacturer.

NOTE Sampling tests for clearance verification, according to 8.3.3.4.3 of IEC 60947-1 are under consideration.

8.1.4 取樣試驗

應對延遲裝置進行取樣試驗，以查證製造廠商所宣稱之延遲時間或延遲時間範圍。

備考： 依據 IEC 60947-1 之 8.3.3.4.3，間隔查證之取樣試驗為考量標的。

8.1.5 Special tests

These tests are subject to agreement between manufacturer and user.

They comprise the verification of the durability (see Annex C).

The mechanical and electrical durability tests shall be performed with the actuator operated by a machine that complies with the requirements of 8.3.2.1.

8.1.5 特殊試驗

該等試驗應由製造廠商與使用者協議取決。

該等試驗包括耐久性查證(參照附錄 C)。

機械與電氣耐受性試驗，應使用符合 8.3.2.1 要求之機器操作其致動器進行試驗。

8.2 Compliance with constructional requirements

Subclause 8.2 of IEC 60947-1 applies except for 8.2.5 and 8.2.6.

8.2 符合構造要求

除 8.2.5 及 8.2.6 外，適用 IEC 60947-1 之 8.2。

8.2.5 Verification of actuating force (or moment)

When required in 7.1.4.3, the minimum actuating force or moment shall be tested during sequence V of 8.3.1. The performance shall be as stated in 7.1.4.3.

8.2.5 致動力(或力矩)之查證

依 7.1.4.3 規定所需，應於 8.3.1 之程序 V 中試驗最小致動力(或力矩)。其性能應符合 7.1.4.3 規定。

8.2.6 Verification of limitation of rotation (of a rotary switch)

When this test is required in 7.1.4.4, it shall be tested during sequence VI of 8.3.1. The test sample shall be mounted according to the manufacturer's instructions.

The operation moment shall be measured five times and the maximum value recorded. The maximum moment value, multiplied by five, shall be applied to the actuator by forcing it against the means of limitation. The moment shall be applied for 10 s.

The test is passed if the means of limitation has not moved, become loose or prevented the actuator's normal operation.

8.2.6 (旋轉開關之)旋轉限制查證

當 7.1.4.4 要求此項試驗時，應依 8.3.1 之程序 VI 進行該試驗。應依製造廠商指示安裝試驗樣本。

操作力矩應測量 5 次，記錄其最大值。將最大值操作力矩之 5 倍施加於致動器上，使其作用在限制擋子上。維持該力矩 10 s。

其限制擋子未產生移動、鬆動或影響致動器之正常操作，視為試驗通過。

8.3 Performance

8.3.1 Test sequences

The type and sequence of tests to be performed on representative samples are as follows.

8.3 性能

8.3.1 試驗程序

對代表樣本應進行之試驗種類與程序如下述。

– **Test sequence I** (sample No. 1)

Test No. 1 – Operating limits of contactor relays (8.3.3.2), if applicable

Test No. 2 – Temperature rise (8.3.3.3)

Test No. 3 – Dielectric properties (8.3.3.4)

Test No. 4 – Mechanical properties of terminals (8.2.4 of IEC 60947-1)

– **Test sequence II** (sample No. 2)

Test No. 1 – Making and breaking capacities of switching elements under normal conditions (8.3.3.5.2)

Test No. 2 – Dielectric verification (8.3.3.5.5 b))

– 試驗程序 1 (樣本編號 1)

試驗編號 1－電磁開關之操作極限(8.3.3.2)(若適用)

試驗編號 2－溫升(8.3.3.3)

試驗編號 3－介電特性(8.3.3.4)

試驗編號 4－終端機械特性(IEC 60947-1 之 8.2.4)

– 試驗程序 2 (樣本編號 2)

試驗編號 1－正常負荷負荷條件下，開關元件之投入及啟斷容量(8.3.3.5.2)

試驗編號 2－介電特性查證(8.3.3.5.5(b)

– **Test sequence III** (sample No. 3)

Test No. 1 – Making and breaking capacities of switching elements under abnormal conditions (8.3.3.5.3)

Test No. 2 – Dielectric verification (8.3.3.5.5 b))

– **Test sequence IV** (sample No. 4)

Test No. 1 – Performance under conditional short-circuit current (8.3.4)

Test No. 2 – Dielectric verification (8.3.3.5.5 b))

– 試驗程序 3 (樣本編號 3)

試驗編號 1－異常負荷負荷條件下，開關元件之投入及啟斷容量(8.3.3.5.3)

試驗編號 2－介電特性查證(8.3.3.5.5(b)

– 試驗程序 4 (樣本編號 4)

試驗編號 1－短路電流條件下之性能(8.3.4)

試驗編號 2－介電特性查證(8.3.3.5.5(b)

– **Test sequence V** (sample No. 5)

Test No. 1 – Degree of protection of enclosed control circuit devices (Annex C of IEC 60947-1)

Test No. 2 – Verification of actuation force or moment (8.2.5)

– **Test sequence VI** (sample No. 6)

Test No. 1 – Measurement of clearances and creepage distances, if applicable (7.1.3)

Test No. 2 – Verification of limitation of rotation of a rotary switch (8.2.6).

– 試驗程序 5 (樣本編號 5)

試驗編號 1－密封控制電路裝置之保護等級(IEC 60947-1 附錄 C)

試驗編號 2－查證致動力或力矩(8.2.5)

– 試驗程序 6 (樣本編號 6)

試驗編號 1－測量間隙與潛變距離(若適用)(7.1.3)

試驗編號 2－查證旋轉開關之旋轉限制(8.2.6)

There shall be no failure in any of the above tests.

More than one test sequence or all test sequences may be conducted on one sample at the request of the manufacturer. However, the tests shall be conducted in the sequence given for each sample above.

NOTE For class II control circuit devices insulated by encapsulation, additional samples are required (see Annex F). For control circuit devices with integrally connected cables, see Annex G.

上述各項試驗必須全部通過。

可依製造廠商要求以同一樣本進行多項試驗程序。但須依上述順序對每件樣本進行試驗。

備考： 有關密封安裝之第 II 類控制電路裝置，需要額外之樣本(參照附錄 F)。

有關附整合連接纜線之控制電路裝置，參照附錄 G。

8.3.2 General test conditions

8.3.2.1 General requirements

Subclause 8.3.2.1 of IEC 60947-1 applies with the following addition:

The tests shall be performed with the actuator operated by a machine complying with the requirements of 8.3.2.1 a) for linear movement or, for a rotary switch, in accordance with 8.3.2.1 b) or 8.3.2.1 c).

a) For push-buttons and/or related control switches the operating machine shall apply the actuating force (or moment) to the actuator in the direction of its motion.

The force (or moment) or the travel of the operating machine shall comply with one of the following conditions according to the manufacturer's instructions:

- the maximum force (or moment) exerted on the actuator shall not exceed 1,5 times the force (or moment) required for maximum over-travel of the contact element(s);
- the cover-travel of the contact elements shall be between 50 % and 80 % of the over-travel inherent in the design of the contact elements.

During the whole part of the operating cycle where the contacts move from the open to closed position (or vice versa) or at least at the moment when the switching operation occurs, the velocity of the operating machine, measured where it touches the actuator, shall be between 0,05 m/s and 0,15 m/s.

The mechanical connection between the operating machine and the actuator shall have a sufficient free play (lost motion) to avoid the operating machine impeding the free motion of the actuator away from it.

8.3.2 一般試驗條件

8.3.2.1 一般要求

適用 IEC 60947-1 之 8.3.2.1 及下列追加規定。

應以符合 8.3.2.1.(a) 需求之機械操作致動器進行線性運動試驗，或依 8.3.2.1.(b) 或 8.3.2.1.(c) 之需求試驗旋轉開關。

(a) 對於按鈕及/或相關控制開關，其操作機械應將致動力(或力矩)依致動器運動方向施加於致動器上。

操作機械之力(或力矩)或行程，應依製造廠商指示符合下列條件之一。

- 施加於致動器上之最大力量(或力矩)，不得超過接點元件最大過行程所需力(或力矩)之 1.5 倍。
- 接點元件之含蓋-行程應介於接點元件原設計過行程之 50 %與 80 % 之間。

在接點從開啟位置到達閉合位置(或相反程序)之整個操作周期內，或至少

當開關操作發生時，操作機械接觸在致動器上之速度應介於 0.05m/s 與 0.15m/s 之間。

操作機械與致動器之間之機械連接，應具有充分游隙(空運動)，以免操作機械妨礙致動器自由離開操作機械。

b) For switches fully rotary in both directions, one operating cycle comprises either one fully clockwise operation of the actuator or one fully anticlockwise operation of the actuator. However, in this case approximately three-quarters of the total number of operating cycles shall be made in the clockwise direction, followed by the remainder in the anticlockwise direction. The angular velocity shall be between 0,5 to 1 revolution per second.

c) For limited movement rotary switches, operation shall be at a speed of 1 to 4 revolutions per second.

(b) 對於可雙方向自由旋轉之開關，完整之操作周期應包含致動器次完整之順時鐘旋轉或逆時鐘旋轉。但所有操作循環次數中約有 4 分之 3 須為順時鐘方向，其餘則為逆時鐘方向。其角速度應為每秒 0.5 轉至 1 轉。

(c) 對於限制運動之旋轉開關，其操作速度應為每秒 1 至 4 轉。

8.3.2.2 Test quantities

Subclause 8.3.2.2 of IEC 60947-1 applies except for 8.3.2.2.3.

8.3.2.3 Evaluation of test results

The condition of the control circuit device after each test shall be checked by the verifications applicable to each test.

A control circuit device is deemed to have met the requirements of this standard if it meets the requirements of each test and/or test sequence as applicable.

8.3.2.4 Test reports

Subclause 8.3.2.4 of IEC 60947-1 applies.

8.3.2.2試驗數量

除 8.3.2.2.3 外，適用 IEC 60947-1 之 8.3.2.2。

8.3.2.3試驗結果評估

應以適用各項試驗之查證方式，於每次試驗後檢驗控制電路裝置之狀況。

符合各相關試驗需求及/或試驗程序之控制電路裝置，視為符合本標準之需求。

8.3.2.4試驗報告

適用 IEC 60947-1 之 8.3.2.4。

無負載、正常負載與異常負載條件

8.3.3 Performance under no-load, normal load and abnormal load conditions

8.3.3.1 Operation

Subclause 8.3.3.1 of IEC 60947-1 applies.

8.3.3.1操作

適用 IEC 60947-1 之 8.3.3.1。

8.3.3.2 Operating limits of contactor relays

The operating limits of contactor relays shall be in accordance with the standard applicable to contactors (see IEC 60947-4-1).

8.3.3.2電磁開關之操作極限

電磁開關之操作極限應符合其適用之標準(參照 IEC 60947-4-1)

8.3.3.3 Temperature rise

Subclause 8.3.3.3 of IEC 60947-1 applies with the following addition:

All switching elements of the control circuit device shall be tested. All switching elements that may be simultaneously closed shall be tested together. However, switching elements forming an integral part of an actuating system in such a manner that the elements cannot remain in the closed position are exempt from this test.

NOTE Several temperature-rise tests may be necessary if the control circuit device has several positions in which switching elements are in their closed position.

The minimum length of each temporary connection, from terminal to terminal, shall be 1 m.

8.3.3.3溫升

適用 IEC 60947-1 之 8.3.3.3 及下列追加規定。

控制電路裝置之所有開關元件皆須試驗；所有可同時閉合之開關元件應一同試驗。但若開關元件構成致動系統之整體部分，以致無法停留在其閉合位置者，則免執行本項試驗。

備考： 若控制電路裝置之接點元件會在多個位置上閉合，則須進行多次溫升試驗。

各臨時連線從端子到端子之最小長度應為 1 m。

8.3.3.4 Dielectric properties

Subclause 8.3.3.4 of IEC 60947-1 applies with the following addition.

For Class II control circuit devices insulated by encapsulation, see Annex F.

8.3.3.4介電性質

適用 IEC 60947-1 之 8.3.3.4 及下列追加規定。

對於密封安裝之第 II 類控制電路裝置，參照附錄 F。

8.3.3.4.1 Type tests

Subclause 8.3.3.4.1 of IEC 60947-1 applies with the following addition.

Add, after the second paragraph of 3) c):

The control circuit device shall be capable of withstanding the test voltage applied as follows:

- between live parts of the switching element and parts of the control switch intended to be earthed;
- between live parts of the switching element and surfaces of the control switch likely to be touched in service, conductive or made conductive by a metal foil;
- between live parts belonging to electrically separated switching elements.

8.3.3.4.1 型式試驗

適用 IEC 60947-1 之 8.3.3.4.1 及下列追加規定。

在(3) (c)第 2 段之後增加下列項目。

控制電路裝置應耐受以下列方式施加之試驗電壓。

- 施加在[開關元件之帶電部分]，及[控制開關之預定接地部分]之間。
- 施加在[開關元件之帶電部分]，及[控制開關表面可能會在維修時被碰觸之部分，具導電性或因金屬箔，而成為導電性之部分]之間。

－ 施加在[開關元件之相互電氣隔離的各帶電部分]之間。

8.3.3.5 Making and breaking capacities

Tests for verification of making and breaking capacities shall be made according to the general test requirements stated in 8.3.2.1.

8.3.3.5投入及啟斷容量

投入及啟斷容量應依 8.3.2.1 所述一般試驗要求試驗確認。

8.3.3.5.1 Test circuits and connections

Tests shall be carried out on a single-pole element or on one pole of a multi-pole device provided that all pole elements are identical in construction and operation.

Adjacent contact elements are considered to be of the opposite polarity unless otherwise stated by the manufacturer.

Change-over contacts of forms C and Za are of the same polarity and change-over contacts of form Zb are of the opposite polarity.

Single-pole elements or contact elements in a multi-pole device stated as the same polarity shall be connected in accordance with the circuit shown in Figure 5. Any adjacent contact elements not being tested shall not be connected.

Change-over contacts of forms C and Za shall be subject to separate tests in the normally open and normally closed positions connected in accordance with Figure 5.

Contact elements of the opposite polarity shall be connected in accordance with the circuit shown in Figure 6. Adjacent contact elements of the opposite polarity not being tested shall be jointly connected to the supply, as shown.

Change-over contacts of form Zb shall be subject to separate tests in the normally open and normally closed positions but with both terminals of the opposite position being connected to the supply, as shown in Figure 6, for an adjacent contact of opposite polarity.

If the make and break operations require different values, the circuit shown in Figure 7 shall represent load L_d in Figures 5 and 6.

8.3.3.5.1 試驗電路與連接

應對單極元件或複極裝置中具相同構造與功能之一極進行試驗。

除非製造廠商另有說明，鄰近接點元件則視為相反極性者。

C 型與 Za 型切換接點為相同極性，Zb 型切換接點則為相反極性者。

單極元件或複極裝置中標示為相同極性之接點元件，應依圖 5 所示電路接線。未受試驗之相鄰元件則不予接線。

C 型與 Za 型切換接點應對其常開與常閉位置，分別依圖 5 所示電路接線進行試驗。

相反極性之開關元件應依圖 6 所示電路接線。未受試驗之相鄰相反極性的接點元件應如圖所示，共同連接到電源上。

Zb 型切換接點應分別就其常開與常閉位置進行試驗，但其相反位置之兩個端子須依圖 6 所示連接到電源，作為相反極性之相鄰接點。

若投入及啟斷操作需要不同數值，則以圖 7 所示電路代表圖 5 與圖 6 中之負荷 Ld。

For a.c. tests:

The load shall be an air-cored inductor in series with a resistor, if needed, to obtain the specified power factor. The inductor shall be shunted by a resistor taking 3 % of the total power consumed (see Figure 7).

For d.c. tests:

To obtain the specified steady-state current the test current shall increase from zero to the steady-state value within the limits shown in Figure 9. For guidance, an example of an iron-cored load is shown in Annex B.

Test voltage and test current shall be in accordance with Tables 4 and 5. The test circuit applied shall be stated in the test report.

對於交流試驗

必要時，其負荷應為與一電阻串聯之空氣芯電感，以獲致指定之功率因數。電感以可承受總消耗功率 3%之電阻接地(如圖 7 所示)。

對於直流試驗

為求取得指定之穩定電流，試驗電流應從零開始增加到圖 9 所示限度內之穩態數值。附錄 B 中有一鐵芯線圈負載之實例可供參考。

試驗電壓與試驗電流應比照表 4 與表 5。應於試驗報告中述明所使用之試驗電路。

8.3.3.5.2 Making and breaking capacities of switching elements under normal conditions

The tests are intended to verify that the control circuit device is capable of performing its intended duty according to the utilization category.

With the load set in accordance with Table 4, the 6 050 operating cycles shall be carried out in the following sequence:

- 50 operations at 10 s intervals with the voltage set at 1,1 U_e;
- 10 operations as rapidly as possible whilst ensuring complete closing and opening of contacts;
- 990 operations at 1 s intervals;
- 5 000 operations at 10 s intervals (or at a shorter interval determined by the manufacturer).

8.3.3.5.2 正常狀態下開關元件之投入與斷開容量

這些試驗旨在確認控制電路裝置，足以依其使用分類發揮應有之功能。

依表 4 設定負載，並依下列程序執行 6 050 操作循環。

- 將電壓設定為 1.1 U_e，以 10 s 為間隔操作 50 次。
- 以最快速度操作 10 次，但須確保接點完整閉合與開啟。
- 以 1 s 為間隔操作 990 次。
- 以 10 s 為間隔操作 5000 次(或依製造廠商指定之較短間隔)。

When the construction of the device is such that rapid cycling is not possible, for example overload relay contacts, the operations shall be at 10 s intervals or as fast as the device will permit.

For auxiliary contacts of a switching device, for example contactor, circuit-breaker, the number of operating cycles shall be the same as that required for the verification of the conventional operational performance capability of the switching device (see appropriate product standard).

若因裝置結構限制無法以快速循環操作，例：過荷繼電器接點，則至少須以

10 s 為間隔，或依裝置允許之最快速度為之。

對於開關裝置之輔助接點，例：電磁開關、斷路器等，其操作循環次數應與試驗開關裝置傳統操作性能所需之次數相同(參考相關產品標準)。

8.3.3.5.3 Making and breaking capacities of switching elements under abnormal conditions

The test is intended to verify that the control circuit device is capable of making and breaking currents associated with electromagnetic loads. Load values, together with the sequence of operations shall be in accordance with Table 5.

8.3.3.5.4 Vacant

8.3.3.5.5 Results to be obtained

a) During the tests of 8.3.3.5.2 and 8.3.3.5.3 there shall be no electrical or mechanical failures, no contact welding or prolonged arcing, and the fuses shall not blow.

b) After the test of 8.3.3.5.2 and 8.3.3.5.3 the device shall withstand the power-frequency test voltage of 2 U_e, but not less than 1 000 V, applied as specified in 8.3.3.4.1.

8.3.3.5.3 異常狀態下開關元件之投入與斷開容量

這些試驗旨在確認控制電路裝置，足以承受電磁負載所關聯之投入與斷開電流。其負載值與操作程序應依表 5 之規定。

8.3.3.5.4 (空白)

8.3.3.5.5 應獲致之結果

(a) 在 8.3.3.5.2 及 8.3.3.5.3 之試驗中，不得產生電氣或機械故障、接點熔融、或過長電弧，且各保險絲不可燒斷。

(b) 在 8.3.3.5.2 及 8.3.3.5.3 之試驗之後，須依 8.3.3.4.1 指示，對該裝置以試驗電壓 $2U_e$(但不可低於 1,000V)進行〝功率-頻率〞試驗。

8.3.4 Performance under conditional short-circuit current

8.3.4.1 General conditions for short-circuit tests

The switching element shall be in a new and clean condition, mounted as in service.

8.3.4 有條件短路電流下之性能

8.3.4.1 短路電流試驗一般條件

開關元件須為全新且清潔狀態，並安裝成服務狀態。

8.3.4.2 Test procedure

The switching element may be operated several times before the test, at no load or at any current not exceeding the rated current.

A contact element with two terminals shall be tested with the actuator in the position corresponding to the closed position of the switching element under test.

The contact element to be tested shall be in series with the short-circuit protective device (SCPD), the load impedance, and a separate switching device in a single-phase circuit as shown in Figure 8. The test quantities shall be in accordance with 8.3.4.3.

8.3.4.2 試驗程序

可於試驗前，以空載或以任何不超過額定值之電流操作開關元件數次。

試驗具有兩個終端之開關元件時，其致動器應位於與其受測開關元件閉合位置相對應之位置。

受測開關元件應與短路保護裝置(SCPD)、負載阻抗，以及如圖 8 所示單相電路

中之獨立開關裝置串聯。試驗數量依 8.3.4.3 規定。

The test is performed by making the current with the separate making switch and the current shall be maintained until the SCPD operates.

The test shall be performed three times on the same contact element, the SCPD being reset or replaced after each test. The time interval between the tests shall be not less than 3 min. The actual time interval shall be stated in the test report.

For change-over contact elements, the above test shall be made separately on both the normally closed and normally open contacts.

NOTE For control switches with both two terminals and change-over contact elements, both types should be tested.

A separate control circuit device may be used for each contact element.

進行之試驗應以獨立之投入開關使點電流導通，其電流應維持到 SCPD 作動為止。

同一接點元件須進行 3 次試驗，每次試驗後須重置或更換 SCPD。試驗間隔不可小於 3 min。應將實際試驗間隔記載於試驗報告。

對於切換開關元件，應就其常開與常閉接點分別進行上述試驗。

備考： 同時具有兩個終端及切換接點元件之控制開關，應就兩種型式分別予以試驗。

對於每個接點元件，可各自使用一個控制電路裝置。

8.3.4.3 Test circuit and test quantities

The switching element shall be connected in series with the short-circuit protective device of type and rating stated by the manufacturer; it shall also be in series with the switching device intended to close the circuit.

The test circuit load impedance shall be an air-cored inductor in series with a resistor, adjusted to a prospective current of 1 000 A, or another value if stated by the manufacturer but not less than 100 A, at a power factor of between 0,5 and 0,7 and at the rated operational voltage. The open circuit voltage shall be 1,1 times the maximum rated operational voltage of the switching element.

The switching element shall be connected in the circuit using 1 m total length of cable corresponding to the operational current of the switching element.

8.3.4.3試驗電路與試驗數量

開關元件應與依製造廠商指定型式與額定值之短路保護裝置(SCPD)串聯，並同時與用以使電路閉合之開關裝置串聯。

試驗電路之阻抗應為空氣芯電感器與一電阻串聯；在功率因數 0.5-0.7 之間及額定操作電壓下，將預期電流調整到 1000A 或製造廠商指定之其他數值，但不可小於 100A。其開啟電壓應為該開關元件最大額定操作電壓之 1.1 倍。

應使用總長 1 m 之纜線將開關元件連接在電路中，該纜線須對應於該開關元件之操作電流。

8.3.4.4 Condition of the switching element after the test

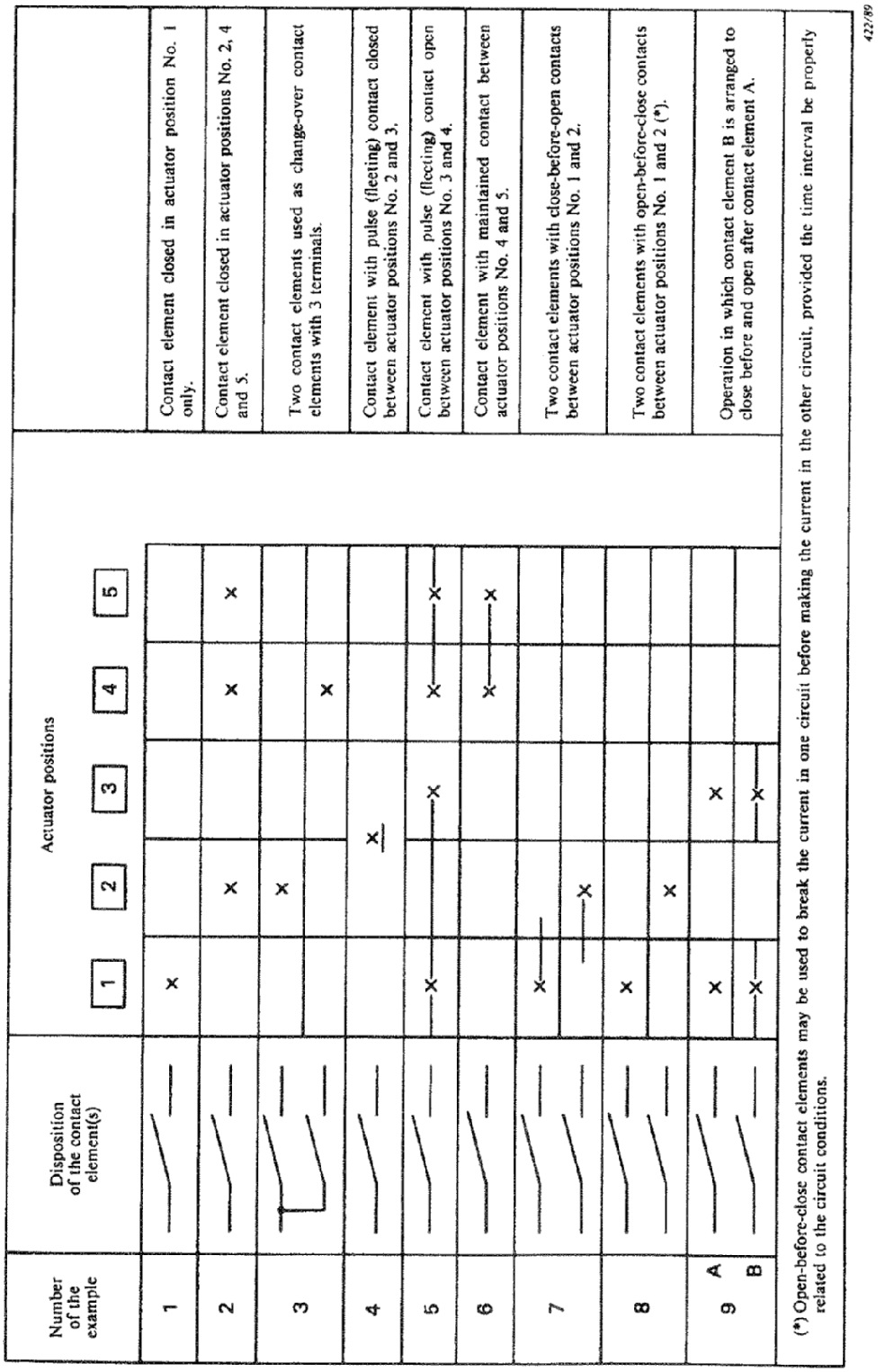
a) After the short-circuit test it shall be possible to open the switching elements by the normal actuating system.

b) After the test the device shall withstand the power-frequency voltage of 2 U_e but not less than 1 000 V applied as specified in 8.3.3.4.1.

8.3.4.4開關元件試驗後之狀態

(a) 經過短路試驗後，應可使用正常致動系統使開關元件開啟。

(b) 試驗後，該裝置應可承受依 8.3.3.4.1 指示施加之 $2U_e$ 功率-頻率電壓，但不可低於 1,000 V。



Number of the example	Disposition of the contact element(s)	Actuator positions 1	2	3	4	5	
1		x					Contact element closed in actuator position No. 1 only.
2			x		x	x	Contact element closed in actuator positions No. 2, 4 and 5.
3			x		x		Two contact elements used as change-over contact elements with 3 terminals.
4			x				Contact element with pulse (fleeting) contact closed between actuator positions No. 2 and 3.
5		x		x	x	x	Contact element with pulse (fleeting) contact open between actuator positions No. 3 and 4.
6					x	x	Contact element with maintained contact between actuator positions No. 4 and 5.
7		x					Two contact elements with close-before-open contacts between actuator positions No. 1 and 2.
			x				
8		x					Two contact elements with open-before-close contacts between actuator positions No. 1 and 2 (*).
			x				
9	A	x		x			Operation in which contact element B is arranged to close before and open after contact element A.
	B	x		x			

(*) Open-before-close contact elements may be used to break the current in one circuit before making the current in the other circuit, provided the time interval be properly related to the circuit conditions.

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Figure 1 – Examples of the recommended method for drawing an operating diagram of a rotary switch

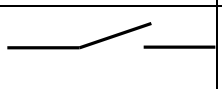
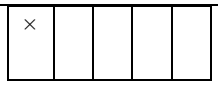
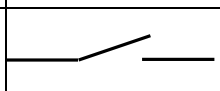
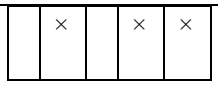
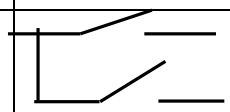
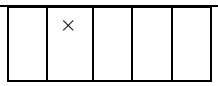
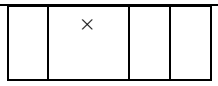
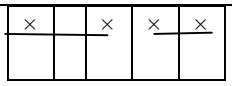
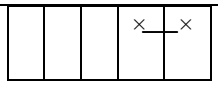
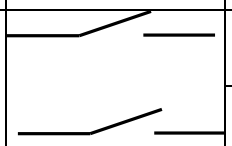
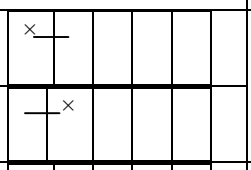
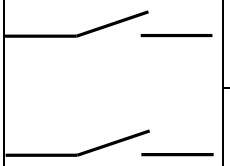
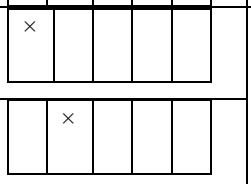
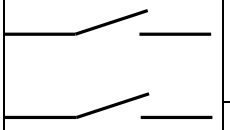
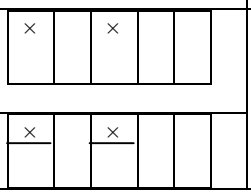
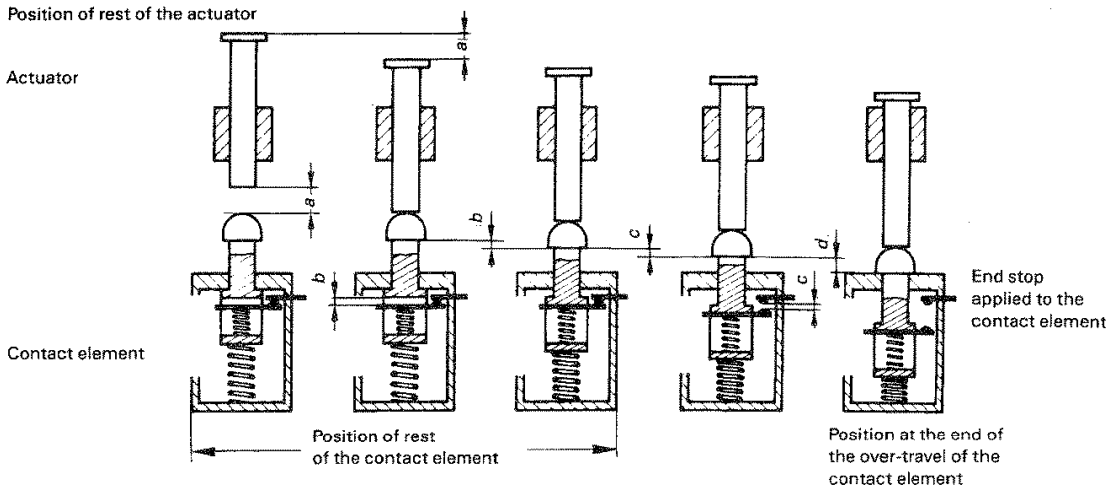
樣本編號	接點元件說明	致動器位置 1 2 3 4 5	
1			接點元件僅於致動器在 1 號位置時閉合。
2			接點元件於致動器在 2、4 及 5 號位置時閉合。
3			作為 3 終端切換接點元件使用之兩個接點元件。
4			接點元件之脈衝(連動 fleeting)接點在致動器之 2 號與 3 號位置之間為閉合
5			接點元件之脈衝(連動 fleeting)接點在致動器之 3 號與 4 號位置之間為開啟。
6			接點元件在致動器 4 號與 5 號位置之間保持接觸。
7			兩個接點元件之接點在致動器 1 號與 2 號位置之間〝先開啟後閉合〞。
8			兩個接點元件之接點在致動器 1 號與 2 號位置之間 〝先閉合後開啟〞 (*)。
9 A B			其操作安排為接點元件 B 在接點元件 A 之前閉合，但在接點元件 A 之後開啟。
* 〝先開啟後閉合〞接點元件可用於投入另一電路的電流之前斷開電路的電流，但其時間間隔須適合電路條件。			

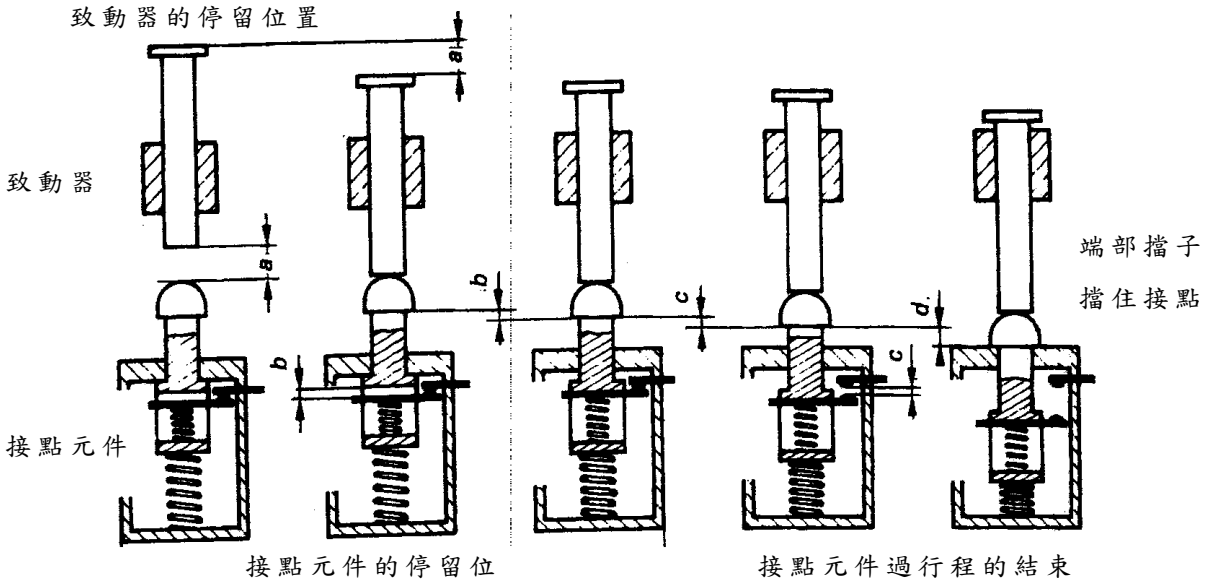
圖 1　繪製旋轉開關操作圖之建議方法



a	Pre-travel of the actuator
b	Pre-travel of the contact element
c	Minimum value required to give adequate contact gap
d	Over-travel of the contact element
b + *c* + *d*	Total travel of the contact element
a + *b* + *c* + *d* + *e*)*	Total travel of the actuator

*NOTE Because of a possible resilient connection between the actuator and the contact element (for example, see Figure 3), the over-travel of the actuator may exceed the over-travel of the contact element by a length *e*.

Figure 2 – Operation of push-buttons



a	致動器前置行程
b	接點元件前置行程
c	提供充足接點間隙之最小值
d	接點元件之過行程
b+c+d	接點元件之總行程
a+b+c+d+e)*	致動器之總行程

*備考：因致動器與接點元件之間可能有彈性體構件(例：圖 3 所示)，其致動器之〝過行程〞可能會超過接點元件之過行程 e 的長度。

圖 2　按鈕操作

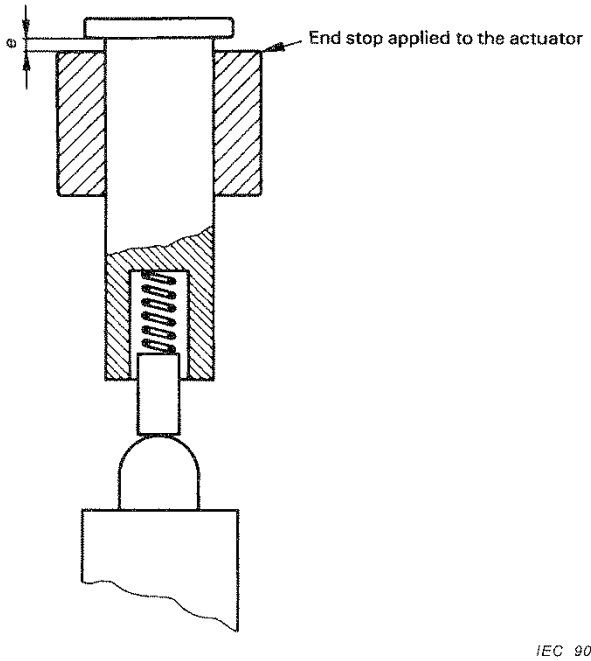


Figure 3 – Difference e between the over-travel of the actuator and that of the contact element

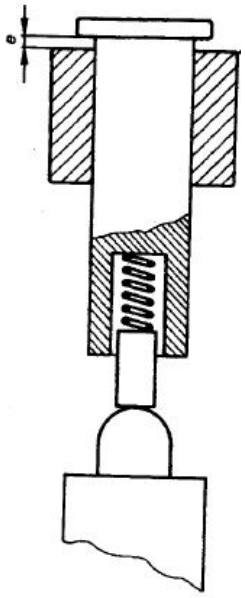
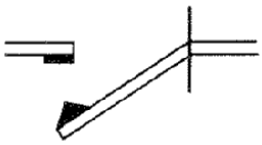
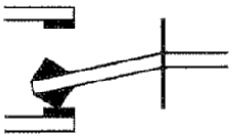
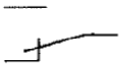
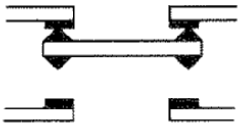
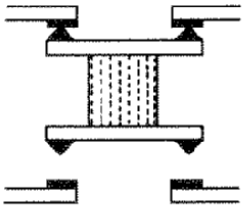


圖 3　致動器過行程與接點元件過行程之間的差異

Figure No.	Figure	Symbols	Forms	Description
4a)		 Note 1	A	Single gap contact element with two terminals
		 Note 1	B	
4b)		 Note 1	X	Double gap contact element with two terminals
		 Note 1	Y	
4c)		 Note 1	C	Change-over, single gap, contact element with three terminals
4d)			Za	Change-over, double gap, contact element with four terminals Note – The contacts are of the same polarity
4e)			Zb	Change-over, double gap, contact element with four terminals (The two moving contacts are electrically separated) Note – Multiple electricaly separated contact configurations are also covered by Zb

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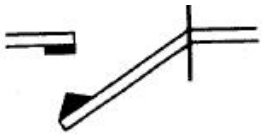
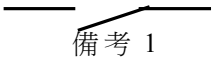
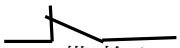
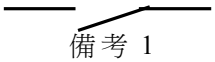
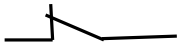
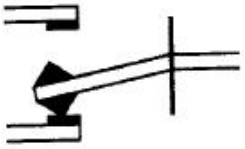
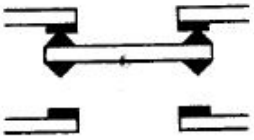
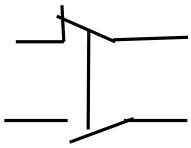
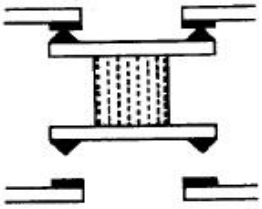
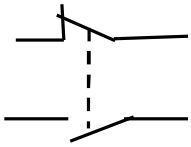
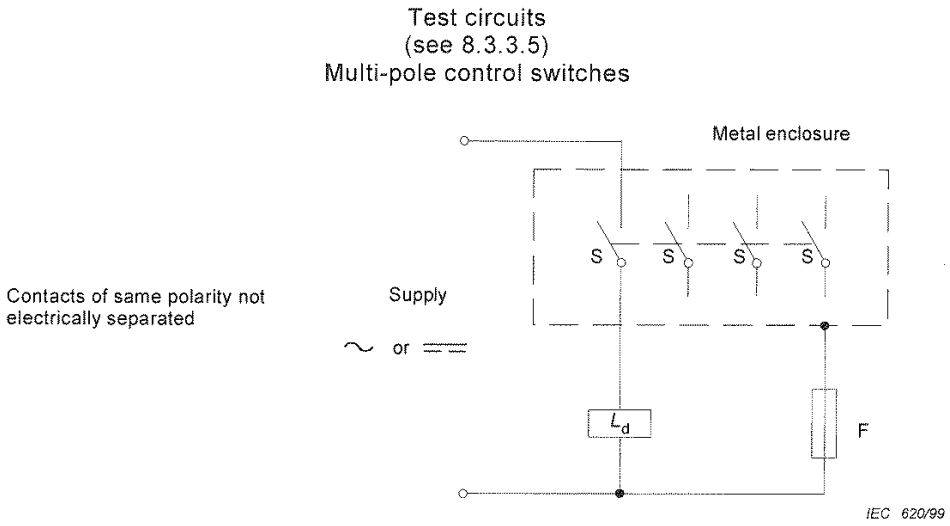
NOTE 1 Symbols according to IEC 60617.

Figure 4 – Examples of contact elements (schematic sketches)

圖號	圖形	符號	型式	說明
4(a)		 備考 1	A	具有 2 終端之單間隙接點元件
		 備考 1	B	
4(b)		 備考 1	X	具有 2 終端之雙間隙接點元件
		 備考 1	Y	
4(c)		 備考 1	C	具有 3 終端之切換、單間隙接點元件
4(d)			Za	具有 4 終端之切換、雙間隙接點元件 備考：所有接點為相同極性
4e)			Zb	具有 4 終端之切換、雙間隙接點元件(其活動之兩個接點互相電氣絕緣) 備考：Zb 也涵蓋多組電氣絕緣接點之組態

備考 1. 符號依據 IEC 60617。

圖 4 接點元件實例(示意圖)

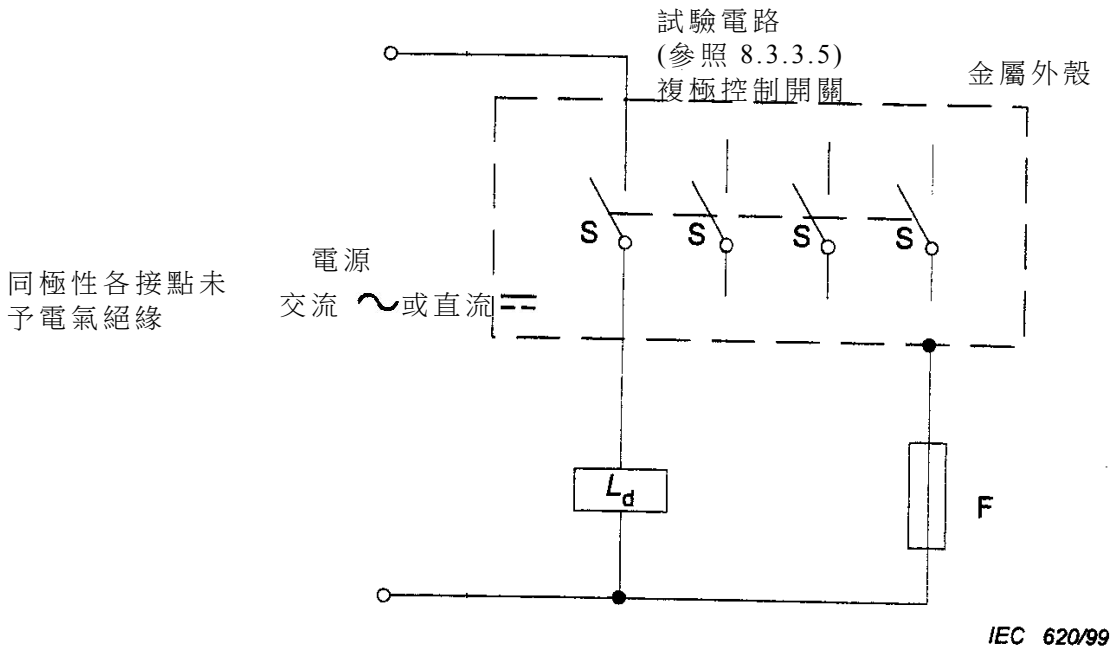


L_d: Load according to Figure 7

F: Fuse or isolation measurement device

S: Contact element (NO or NC)

Figure 5 – Test circuits for multi-pole control switches – Contacts of same polarity, not electrically separated

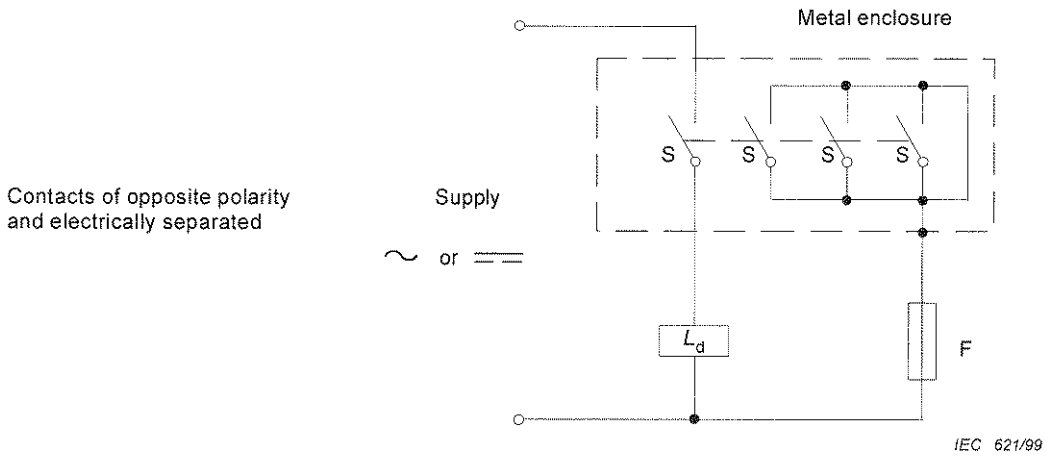


L_d: 依據圖 7 之負荷

F: 保險絲或絕緣措施裝置

S: 接點元件(NO 或 NC)

圖 5　多極控制開關試驗電路－同極性、未絕緣接點

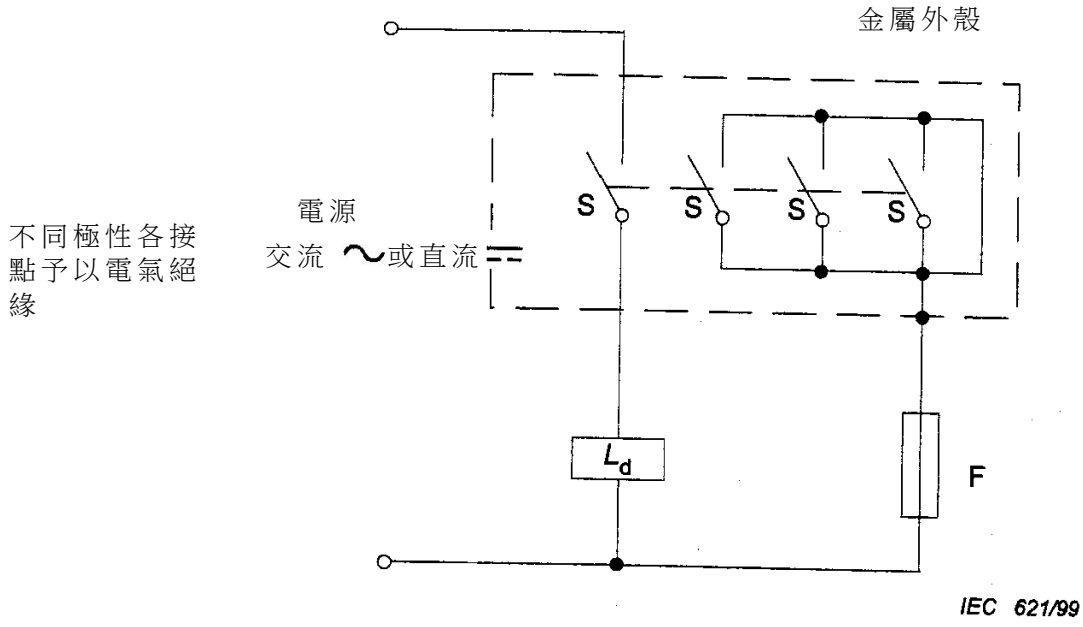


L_d: Load according to Figure 7

F: Fuse or isolation measurement device

S: Contact element (NO or NC)

Figure 6 – Test circuits for multi-pole control switches – Contacts of opposite polarity, and electrically separated



L_d: 依據圖 7 之負荷

F: 保險絲或絕緣措施裝置

S: 接點元件(NO 或 NC)

圖 6　多極控制開關試驗電路－不同極性之絕緣接點

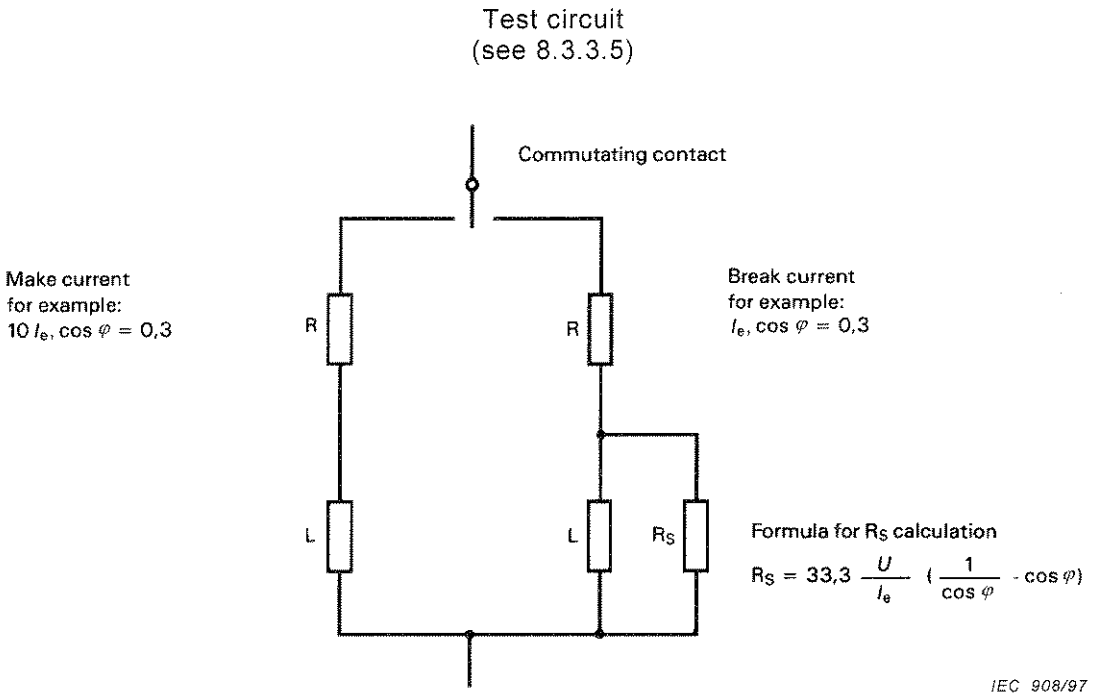


Figure 7 – Load L_d details for test conditions requiring different values of make and break current and/or power factor (time constant)

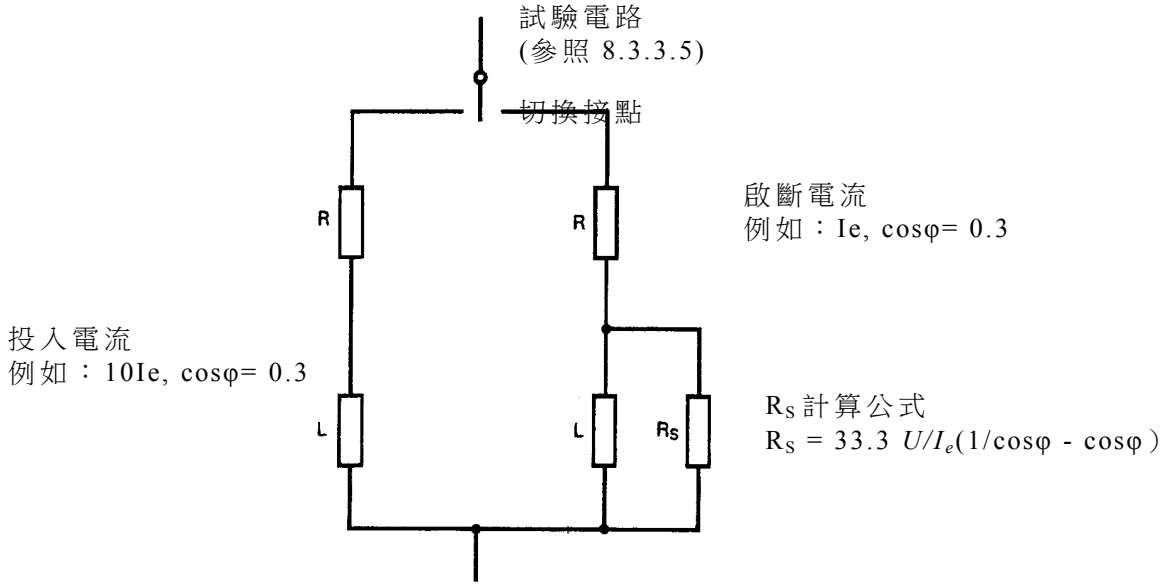
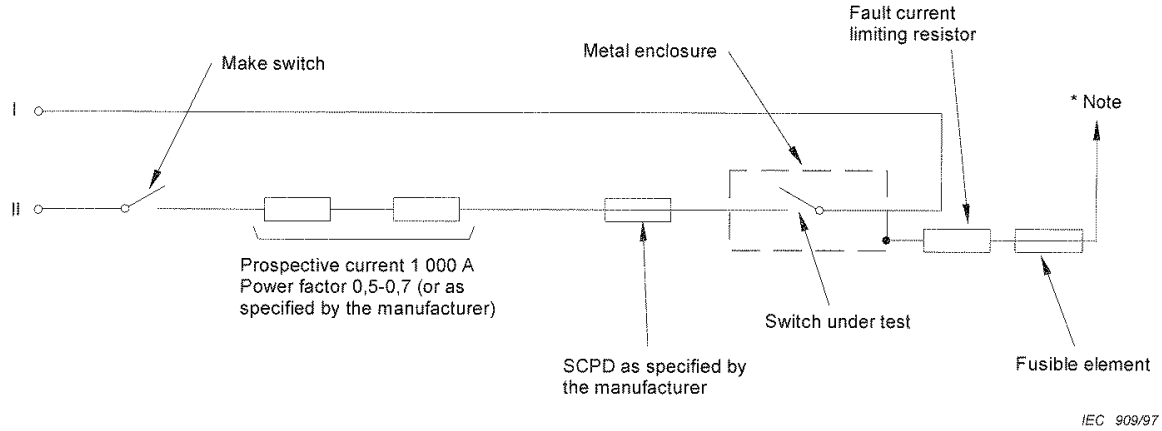
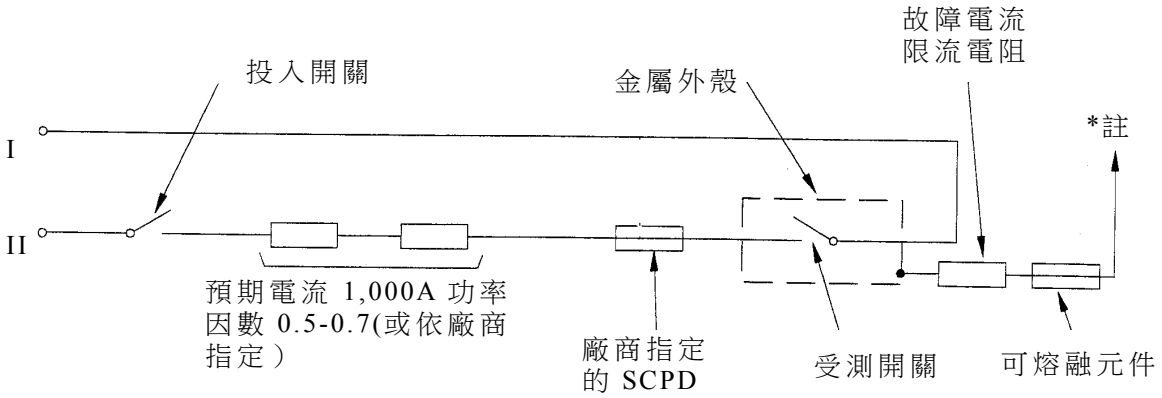


圖 7　需要不同投入與啟斷電流及/或功率因數(時間常數)之試驗條件下，負荷 Ld 之細節



NOTE To be connected alternatively to I or II on successive tests.

Figure 8 – Test circuit, conditional short-circuit current (see 8.3.4.2)



備考：在後續試驗中，交互連接至 I 及 II。

圖 8　試驗電路，條件短路電流(參照 8.3.4.2)

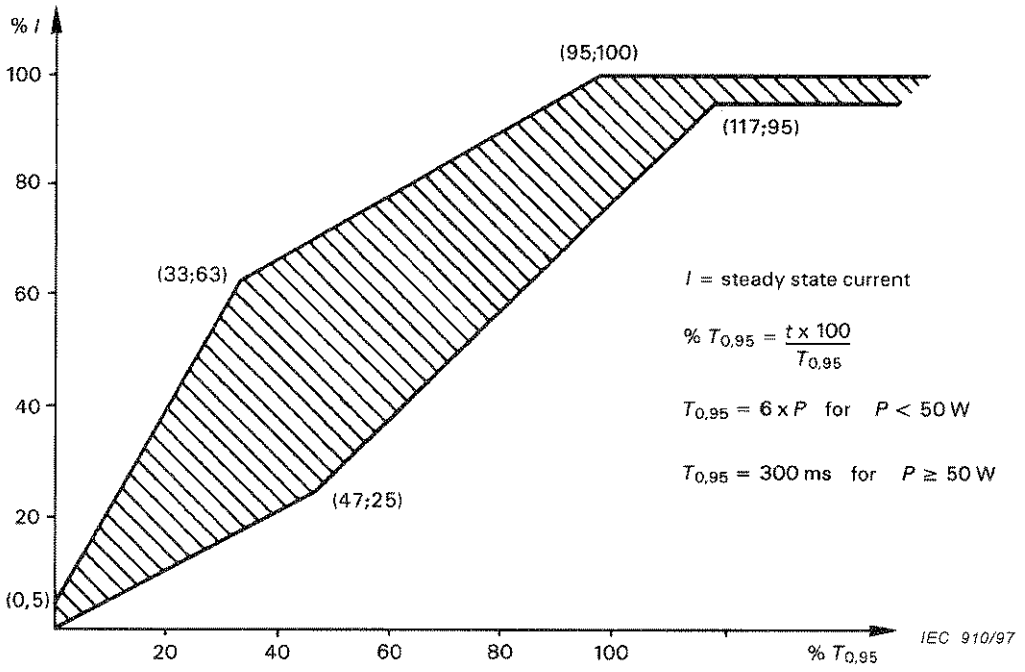


Figure 9 – Current/time limits for d.c. test loads (see 8.3.3.5.3)

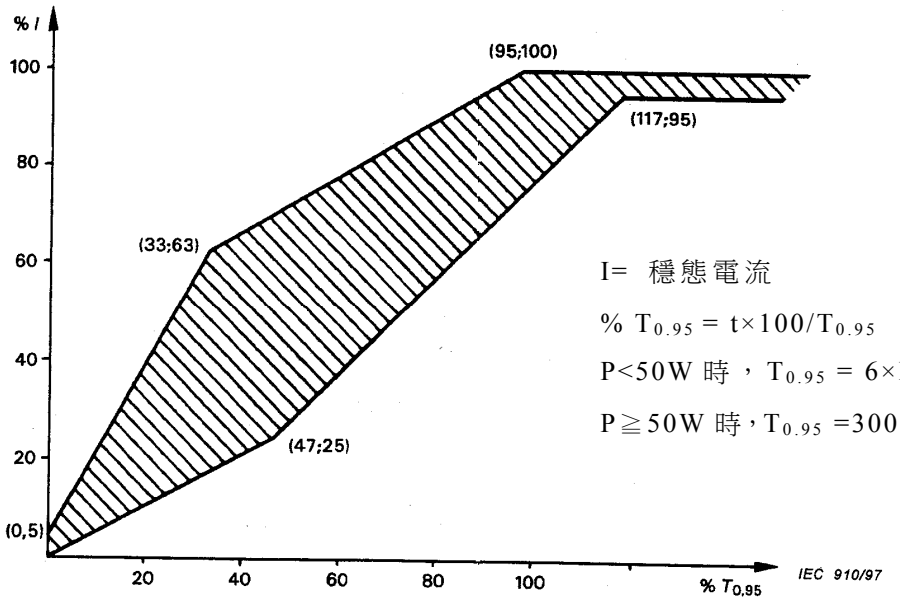


圖 9　直流試驗負荷之電流/時間限制(參照 8.3.3.5.3)

Annex A
(normative)

Electrical ratings based on utilization categories
(see 3.1)

Table A.1 – Examples of contact rating designation based on utilization categories

Désignation 1)	Utilization category	Conventional enclosed thermal current I_{the} A	Rated operational current I_e (A) at rated operational voltage U_e						VA rating VA	
Alternative current			120 V	240 V	380 V	480 V	500 V	600 V	M	B
A150	AC-15	10	6	–	–	–	–	–	7 200	720
A300	AC-15	10	6	3	–	–	–	–	7 200	720
A600	AC-15	10	6	3	1,9	1,5	1,4	1,2	7 200	720
B150	AC-15	5	3	–	–	–	–	–	3 600	360
B300	AC-15	5	3	1,5					3 600	360
B600	AC-15	5	3	1,5	0,95	0,75	0,72	0,6	3 600	360
C150	AC-15	2,5	1,5	–	–	–	–	–	1 800	180
C300	AC-15	2,5	1,5	0,75	–	–	–	–	1 800	180
C600	AC-15	2,5	1,5	0,75	0,47	0,375	0,35	0,3	1 800	180
D150	AC-14	1,0	0,6	–	–	–	–	–	432	72
D300	AC-14	1,0	0,6	0,3	–	–	–	–	432	72
E150	AC-14	0,5	0,3	–	–	–	–	–	216	36
Direct current			125 V	250 V		400 V	500 V	600 V		
N150	DC-13	10	2,2	–		–	–	–	275	275
N300	DC-13	10	2,2	1,1		–	–	–	275	275
N600	DC-13	10	2,2	1,1		0,63	0,55	0,4	275	275
P150	DC-13	5	1,1	–		–	–	–	138	138
P300	DC-13	5	1,1	0,55		–	–	–	138	138
P600	DC-13	5	1,1	0,55		0,31	0,27	0,2	138	138
Q150	DC-13	2,5	0,55	–		–	–	–	69	69
Q300	DC-13	2,5	0,55	0,27		–	–	–	69	69
Q600	DC-13	2,5	0,55	0,27		0,15	0,13	0,1	69	69
R150	DC-13	1,0	0,22	–		–	–	–	28	28
R300	DC-13	1,0	0,22	0,1		–	–	–	28	28
									M = make B = break	

NOTE 1 The letter stands for the conventional enclosed thermal current and identifies (a.c. or d.c.): for example B means 5 A a.c. The rated insulation voltage U_i is at least equal to the number after the letter.

NOTE 2 The rated operational current I_e (A), the rated operational voltage U_e (V) and the break apparent power B (V.A) are correlated by the formula $B = U_e \cdot I_e$.

附錄 A

(規定)

依據使用分類之電氣額定值(參照 3.1)

表 A.1　依據使用分類之接點額定容量命名實例

命名 (1)	使用分類	傳統密封熱電流 I_{the} A	額定操作電壓 U_e 時之額定操作電流 I_e (A)						VA 額定值 VA	
交流電流			120V	240V	380V	480V	500V	600V	M	B

A150	AC-15	10	6	-	-	-	-	-	7200	720
A300	AC-15	10	6	3	-	-	-	-	7200	720
A600	AC-15	10	6	3	1.9	1.5	1.4	1.2	7200	720
B150	AC-15	5	3	-	-	-	-	-	3600	360
B300	AC-15	5	3	1.5					3600	360
B600	AC-15	5	3	1.5	0.95	0.75	0.72	0.6	3600	360
C150	AC-15	2.5	1.5	-	-	-	-	-	1800	180
C300	AC-15	2.5	1.5	0.75	-	-	-	-	1800	180
C600	AC-15	2.5	1.5	0.75	0.47	0.375	0.35	0.3	1800	180
D150	AC-14	1.0	0.6	-	-	-	-	-	432	72
D300	AC-14	1.0	0.6	0.3	-	-	-	-	432	72
E150	AC-14	0.5	0.3	-	-	-	-	-	216	36
直流電流			125V	250V		400V	500V	600V		
N150	DC-13	10	2.2			-	-	-	275	275
N300	DC-13	10	2.2	1.1		-	-	-	275	275
N600	DC-13	10	2.2	1.1		0.63	0.55	0.4	275	275
P150	DC-13	5	1.1	-		-	-	-	138	138
P300	DC-13	5	1.1	0.55		-	-	-	138	138
P600	DC-13	5	1.1	0.55		0.31	0.27	0.2	138	138
Q150	DC-13	2.5	0.55	-		-	-	-	69	69
Q300	DC-13	2.5	0.55	0.27		-	-	-	69	69
Q600	DC-13	2.5	0.55	0.27		0.15	0.13	0.1	69	69
R150	DC-13	1.0	0.22	-		-	-	-	28	28
R300	DC-13	1.0	0.22	0.1		-	-	-	28	28
									M=投入	
									B=啟斷	

備考 1. 字母部分代表傳統密封熱電流並區分(交流或直流電流)：例：B 為交流 5 A。額定絕緣電壓 U_i 至少等於字母後之數字。

備考 2. 額定操作電流 I_e(A)、額定操作電壓 U_e (V)及明顯啟斷功率 B(V.A.)之間的關係為公式 $B=U_e \cdot I_e$。

Table A.2 – Examples of semiconductors switching element ratings for 50 Hz and/or 60 Hz [1)]

Switching element rating	Rated operational current I_e	Rated make current A				Minimum operational current	Maximum OFF-state current
Designation	A	AC15	AC14	AC13	AC12	A	mA
SA	10	100	60	20	10	0,1	15
SB	5	50	30	10	5	0,1	15
SC	2	20	12	4	2	0,05	10
SD	1	10	6	2	1	0,05	10
SE	0,5	5	3	1	0,5	0,01	10
SF	0,25	2,5	1,5	0,5	0,25	0,01	5
SG	0,1	1	0,6	0,2	0,1	0,01	3

[1)] The rated operational voltage shall be specified by the manufacturer.

表 A.2 半導體開關元件於 50 Hz 及/或 60 Hz(1)之額定容量實例

開關元件額定命名	額定操作電流 I_e A	額定投入電流 A				最小操作電流 A	最大 OFF 態電流 mA
		AC15	AC14	AC13	AC12		
SA	10	100	60	20	10	0.1	15
SB	5	50	30	10	5	0.1	15
SC	2	20	12	4	2	0.05	10
SD	1	10	6	2	1	0.05	10
SE	0.5	5	3	1	0.5	0.01	10
SF	0.25	2.5	1.5	0.5	0.25	0.01	5
SG	0.1	1	0.6	0.2	0.1	0.01	3
註(1)額定操作電壓應由製造廠商指定。							

Table A.3 – Examples of semiconductors switching element ratings for d.c. 1)

Switching element rating Designation	Rated operational current I_e A	Rated make current A			Maximum OFF-state current mA
		DC14	DC13	DC12	
SN	10	100	10	10	5
SP	5	50	5	5	4
SQ	2	20	2	2	4
SR	1	10	1	1	2
SS	0,5	5	0,5	0,5	2
ST	0,25	2,5	0,25	0,25	1
SU	0,1	1	0,1	0,1	0,4
SV	0,05	0,5	0,05	0,05	0,2
1) The rated operational voltage shall be specified by the manufacturer.					

表 A.3 半導體開關元件之 d.c. (1)額定容量實例

開關元件額定命名	額定操作電流 I_e	額定投入電流 A			最大 OFF 態電流
	A	DC14	DC13	DC12	mA
SN	10	100	10	10	5
SP	5	50	5	5	4
SQ	2	20	2	2	4
SR	1	10	1	1	2
SS	0.5	5	0.5	0.5	2
ST	0.25	2.5	0.25	0.25	1
SU	0.1	1	0.1	0.1	0.4
SV	0.05	0.5	0.05	0.05	0.2
註(1)額定操作電壓應由製造廠商指定。					

Annex B
(normative)

Example of inductive test loads for d.c. contacts

附錄 B
(規定)

dc 接點感應試驗負荷實例

B.1 General

The direct current inductive loads found in control circuits are usually electromagnetically driven relays, contactors and solenoids with solid iron loads rated 50 W or less. The influence of these loads on the contacts of the control circuit device is determined by the stored energy of the inductor which, in turn, is related to the average rate of rise of the current in the inductor or to the charging time of the inductor.

It has been empirically determined that inductive loads up to 50 W almost always have a charging time ($T_{0,95}$) to 95 % of their full current value of 6 ms per watt or less.

B.1 一般

控制電路中之直流感應負荷通常為，電磁作動繼電器、接點及電磁線圈含功率小於 50W 之實心鐵芯負荷。這些負荷對控制電路裝置接點之影響取決於電感儲存之能量，該能量又關聯於電感內平均電流上升率或電感之充電時間。

經實驗證實，50 W 以內之感應負荷充電到全電流值 95%的時間 ($T_{0.95}$)，通常都小於每瓦 (W) 6 毫秒(ms)。

B.2 Construction

The following inductive test loads may be used to approximate the loads imposed upon contacts used in d.c. control circuits:

The magnetic circuit consists of two solid steel cores, 44,5 mm in diameter and 158,7 mm long, which are fastened by screws at each end to solid steel yokes 25,4 mm × 63,5 mm × 152,4 mm on 101,6 mm centres (see Figure B.1). The steel has a resistance of between 13,3 and 19,9 μΩ/cm. (Cold-finished low carbon steels such as AISI 1010, 1015, 1018 or 116 equivalent meet this requirement.) At one end of each core, a non-magnetic spacer having a thickness adjustable to between 0,127 mm and 0,762 mm is interposed between the end of the core and the yoke. Non-magnetic screws shall be used to hold the yoke at the end having the non-magnetic spacer, and steel screws shall be used at the other end.

A coil having the winding characteristics shown in Figure B.1 surrounds one of the cores. The current in the coil, when energized at the test voltage, is adjusted to the value specified in the Table B.1 by means of a series resistor.

B.2 結構

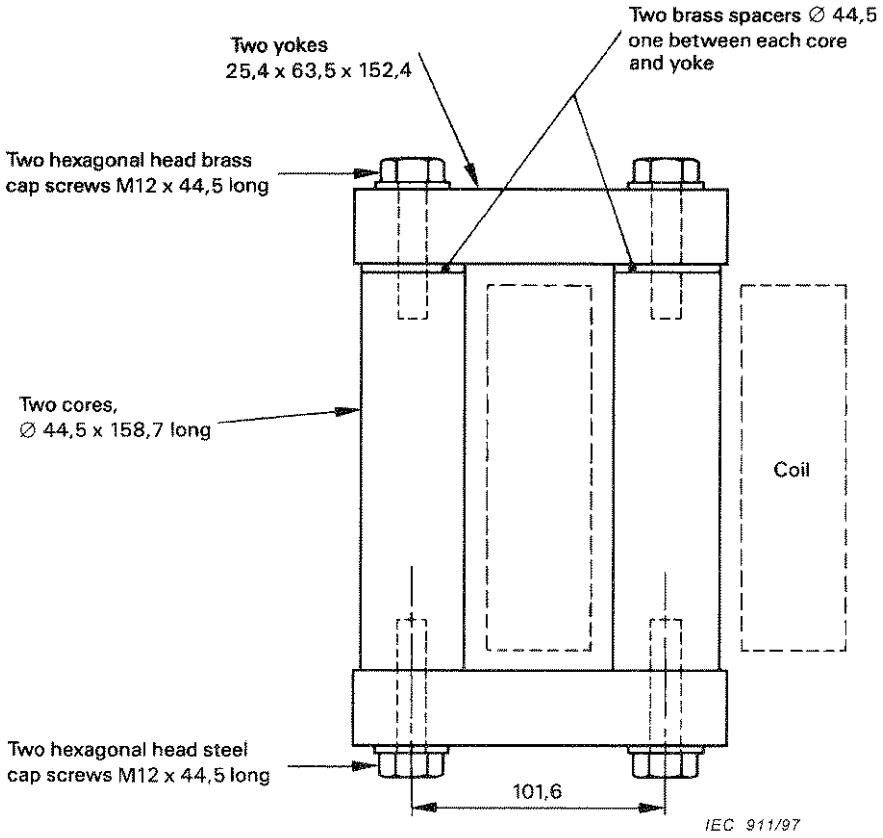
下列感應試驗負載可用於求出，直流控制電路中所使用接點之負載約值。

電磁電路包含兩個實心鋼製核心，直徑 44.5 mm、長 158.7 mm，以螺絲固定在 25.4 mm ×63.5 mm × 152.4 mm、中心距離 101.6 mm 之實心鋼軛兩端(參照圖 B.1)。這些鋼料之電阻介於 13.3-19.9μΩ/cm(冷作低碳鋼料，如 AISI 1010、1015、1018 或 116 之同等品可符合本項需求)。在每個核心之一端，在核心及鋼軛之間插入無磁性墊片，其厚度可在 0.127 mm - 0.762 mm 之間調整。應使用無磁性螺絲將軛固定在有無磁性墊片之一端，另一端則使用鋼螺絲。

符合圖 B.1 所示特性之線圈，繞在核心之一上。試驗電壓通電時，利用串聯電阻將線圈之電流調整為表 B.1 所示數值。

The thickness of the spacer is adjusted so that the coil current builds up from zero to 95 % of its full value within the limits shown in Figure 9. If the current curve falls below the minimum time limit, the cross section of the iron yoke is increased and if it falls above the maximum limit the cross section is reduced.

調整墊片厚度，使線圈建立之電流在圖 9 所示限度內，從零達到全值之 95%。若電流曲線低於最小時間限制，須增加鐵軛截面積；若超出最大限度，則減少截面積。



Dimensions in millimetres

Figure B.1 – Construction of load for d.c. contacts

Table B.1 – DC loads

Coil construction					
Test voltage V	Number of turns	Wire size mm^2	Approximate coil resistance Ω	Current limit with series resistor A	Wattage at test voltage W
125	7 000	0,52	74	1,1	138
250	14 000	0,26	295	0,55	138
600	33 400	0,10	1 680	0,20	120

單位：mm

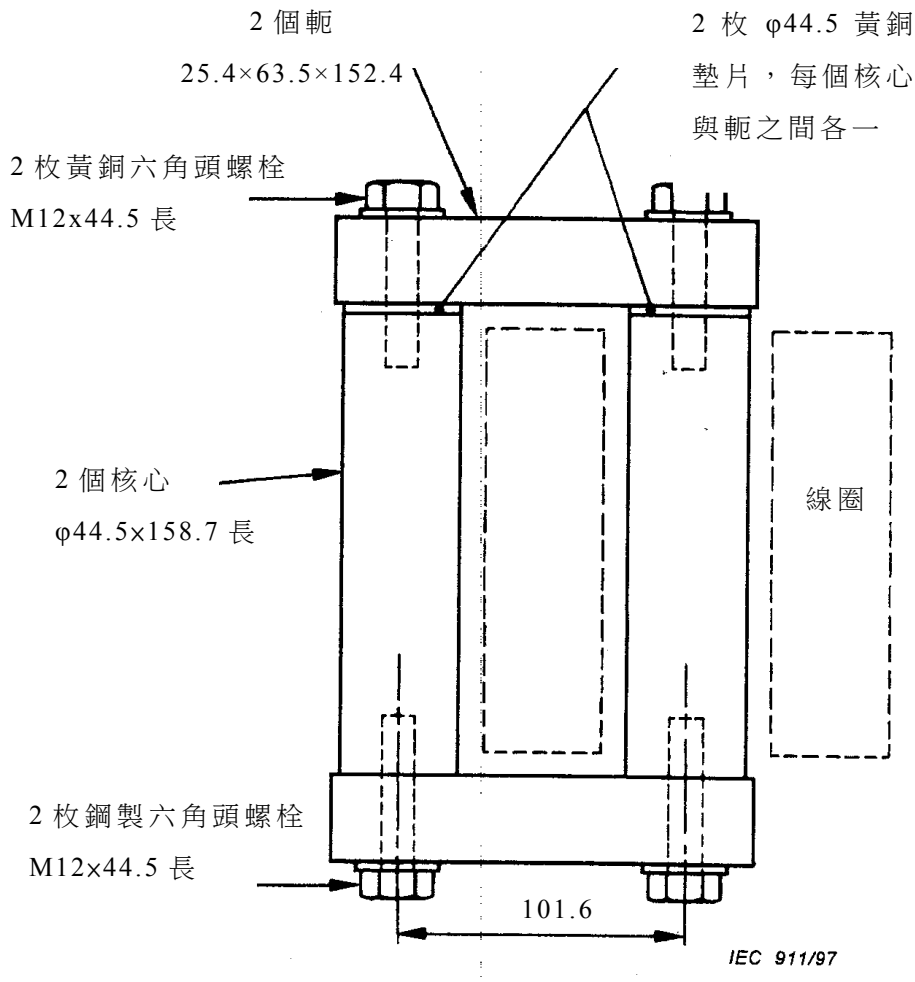


圖 B.1　直流接點之負荷構造

表 B.1　DC 負載

線圈結構					
試驗電壓 V	圈數	線徑 mm2	線圈電阻約值 Ω	以串聯電阻限流 A	試驗電壓下之功率 W
125	7,000	0.52	74	1.1	138
250	14,000	0.26	295	0.55	138
600	33,400	0.10	1 680	0.20	120

Annex C
(normative)

Special tests – Durability tests

附錄 C
(規定)

特殊試驗－耐用度試驗

C.1 General

C.1.1 Durability declaration

The special durability tests (see 7.2.4.3) described in this annex are conducted at the discretion of the manufacturer. If the manufacturer declares a mechanical and/or electrical durability, the value shall correspond to the special tests described respectively in C.2 and/or C.3.

NOTE Both durability types apply to the complete control circuit device.

Both durability types are expressed as a number of operating cycles (see C.2.1 and/or C.3.1).

The preferred numbers of operating cycles declared for any type of durability are the following: 0,01 – 0,03 – 0,1 – 0,3 – 1 – 3 – 10 – 30 or 100 millions.

C.1 一般

C.1.1 耐用度聲明

本附錄所述特殊耐用度試驗(參照 7.2.4.3)，依製造廠商自行決定試驗。若製造廠商宣稱機械或電氣耐用性，其值須對應於 C.2 及 C.3 所述之特殊耐用度試驗。

備考： 兩種耐用度試驗都可適用完整之控制電路裝置。

兩種耐用度都是以操作次數(循環)表示(參照 C.2.1 或 C.3.1)。

常用之耐用度表示數值如下：

0. 01–0.03–0.1–0.3–1–3–10–30 或 100 百萬次。

C.1.2 Test procedures

C.1.2.1 General

Every test shall be performed under the general conditions stated in 8.3.2.1, and at a rate equal or higher than that declared by the manufacturer. The moving parts of the device shall reach their maximum operating positions in both directions, as recommended by the manufacturer.

The test results are verified by statistical analysis according to the *single 8* (see C.1.2.2) or *double 3* (see C.1.2.3) test methods.

The manufacturer may declare mechanical durability based on experience with similar design.

NOTE The *single 8* or *double 3* test methods are both given in IEC 60410 (see Tables X-C-2 and X-D-2). These two tests have been chosen with the objective of testing a limited number of control circuit devices on the same statistical characteristics (acceptance level: 10 %). Other methods providing the 10 % acceptance level may be used.

C.1.2試驗程序

C.1.2.1 一般

每次試驗應依 8.3.2.1 所述一般條件，及高於或等於製造廠商宣稱之額定值進行。裝置之活動零件應在兩個移動方向上，都達到製造廠商建議之最大操作位置。

試驗結果應依單 8(參照 C.1.2.2)或雙 3(參照 C.1.2.3)方式統計分析，以作為確認。

製造廠商可依據類似設計之經驗值，宣告其耐用度。

備考： IEC 60410 說明單 8 及雙 3 試驗方式(參照表 X-C-2 與 X-D-2)。選擇這兩種試驗是要限制相同統計特性之控制電路裝置的試驗數量(接受準位：10 %)，亦可使用提供 10 %接受準位之其他試驗方式。

C.1.2.2 Single 8 test

Eight control circuit devices shall be tested to the declared number of operating cycles.

If the number of failed devices does not exceed two, the test is considered passed.

C.1.2.2 單 8 試驗

須依據宣稱之操作次數試驗 8 件控制電路裝置。

若失敗裝置之數量小於 2，該試驗視為合格。

C.1.2.3 Double 3 test

Three control circuit devices shall be tested to the declared number of operating cycles.

The test is considered passed if there is no failure, and failed if there is more than one failure. Should there be only one failure, then three additional control circuit devices are tested to the declared number of operating cycles and providing there is no additional failure, the test is considered passed.

C.1.2.3 雙 3 試驗

須依據宣稱之操作次數試驗 3 件控制電路裝置。

若沒有裝置失敗，該試驗視為合格；超過 1 個裝置失敗，則視為不合格。若只有 1 個裝置失敗，則須依據宣稱之操作次數，另行試驗 3 件控制電路裝置。若不再有失敗裝置，該試驗視為合格。

C.1.3 Failure criteria

During the tests described in C.2.2 and C.3.2, there shall be no electrical and/or mechanical failures. Following the tests, the switching element shall pass the dielectric test of 8.3.3.4 with a rated test voltage equal to 2 U_e with a minimum of 1 000 V.

C.1.3失效標準

進行 C.2.2 及 C.2.3 所述試驗時，不得有電氣及/或機械故障。完成試驗後，其開關元件須通過 8.3.3.4 之介電試驗：額定電壓等於 2Ue、最低 1000V。

C.2 Mechanical durability

C.2.1 General

The mechanical durability of a control circuit device is defined as the number of no-load operating cycles which will be attained or exceeded by 90 % of all devices tested without repair or replacement of any part.

C.2 機械耐用性

C.2.1一般

控制電路裝置之機械耐用性定義為〝全部受測裝置之 90%或以上，可在不修理或更換任何零件下，達到無負載操作次數需求〞。

C.2.2 Test procedures

Tests are carried out according to C.1.2.

During the test, periodically the contacts shall be checked at any voltage and current, selected by the manufacturer, and there shall be no failure (see C.1.3).

C.2.2 試驗程序

依據 C.1.2 進行試驗。

試驗進行中，定時檢驗由製造廠商選擇之任何電壓與電流下的接點，不得產生任何故障(參照 C.1.3)。

C.3 Electrical durability

C.3.1 General

The electrical durability of a control circuit device is defined as the number of on-load operating cycles which will be attained or exceeded by 90 % of all devices tested, without repair or replacement of any part.

C.3 電氣耐用性

C.3.1 一般

控制電路裝置之電氣耐用性定義為〝全部受測裝置之 90%或以上，可在不修理或更換任何零件下，達到有負載操作次數需求〞。

C.3.2 Test procedures

Electrical durability tests are carried out by operating the device under the conditions defined in Table C.1, in accordance with C.3.2.1 for a.c. or with C.3.2.2 for d.c.

Each mechanical operating cycle shall include an interruption of test current.

The ON-duration of current shall be not more than 50 % and not less than 10 % of an operating cycle. If the test circuit shown in Figure C.1 is used, the ON-duration of current at ten times I_e shall not cause overheating.

Alternatively these tests may be performed on the actual load for which the control switch is intended.

C.3.2 試驗程序

依據表 C.1 所定義條件進行電氣耐用性試驗；依 C.3.2.1 試驗交流、依 C.3.2.2 試驗直流電。

每個機械操作周期應有一次電流中斷試驗。

電流之 ON-時間不得超過操作周期之 50%，也不可低於 10%。若使用圖 C.1 之試驗電路，其 10 倍 Ie 之電流 ON-期間不可造成過熱。

或者可依控制開關之實際設計負載，進行該等試驗。

Table C.1 – Making and breaking conditions for electrical durability

Kind of current	Utilization category	Make			Break		
Alternating	AC-15	I	U	cos φ	I	U	cos φ
		10 I_e	U_e	0,7[1)]	I_e	U_e	0,4[1)]
Direct[2)]	DC-13	I	U	$T_{0,95}$	I	U	$T_{0,95}$
		I_e	U_e	$6 \times P$[3)]	I_e	U_e	$6 \times P$[3)]

I_e Rated operational current — I Current to be made or broken

U_e Rated operational voltage — U Voltage

$P = U_e \times I_e$ Steady-state power consumption, in W — $T_{0,95}$ Time to reach 95 % of the steady-state current, in milliseconds

1) The power-factors indicated are conventional values and apply only to the test circuits which simulate the electrical characteristics of coil circuits. It should be noted that, for circuits with power-factor 0,4, shunt resistors are used in the test circuit to simulate the damping effect on the eddy current losses of the actual electromagnet.

2) For d.c. electromagnetic loads provided with switching devices introducing an economy resistor, the rated operational current shall be at least equal to the maximum value of the inrush current.

3) The value "6 × *P*" results from an empirical relationship which is found to represent most d.c. magnetic loads to an upper limit of *P* = 50 W, i.e. 6 × *P* = 300 ms. Loads having power consumption greater than 50 W are assumed to consist of smaller loads in parallel. Therefore, 300 ms is to be an upper value, irrespective of the power.

表 C.1 電氣耐用性之投入(make)與啟斷(break)條件

電流種類	使用分類	投入			啟斷		
交流	AC-15	I	U	cosφ	I	U	cosφ
		10 I_e	U_e	0.7 (1)	I_e	U_e	0.4 (1)
直流(2)	DC-13	I	U	$T_{0.95}$	I	U	$T_{0.95}$
		I_e	U_e	6×P,(3)	I_e	U_e	6×P,(3)

I_e 額定操作電流	I 須經投入或啟斷之電流
U_e 額定操作電壓	U 投入前之電壓
P= U_e × I_e 穩態功率消耗，以瓦為單位	$T_{0.95}$ 電流達到 95%穩定值之時間 ms

(1) 所顯示之功率因數為環境值，且僅適用於模擬線圈電路電氣特性之試驗電路。應須注意的是，對於功率因數為 0.4 之電路，試驗電路中使用旁路電阻模擬實際電磁鐵之渦流電流(eddy current)損耗之阻尼效果。

(2) 對於開關裝置中含有節能電阻之直流電磁負載，其額定操作電流應至少等於輸入電流之最大值。

(3) 來自實驗關係之〝6×P〞結果，可在 P=50 W 上限內，代表多數之直流電磁性負荷，亦即 6 ×P=300 ms。功率超過 50 W 之負荷可假設為多個並聯之小功率負荷。因此不論功率消耗值為何，300 ms 為上限值。

C.3.2.1 AC tests

The circuit to be used shall be as shown in Figure C.1 below, comprising

– a making circuit, consisting of an air-cored inductor, in series with a resistor, having a power factor of 0,7 and drawing a current of 10 I_e;

– a breaking circuit, consisting of an air-cored inductor in series with a resistor, the whole being in parallel with a resistor in which flows about 3 % of the breaking current I_e, so that the total power factor be of 0,4.

If the contact element has a bounce time less than 3 ms, the test may be made with the simplified circuit shown in Figure C.2.

The test report shall record which test circuit has been used.

C.3.2.1 交流電試驗

受測電路應如下圖 C.1 所示，包括

– 投入電路，包含空氣芯電感、串聯一電阻、功率因數為 0.7，且其流過電流為 10 I_e；

— 啟斷電路，包含空氣芯電感、串聯一電阻，該整個電路與一電阻並聯，該並聯電阻中流過約 3%之啟斷電流 I_e，使整體功率因數成為 0.4。

若接點元件之作用時間小於 3 ms，則可依圖 C.2 所示之簡化電路試驗。

試驗報告中須記錄使用何者試驗電路。

C.3.2.2 DC tests

Circuits to be used shall consist of:

a) an air-cored inductor in series with a resistor.

A resistor shall be connected across the complete test circuit to simulate the damping due to eddy currents; the resistance value shall be such that 1 % of the test current will pass through this resistor; or,

b) an iron-cored inductor, in series with a resistor, if required, to obtain a duration $T_{0,95}$ as indicated in Table C.1.

It shall be verified, by oscillograms, that the time to reach 95 % of the steady-state current is equal to the value given in Table C.1 ± 10 %, and the time to reach 63 % of the steady-state current is one-third of the value given in Table C.1 ± 20 %.

C.3.2.2 直流電試驗

使用電路應包含。

(a) 與一電阻串聯之空氣芯電感

將一電阻跨接在完整之試驗電路上，以模擬渦流電流產生之阻尼效應。其阻值應為使試驗電流之 1%通過該電阻；或

(b) 與一電阻串聯之鐵芯電感，以便必要時，依表 C.1 所示獲致 $T_{0.95}$ 之時間。應使用示波器確認達到 95 %穩態電流之時間，應等於表 C.1 所列數值±10%；而達到 63%穩態電流之時間，應等於表 C.1 所列數值±20 %。

AC test circuits (see C.3.2.1)

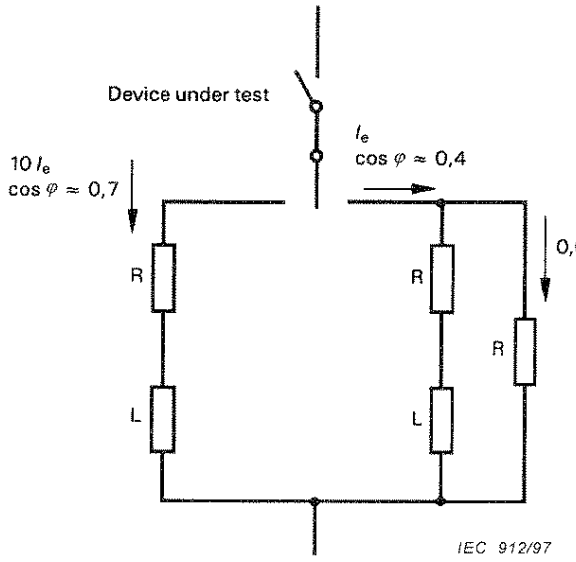


Figure C.1 – Normal circuit
(see C.3.2.1)

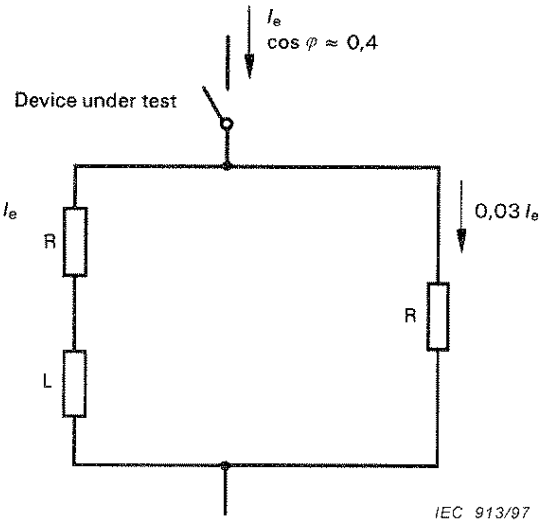


Figure C.2 – Simplified circuit
(see C.3.2.1)

交流電試驗電路(參照 C.3.2.1)

受測裝置

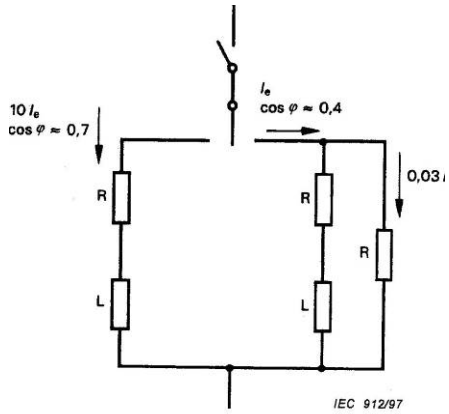


圖 C.1 正常電路
(參照 C.3.2.1)

受測裝置

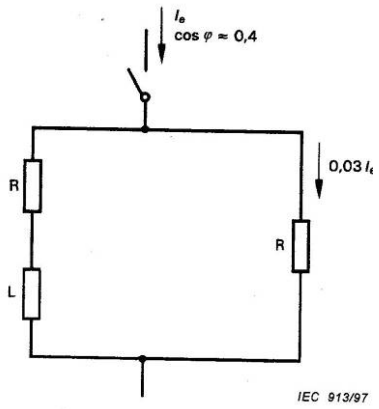


圖 C.2 簡化電路
(參照 C.3.2.1)

Annex D

Vacant

附錄 D

(空白)

Annex E
(normative)
Items subject to agreement between manufacturer and user

附錄 E
(規定)
製造廠商與使用者協議事項

NOTE For the purpose of this annex:
- "agreement" is used in a very wide sense.
- "user" includes testing stations.

Annex J of IEC 60947-1 applies, as far as covered by clauses and of this standard, with the following additions:

備考： 依本附錄之宗旨。

— 〝協議〞泛指其廣義含義。

— 〝使用者〞包含各試驗站。

IEC 60947-1 之附錄 J 增加下列項目後，即可適用。

Clause or subclause number of this standard	Item
5.2.5	Relationship between the positions of the actuator of rotary switches and the associated contact element positions in the operating diagram (indication by the manufacturer)
5.2.6	Characteristics of the delay of time-delay contact elements with adjustable delay of contactors relays (indication by manufacturer)
6.1.1 (Annex K)	Choice of connecting conductors for position switches with direct opening action
8.3.1	Test sequences made on one sample only (at the manufacturer's request)
8.3.4.3	Conditional short-circuit current test:
	– adjustment of the test circuit if the prospective current is different from 1 000 A (to be specified by the manufacturer)
	– power factor of the test circuit less than 0,5 (with the manufacturer's consent)

本標準之節次	項目
5.2.5	操作圖中，旋轉開關致動器位置與相關接點元件位置之間的關係(由製造廠商標示)。
5.2.6	[時間延遲接點元件]與[電磁開關之可調整時間延遲]之性能曲線(由製造廠商標示)
6.1.1(附錄 K)	選擇直接開啟動作之位置開關的連接導體。
8.3.1	就單一樣品之試驗程序(依製造廠商要求)
8.3.4.3	有條件短路電流試驗 －若預期電流不是 1,000 A 時，對試驗電路之調整(由廠商指定)。 －試驗電路之功率因數小於 0.5(須經製造廠商同意)。

Annex F
(normative)

Class II control circuit devices insulated by encapsulation Requirements and tests

附錄 F

(規定)

依據封裝要求與試驗之第 II 類控制電路裝置

F.1 General

This annex specifies constructional requirements and tests for class II control circuit devices or parts of devices in which insulation of class II according to IEC 61140 is achieved by encapsulation.

All non-encapsulated parts shall have clearances and creepage distances double to those specified in 7.1.3.

F.1 一般

本附錄規範第 II 類控制電路裝置或裝置零件之結構需求與試驗方式。其依據 IEC 61140 規定之第 II 類絕緣，係藉由封裝方式為之。

所有未封裝部件之間隙及潛變距離，須為 7.1.3 節所指定者之 2 倍。

F.2 Definitions

For the purposes of this annex, the following definitions apply:

F.2 定義

下列定義僅適用於本附錄。

F.2.1
encapsulation
process by which all components, conductors and ends of integral cables are encased in an insulating compound by suitable means such as embedding or potting

F.2.1 封裝

以適當方法(例：埋入或罐封(potting)方式)，使絕緣膠劑包裹所有組件、導體及整合纜線端部之程序。

F.2.1.1
embedding
process of completely encasing electrical device(s) by pouring a compound over it (them) in a mould, and removing the encased device(s) from the mould after solidification of the compound

F.2.1.1 埋入

在模具內澆入膠劑，完全包住其內之電氣裝置，待膠劑凝結後再將經封裝之裝置脫模。

F.2.1.2
potting
embedding process in which the mould remains attached to the encased electrical device(s)

F.2.1.2 罐封(potting)

這種封裝程序之模殼，保留在經封裝之電氣裝置上。

F.2.2
compound
thermosetting, thermoplastic, catalytically cured and elastomeric materials with or without fillers and/or additives, after their solidification

F.2.2 膠劑

熱融、熱塑、催化凝結之彈性體材料，凝結後可摻有或不摻填充劑及/或添加劑。

F.2.3
temperature range of the compound
the ambient temperature range stated in 6.1.1 of IEC 60947-1

F.2.3 膠劑之溫度範圍

周遭溫度範圍如 IEC 60947-1 之 6.1.1 所述。

F.5 Marking

Control devices according to this annex shall be marked with the following symbol

This symbol is 60417-2-IEC-5172.

F.5 標示

依循本附錄之控制裝置應標註下列符號

此符號為 60417-2-IEC-5172。

F.7 Instructional and functional requirements

F.7.1 Choice of compound

The compound shall be chosen so that the encapsulated control devices comply with the tests defined in F.8.

F.7 說明性需求與功能需求

F.7.1 選擇膠劑

應選擇膠劑，使封裝之控制裝置符合 F.8 所述試驗需求。

F.7.2 Adhesion of the compound

The adhesion of the compound shall be sufficient to prevent the ingress of moisture between the compound and all encapsulated parts and to prevent movement of the encapsulated portion of the cable if any.

Compliance shall be verified by tests of F.8.1.2.5 and F.8.1.2.2.

F.7.2 膠劑黏性

膠劑應有足夠黏性可防止濕氣侵入膠劑與所有封裝零件之間，並可防止任何經封裝之纜線部分(若有)產生移動。

應以 F.8.1.2.5 及 F.8.1.2.2 之試驗檢驗符合性。

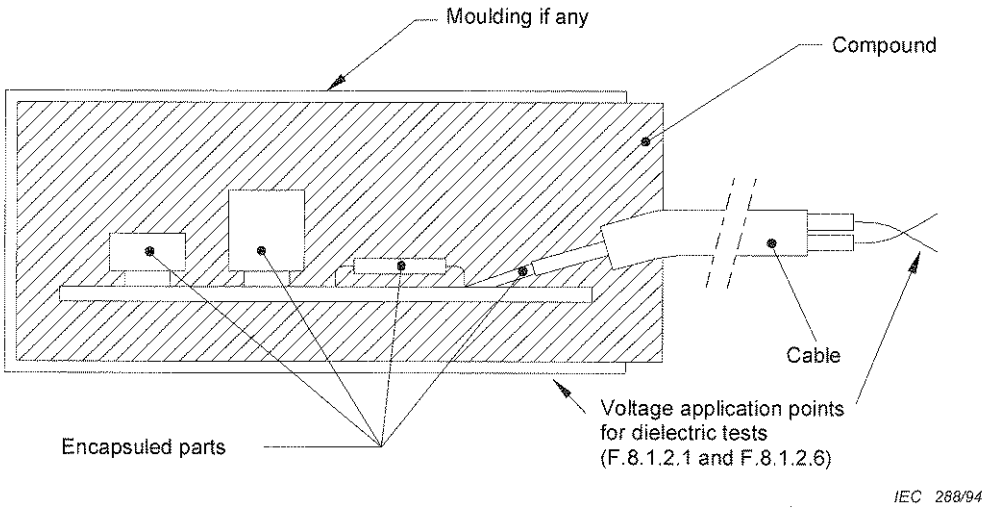


Figure F.1 – Insulation by encapsulation

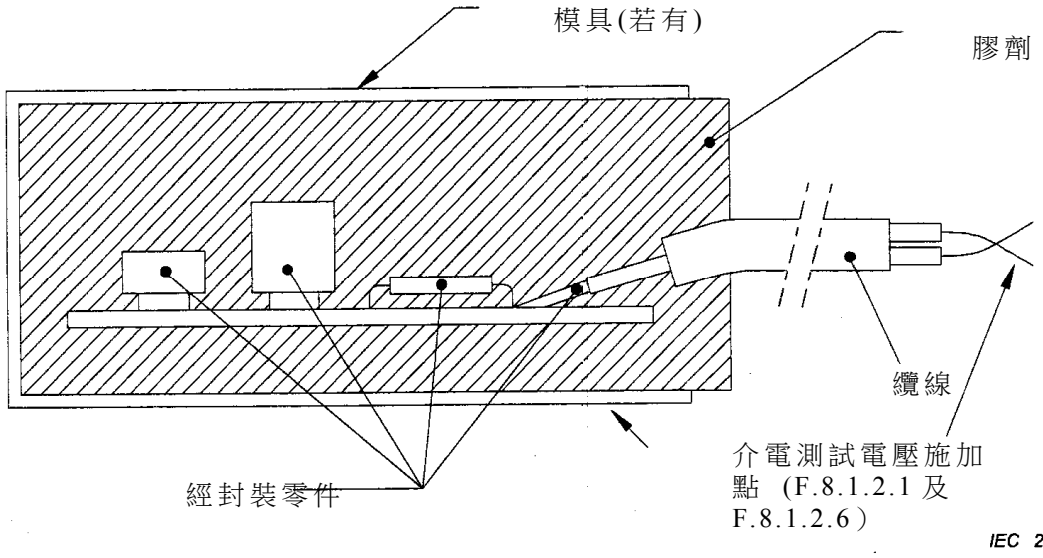


圖 F.1　以封裝材料絕緣

F.7.3 Dielectric properties

Subclause 7.2.3 applies with the following changes.

For the verification of the impulse withstand voltage, the test voltage U_{imp} shall be the next higher category of the maximum rated operational voltage in the first column of Table H.1 of IEC 60947-1 for the stated overvoltage category.

For the verification of the power frequency withstand voltage, the test voltage shall be the sum of the voltage stated in Table 12A of IEC 60947-1 plus 1 000 V.

F.7.3 介電特性

經下列變更後，適用 7.2.3。

測定衝擊耐電壓時，其試驗電壓 U_{imp} 應為 IEC 60947-1 之表 H.1 中第 1 欄最高額定操作電壓所述，過電壓分類中之次高分類。

測定電源頻率耐受電壓時，其試驗電壓應為 IEC 60947-1 之表 12A 所述電壓加上 1,000 V 之後的總和。

F.8 Tests

F.8.1 Kind of tests

F.8.1.1 General

Subclause 8.1.1 of IEC 60947-1 applies.

F.8.1.2 Type test

The following sequence of 6 tests shall be applied to each of 3 samples in the specified order.

F.8 試驗

F.8.1 試驗種類

F.8.1.1 一般

適用 IEC 60947-1 之 8.1.1。

F.8.1.2 定型試驗試驗

應依指定順序就 3 件樣本進行下列 6 項試驗程序。

F.8.1.2.1 Dielectric tests in new conditions

Subclause 8.3.3.4 of IEC 60947-1 applies with the exception that the values of voltages shall be applied between the stripped joined ends of the cable or the shorted terminals and any point of the surface (or metallic foil on the surface) of the encapsulated device (see Figure F.1). No breakdown of the insulation shall occur.

F.8.1.2.1 全新狀態之介電試驗

適用 IEC 60947-1 之 8.3.3.4，但其電壓值須施加在纜線之剝皮接頭端，或短路連接之端子及經封裝裝置表面(或金屬箔表面)之任何一點之間(參照圖 F.1)。其絕緣不可被擊穿。

F.8.1.2.2 Cable tests (if applicable)

Control circuit devices provided with integrally connected cables shall comply with requirements of Annex G.

F.8.1.2.2 纜線試驗(若適用)

附有整合連結纜線之控制電路裝置，應符合附錄 G 之要求。

F.8.1.2.3 Rapid change of temperature test

Test Na shall be performed in accordance with IEC 60068-2-14 with the following values:

T_A and T_B are the minimum and the maximum temperatures stated in F.2.3

Transition time t_2: 2 min to 3 min

Number of cycles: 5

Exposure time t_1: 3 h

After the test no visible damage shall be observed.[1)]

1) Small cracks of the moulding compounds, if any (see Figure F.1) are acceptable after tests F.8.1.2.3, F.8.1.2.4 and F.8.1.2.5.
They shall not impair the results of the final test of F.8.1.2.6.

F.8.1.2.3 急速溫度變化試驗

應以下列數值依據 IEC 60068-2-14 進行其 Na 試驗。

TA 與 TB 為 F.2.3 所述最低與最高溫度

過渡時間 t_2： 2 min 至 3 min

循環次數： 5

暴露時間 t_1： 3 h

試驗後不可出現可見損壞。

註(1) 經過 F.8.1.2.3、F.8.1.2.4 及 F.8.1.2.5 試驗後，可允許封裝膠劑上產生細小裂紋(若有)(參照圖 F.1)。但該等裂紋不得影響最終之試驗(F.8.1.2.6)。

F.8.1.2.4 Impact test

The test is performed as follows (see Figure F.2). The sample is placed on a rigid support.

Three impacts of 0,5 J shall be applied near the centre of the largest surface or the longest axis (for cylindrical shape) of the encapsulated device.

The impacts are provided by dropping a steel ball of 0,25 kg from a height of 0,20 m.

F.8.1.2.4 衝擊試驗

試驗方式如下(參照圖 F.2)。將試樣放置在剛性基座上。

在封裝裝置(圓柱體形狀)近最大面積表面之中心或較長軸向上，施加 3 次 0.5 J 之衝擊。

該衝擊之產生方式為使 0.25 kg 重鋼球，從 0.20 m 高度墜下。

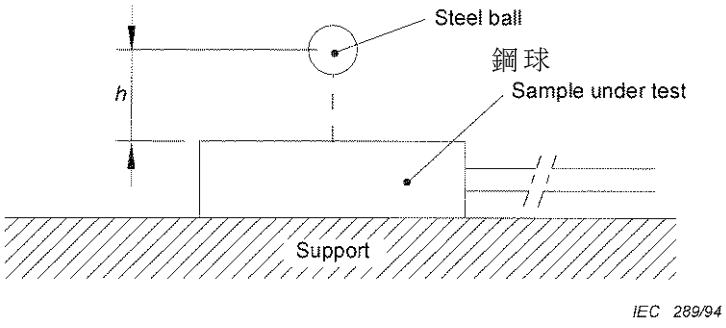


Figure F.2 – Test apparatus

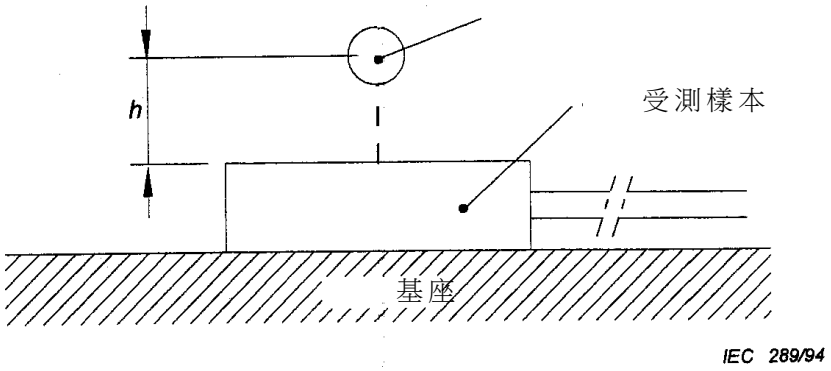


圖 F.2 試驗裝置

The support is considered sufficiently rigid if its displacement under the impact energy is lower than 0,1 mm.

After test no visible damage shall be observed.[1)]

在衝擊能量作用下，基座位移小於 0.1 mm 者視為充分堅固。

試驗後不得出現可見損壞[(1)]。

F.8.1.2.5 Damp heat, cyclic

The test Db shall be performed according to IEC 60068-2-30 with the following values:

Upper temperature: 55 °C

Number of cycles: 6

The test report shall state which variant is applied: variant 1 or variant 2.

After the test no visible damage shall be observed.[1)]

F.8.1.2.5 潮濕加熱、循環

應以下列數值依 IEC 60068-2-30 進行 Db 試驗。

上限溫度：55 °C

循環次數：6

試驗報告中應述明採用之變數：變數 1 或變數 2。

試驗後不得出現可見損壞[(1)]。

F.8.1.2.6 Dielectric test after stresses

Following Test F.8.1.2.5, the dielectric properties shall be checked by repeating tests specified in 8.3.3.4 with the test voltage of power-frequency withstand voltage being applied for 5 s.

The results to be obtained shall be as stated in 8.3.3.4 with the addition that the leakage current shall not exceed 2 mA at 1,1 U_i.

F.8.1.2.6 施加應力後之介電試驗

繼 F.8.1.2.5 試驗後，以 8.3.3.4 所述〝功率-頻率耐受電壓〞之試驗電壓施加 5 s，重複試驗其介電特性。

其試驗結果應如 8.3.3.4 所述者，但其 1.1 U_i 時之漏電電流不得超過 2 mA。

F.8.1.3 Routine tests

Subclause 8.1.3 applies but the dielectric test is mandatory.

F.8.1.3 例行試驗

適用 8.1.3，但其介電試驗為必不可缺。

Annex G
(normative)

Additional requirements for control circuit devices with integrally connected cables

附錄 G

(規定)

附整合連接纜線控制電路裝置之附加要求

G.1 General

This annex gives additional requirements applying to control circuit devices with integrally connected cables for electrical connection to other equipment and/or to the power source.

The cable integrally connected to such control circuit devices is not considered replaceable by the user. This annex states the constructional and performance requirements for the cable, the cable anchorage and the cable entrance seal.

G.1 一般

本附錄說明適用於附整合連接纜線控制電路裝置，連接至其他設備及/或電源上之附加要求。

使用者通常無法更換附在控制電路裝置之整合連接纜線。本附錄說明該等纜線、纜線固定方式，以及纜線入口密封之結構與性能要求。

G.2 Definitions

For the purpose of this annex, the following definitions apply:

G.2 定義

下列定義僅適用於本附錄。

G.2.1
cable connected control circuit device
control circuit devices having integrally connected leads for electrical connection to other equipment and/or to the power source

G.2.2
cable entrance sealing means
sealing means between the cable and device enclosure providing the required protection from cable abrasion and which may provide required sealing of enclosure and cable anchorage

G.2.3
cable anchorage
means to relieve mechanical stress from the cable termination so as to prevent damage to the electrical connection between the device and the cable

G.2.1 附纜線之控制電路裝置

控制電路裝置附有整合連接引線，可供電氣連接至其他設備或電源上。

G.2.2 纜線入口密封方式

纜線與裝置外殼之間的密封方式，可提供必要保護以防止纜線摩擦，並可提供外殼所需之密封及纜線之固定。

G.2.3 纜線固定

減輕纜線連接端子上應力之方法，以防止破壞裝置及纜線之間的電氣連接。

G.7 Constructional and performance requirements

G.7.1 Constructional requirements

G.7.1.1 Cable material

The control circuit device shall be provided with flexible cable of appropriate voltage, current and temperature rating and environmental condition.

NOTE The length of cable provided may be specified in the relevant product standard.

G.7 結構與性能要求

G.7.1 結構要求

G.7.1.1 纜線材質

控制電路裝置須配置具有適當電壓、電流及溫度規範與環境條件之軟性纜線。

備考： 可於相關產品標準中，指定所附纜線之長度。

G.7.1.2 Cable anchorage

The cable anchorage shall be such that a force being applied to the cable is not transmitted to electrical connections integral to the device.

Movement of the cable into or out of the control circuit device shall not cause damage to the cable connection or internal parts of the device.

G.7.1.3 Cable entrance sealing means

A sealing means shall be provided at the cable entrance to the control circuit device suitable for the degree of protection specified for the device (see Annex C of IEC 60947-1).

NOTE The sealing means may be inherent in the device encapsulation.

G.7.1.2 纜線固定

纜線之固定方式應可防止作用在纜線上之力，傳遞到整合在裝置上之電氣接頭。

拆卸或裝設控制電路裝置之纜線，應不致損壞纜線接頭或裝置之內部零件。

G.7.1.3 纜線入口密封方式

應依裝置之保護等級，提供控制電路裝置纜線入口之密封方法(參照 IEC 60947-1 之附錄 C)。

備考： 密封方式可併入於裝置之封裝內。

G.7.2 Performance requirements

The cable and the cable entrance sealing means shall be capable of withstanding the tests given in G.8.

G.7.2 性能要求

纜線及纜線入口密封方式須能承受 G.8 所述試驗。

G.8 Tests

The purpose of these tests is to ensure integrity of the cable anchorage during handling and installation. Once installed, the control circuit device and cable should be fixed relative to each other.

G.8 試驗

該等試驗之目的在於確認纜線固定在搬運及安裝時之完整性。安裝後，控制電

路裝置及纜線應相互固定。

G.8.1 Type tests

The following sequence of four tests shall be performed on a representative sample in the specified order.

G.8.1 型式試驗

應對代表性樣本依序進行下列 4 項試驗程序。

G.8.1.1 Pull test

The cable shall be subjected to a steady pull along the axis of the cable entry, applied to the insulating jacket of the cable for a duration of 1 min.

The pull force shall be 160 N for a cable diameter greater than or equal to 8 mm. The pull force for cable diameters of less than 8 mm shall be of the value (in N) of 20 times the external cable diameter (in mm).

G.8.1.2 Torque test

The cable shall be subjected to a torque of 0,1 N·m or limited to the value giving an angle of torque of 360°. The torque shall be applied clockwise for 1 min and then counter-clockwise for 1 min, to the cable at a distance of 100 mm from the control circuit device entrance.

G.8.1.3 Push test

The push force shall be applied along the axis of the cable as close as possible to the cable entrance.

The force is increased slowly to 20 N. The force shall be applied for 1 min for each time and with 1 min pause between applications.

After the tests, no visible damage of the cable entrance sealing means and no displacement of the cable shall be observed.

G.8.1.1 拉拔試驗

沿纜線入口軸向以施加在絕緣套管上之穩定拉力，拉拔纜線為時 1 min。

線徑 8 mm 及以上纜線，施加拉力為 160N。線徑 8 mm 及以下纜線之施加拉力(單位 N)，應為纜線外徑(單位 mm)乘以 20。

G.8.1.2 扭力試驗

施加扭力應為 0.1N·m 或以扭轉 360 度為限。施加時，應在離控制電路裝置入口 100 mm 處，順時鐘扭轉 1 min 然後逆時鐘扭轉 1 min。

G.8.1.3 推力試驗

應在儘量靠近控制電路裝置纜線入口處施加推力。

將推力逐漸增加到 20N。每次施力 1 min 且於每次施力之間停止 1 min。

試驗完成後，纜線入口密封設施不得有可見損傷，且纜線不可出現位移。

G.8.1.4 Bend test

The cable shall be loaded and bent in the following manner:

a) suspend a 3 kg mass by attaching it to the cable, 1 m from the cable entrance and with the axis of the cable entrance vertical;

b) tilt the control circuit device 90° to cause a 90° bend in the cable, maintaining that position for 1 min;

c) tilt the control circuit device 90° in the opposite direction relative to vertical so as to cause an opposite 90° bend in the cable, maintaining the position for a duration of 1 min.

G.8.1.4 彎曲試驗

以下列方式對纜線施加負載及彎曲。

(a) 將 3 kg 重物懸掛在纜線上(離纜線入口 1 m 處)，並使纜線軸線保持垂直。

(b) 將控制電路裝置傾斜 90 度，使纜線產生 90 度彎曲並維持該位置 1 min。

(c) 將控制電路裝置傾斜到相反方向(與垂直軸成 90 度角)，也使纜線產生 90 度彎曲並維持該位置 1 min。

G.8.2 Results to be obtained

There shall be no damage to the cable, cable sealing means, cable entrance or the electrical connecting means of the control circuit device. This will be verified by visual examination and verification of compliance with the stated IP designation.

G.8.2 合格試驗結果

控制電路裝置之纜線、纜線密封、纜線入口或電氣接頭，不可產生損傷。此結果應以目視檢驗判斷，並確認其 IP 保護等級標示。

Annex H
(normative)

Additional requirements for semiconductor switching elements for control circuit devices

附錄 H

(規定)

控制電路裝置半導體開關元件之附加要求

H.1 General

H.1.1 Scope

This annex applies to control circuit devices with semiconductor switching elements for controlling, signalling, interlocking, etc. switchgear and controlgear. These devices shall also comply with the relevant requirements of this standard.

H.1 一般

H.1.1 範圍

本附錄適用於附有半導體開關元件之控制電路裝置，使用於開關盤及控制盤之控制、信號、互鎖等功能。該等裝置應符合本標準之相關要求。

H.1.2 Object

The object of this annex is to state additional requirements for semiconductor switching elements which are not contained in this standard.

H.1.2 目的

本附錄旨在說明未包含於本標準半導體開關元件之附加要求。

H.2 Definitions

In addition to this standard, the following definitions apply.

H.2 定義

除本標準外，下列定義可適用。

H.2.1
voltage drop
U_d
the voltage measured across the semiconductor switching element when carrying the operational current under specified conditions

H.2.1 電壓降 U_d

半導體開關元件在指定條件下通過操作電流時，所測得跨越該元件之電壓。

H.2.2
minimum operational current
I_m
the current that is necessary to maintain ON-state conduction of the semiconductor switching element

H.2.2 最低操作電流 I_m

半導體開關元件維持 ON 狀態所需之電流。

H.2.3
OFF-state current
I_r
the current which flows through the load circuit when the switching element is in the OFF-state

H.2.3 OFF 狀態電流 I_r

開關元件在 OFF 狀態時，通過負載電路之電流。

H.3 Classification

H.3.1 Semiconductor switching elements

1) Utilization categories (see 4.4 and H.4.2).
2) Electrical ratings based on utilization categories (see Annex A).

H.3 分級

H.3.1 半導體開關元件

(1) 使用分類(參照 4.4 及 H.4.2)。

(2) 依據使用分類之電氣額定值(參照附錄 A)。

H.4 Characteristics

H.4.1 Rated voltage

H.4.1.1 Rated operational voltage (U_e)

Subclause 4.3.1.1 applies.

H.4 特性

H.4.1 額定電壓

H.4.1.1 額定操作電壓(U_e)

適用 4.3.1.1。

H.4.1.2 Operational voltage

The operational voltage may be stated as a single value or as a range. When it is stated as a range it shall include all the tolerances of U_e and shall be designated U_B. The relationship between U_e and U_B is shown in Figure H.1.

H.4.1.2 操作電壓

操作電壓可表示為單一電壓或電壓範圍。當表示為電壓範圍時，應包含 U_e 之所有誤差，且命名為 U_B。圖 H.1 顯示 U_e 與 U_B 之關係。

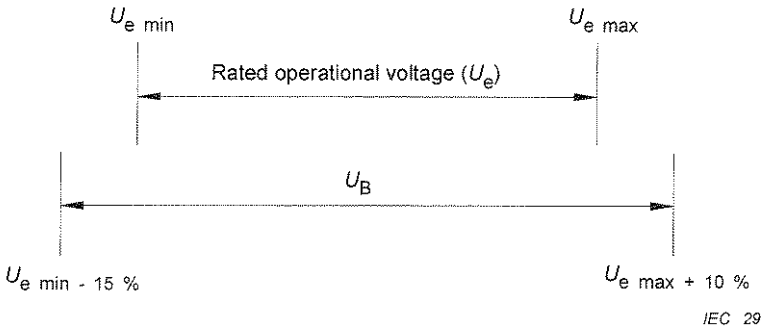


Figure H.1 – Relationship between U_e and U_B

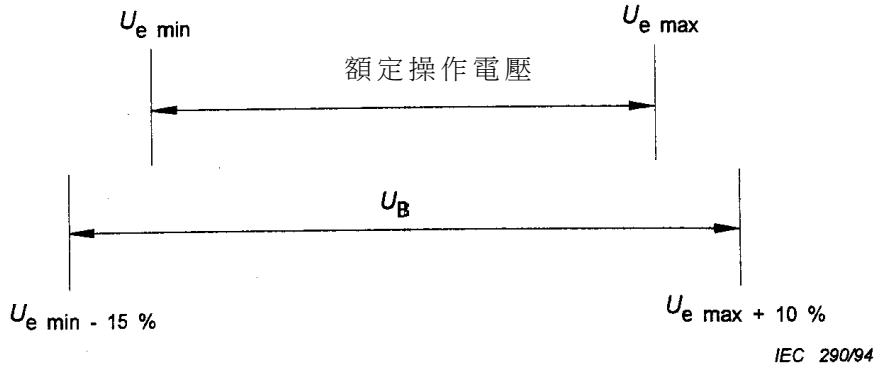


圖 H.1　U_e 與 U_B 關係圖

H.4.2 Utilization categories

The utilization categories given in Table 1 are considered standard. Any other types of application shall be based on an agreement between manufacturer and user, but information given in the manufacturer's catalogue or tender may constitute such an agreement.

H.4.2 使用分類

表 1 顯示標準使用分類。任何其他應用方式應由製造廠商與使用者協議之，但製造廠商型錄或標單中所載資訊，可構成該等協議。

H.5 Product information

Nature of information

The following information shall be given by the manufacturer: 5.1 applies with the following additions:

H.5 產品資訊

資訊性質

製造廠商應提供下列資訊：適用 5.1 及下列追加規定。

Basic rated values and utilization

a) Voltage drop (see H.7.1.1)
b) Minimum operational current (see H.7.1.2)
c) OFF-state current (see H.7.1.3)
d) Making and breaking capacities (see H.7.2.1)
e) Conditional short-circuit current (see H.7.3)
f) Electromagnetic compatibility, EMC (see H.7.4)

基本額定值與應用

(a) 電壓降(參照 H.7.1.1)

(b) 最低操作電流(參照 H.7.1.2)

(c) OFF 狀態電流(參照 H.7.1.3)

(d) 投入與啟斷容量(參照 H.7.2.1)

(e) 有條件短路電流(參照 H.7.3)

(f) 電磁相容性 EMC (參照 H.7.4)

H.7 Constructional and performance requirements

H.7.1 Performance requirements

Subclause 7.2 applies with the following additions:

H.7 結構與性能要求

H.7.1 性能要求

適用 7.2 及下列追加規定。

H.7.1.1 Voltage drop (U_d)

The voltage drop, measured across the switching element in the conductive mode, shall be stated by the manufacturer and verified according to H.8.2.

H.7.1.2 Minimum operational current (I_m)

This shall be stated by the manufacturer and verified according to H.8.3.

NOTE In Table A.2 the minimum operational currents are specified for the ratings shown.

H.7.1.3 OFF-state current (I_r)

The maximum current (I_r) which flows through the load in the OFF-state shall be in accordance with the values given in Tables A.2 and A.3, unless otherwise specified in the relevant product standard. The OFF-state current shall be verified according to H.8.4.

H.7.1.1 電壓降(U_d)

於導電模式中所測得跨越開關元件之電壓降，須由製造廠商指明並依 H.8.2 確認。

H.7.1.2 最低操作電流(I_m)

須由廠商指明並依 H.8.3 確認。

備考： 表 A.2 列出各額定值之最低操作電流。

H.7.1.3 OFF 狀態電流(I_r)

除非相關產品標準中另有說明，在 OFF 狀態下，流經負載之最大電流(Ir)應符合表 A.2 與 A.3 所列數值。OFF 狀態電流應依 H.8.4 確認之。

H.7.2 Ability to make under abnormal and normal conditions

H.7.2.1 Making and breaking capacities

See 4.3.5.

H.7.2 異常及正常狀況下之投入能力

H.7.2.1 投入及啟斷容量

參照 4.3.5。

H.7.3 Conditional short-circuit current

The switching element shall withstand the stresses resulting from short-circuit currents under the conditions specified in H.8.6.

H.7.4 Electromagnetic compatibility (EMC)

Subclause 7.3 of IEC 60947-1 applies.

H.7.3 有條件短路電流

開關元件應能承受 H.8.6 所述狀況下，短路電流所導致之應力。

H.7.4 電磁相容性(EMC)

適用 IEC 60947-1 之 7.3。

H.8 Tests

H.8.1 Type tests

Subclause 8.1.2 applies with the following additions:

a) Voltage drop (see H.8.2)
b) OFF-state current (see H.8.4)
c) Making and breaking capacities (see H.8.5)
d) Performance under short-circuit current conditions (H.8.6)
e) Verification of electromagnetic compatibility (see H.8.7)
f) Impulse voltage withstand test (see 8.3.3.4)

H.8 試驗

H.8.1 定型試驗

適用 8.1.2 及下列追加規定。

(a) 電壓降(參照 H.8.2)。

(b) OFF 狀態電流(參照 H.8.4)。

(c) 投入與斷開容量(參照 H.8.5)。

(d) 短路狀況下之性能(參照 H.8.6)。

(e) 電磁相容性確認(參照 H.8.7)。

(f) 脈衝電壓耐受試驗(參照 H.8.3.3.4)。

H.8.2 Voltage drop (U_d)

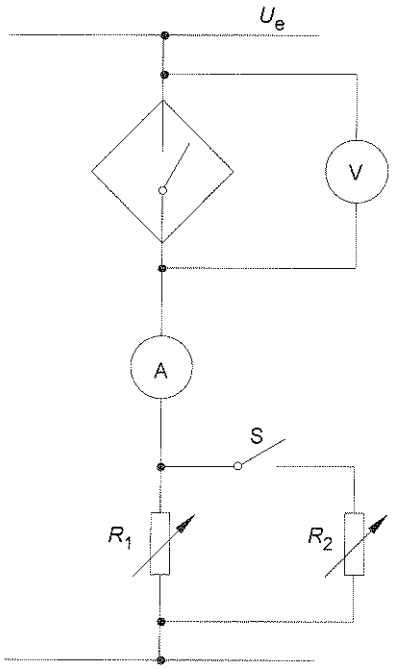
The voltage drop is measured across the active output of the switching element in the ON state and carrying the current range of I_m and I_e at an ambient temperature of 23 °C ± 5 °C and at the rated frequency. The measurement is performed with the circuit in Figure H.2, with the switch S closed. The loads shall be resistive and R_2 is adjusted to obtain the test current with the supply voltage U_e.

The measured voltage drop shall not exceed the value specified in H.7.1.1.

H.8.2 電壓降(U_d)

測定其跨越主動輸出之電壓降時，開關元件應在 ON 狀態，以及在周遭溫度 23°C±5°C 且額定頻率下，通過元件之電流範圍為 I_m 及 I_e。測量作業依圖 H.2 所示電路進行，圖中之開關 S 須為閉合。其負荷應為電阻性，且將 R2 調整到在電源電壓 U_e 下，可產生所需之試驗電流。

測得之電壓降不可超過 H.7.1.1 所規範之數值。



R_1 = Resistive load

R_2 = Resistive load

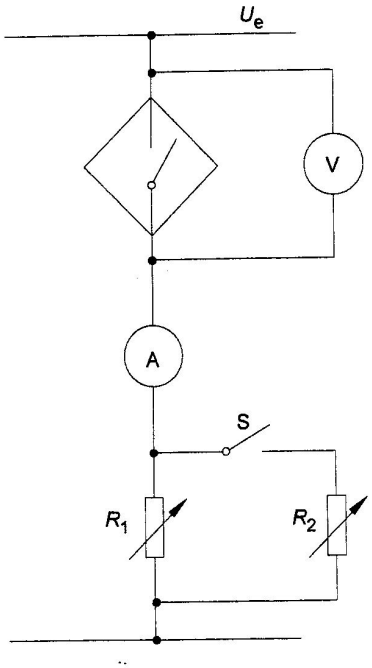
V = High impedance voltmeter, 0,2 MΩ/V

A = Ammeter

S = Switch

r.m.s. for a.c.
average for d.c.

Figure H.2 – Example of test circuit for the verification of voltage drop, minimum operational current and OFF-state current (see H.8.2, H.8.3 and H.8.4)



R_1= 電阻性負荷

R_2= 電阻性負荷

V= 高阻抗電位器，0.2 MΩ/V

A= 安陪計

S = 開關

交流電取均方根值(rms)

直流取平均值

圖 H.2 檢驗電壓降、最低操作電流及 OFF 狀態電流之試驗電路實例

(參照 H.8.2、H.8.3 及 H.8.4)

H.8.3 Minimum operational current (I_m)

The test is performed with the switching element connected to a test circuit shown in Figure H.2. With supply voltage (U_e), the switch open and the switching element in ON-state conduction, the resistive load R_1 is adjusted to obtain the current I_m. The measured value shall be according to H.7.1.2.

H.8.3 最低操作電流(I_m)

將開關元件連接在圖 H.2 所示試驗電路上，以電源電壓 Ue 進行試驗。將開關開路，使開關元件在 ON 狀態，調整 R1 以獲致電流 I_m。測量值應符合 H.7.1.2。

H.8.4 OFF-state current (I_r)

With the circuit in Figure H.2, and the S switch closed, the load R_2 is adjusted to obtain the rated operational current (I_e) when the highest supply voltage (U_e) is connected to the circuit. The switching element is then turned off and the OFF-state current is measured. The current shall be according to H.7.1.3.

H.8.4 OFF 狀態電流(I_r)

如圖 H.2 所示電路使 S 開關閉合，調整 R2，使電路連接最高電源電壓(Ue)時，獲致額定操作電流(Ie)。然後將開關元件轉為 off，並測定 OFF 狀態之電流。電流測量值應符合 H.7.1.3。

H.8.5 Making and breaking capacities

Subclause 8.3.3.5 applies.

H.8.5 投入及啟斷容量

適用 8.3.3.5。

H.8.6 Performance under short-circuit current conditions

H.8.6 短路電流狀況下之性能

H.8.6.1 Test circuit and test procedure

A new switching element shall be mounted as in service, in free air, and connected to the test circuit using a 2 m total length cable suitable for the operational current of the switching element (see Figure H.3).

The short-circuit protective device (SCPD) shall be of the type and rating stated by the manufacturer. This SCPD shall be omitted if the switching element is integrally protected against short circuit.

The loads, *R* and *L* are so selected that the current flowing through the switching element is equal to its rated operational current at the rated operational voltage (U_e) and at the power factor or $T_{0,95}$ time constant stated in Table 5 or in Table H.3. The supply S shall be adjusted to a prospective short-circuit current of 1 000 A, unless otherwise specified in the product standard, at the rated operational voltage (U_e). The supply circuit shall have air-cored reactors connected in series with resistors to provide a power factor of 0,5 to 0,7. No damping load shall be added parallel with the reactors. The open circuit voltage shall be 1,1 times the maximum rated operational voltage of the switching element.

H.8.6.1 試驗電路與試驗程序

將新品開關元件依操作狀態安裝於自由空氣中，並以適用開關元件操作電流、全長 2 m 之纜線，連接至試驗電路(參照圖 H.3)。

短路保護裝置(SCPD)應依製造廠商指定之形式與額定值。若開關元件本身附有短路保護之內建裝置，則可省略 SCPD。

選擇負載 R 與 L，使流經開關元件之電流在額定操作電壓(U_e)時，且功率因數或 $T_{0.95}$ 乘以表 5 或表 H.3 所列時間常數後，等於其額定操作電流。除非產品

標準另有指定，應調整電源 S，使額定操作電壓(U_e)時之預期短路電流為 1,000 A。電源電路應有與電阻串聯之空氣芯電感，以提供 0.5 至 0.7 之功率因數。電感上不可增加並聯之阻尼性負荷。其開路電壓應為 1.1 乘以開關元件之最大額定操作電壓。

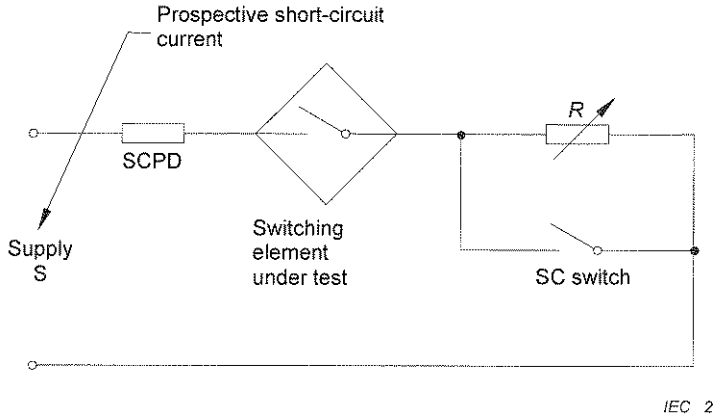


Figure H.3 – Short-circuit testing (see H.8.6.1)

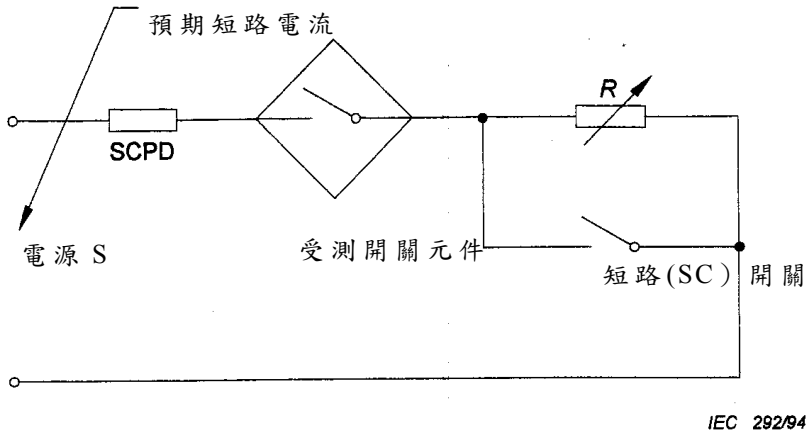


圖 H.3　短路試驗(參照 H.8.6.1)

The test shall be performed three times by randomly closing the "SC" switch. The test current is maintained until the SCPD operates or in the case of self-protecting elements, for 30 min. After each test the SCPD shall be replaced or reset. The interval between each of the three tests shall be not less than 3 min. The actual time between tests shall be stated in the test report.

藉隨機閉合〝SC〞開關進行 3 次試驗。試驗電流須維持到 SCPD 作動為止，若為自我保護元件則維持 30 min。每次試驗後，應更換或重置 SCPD。3 次試驗之間隔時間，不可低於 3 min。應將實際間隔時間記錄於試驗報告中。

H.8.6.2　Condition of the switching element after the test

Subclause 8.3.4.4 applies.

H.8.6.2　試驗後開關元件狀況

適用 8.3.4.4。

H.8.7 Verification of electromagnetic compatibility

H.8.7.1 General

Emission and immunity tests are type tests and shall be carried out under the following common conditions.

The switching element is mounted in free air connected to a load corresponding to the rated operational current (I_e) and is supplied with its rated operational voltage (U_e), or the maximum voltage of its voltage range.

The connecting leads shall be 2 m in length.

H.8.7 確認電磁相容性

H.8.7.1 一般

放射試驗與抗擾試驗皆為定型試驗，且應於下列共同條件下進行試驗。

將連接在對應於額定操作電流(I_e)之負載電阻上的開關元件，安裝於自由空氣中，並以額定操作電壓(U_e)或其電壓範圍之最高電壓供電。

連接引線之長度應為 2 m。

The tests shall be performed

a) with the switching element in the ON-state,
b) with the switching element in the OFF-state.

依下列程序進行試驗

(a) 開關元件設定為 ON 狀態。

(b) 開關元件設定為 OFF 狀態。

H.8.7.2 Immunity

H.8.7.2.1 General

Performance criteria are based on the acceptance criteria in Table 24 of IEC 60947-1.

Performance criterion A: During the tests, the output state of the switching element shall not change.

Performance criterion B: During the tests, the output state of the switching element shall not change for more than 1 ms for d.c. devices or one half-wave of supply frequency for a.c. devices.

Performance criterion C: Temporary degradation or loss of performance which is self recoverable or requires system reset.

H.8.7.2 抗擾性

H.8.7.2.1 一般

性能準則應依據 IEC 60947-1 之表 24 之驗收準則。

性能準則 A: 試驗時，不可改變開關元件之輸出狀態。

性能準則 B: 試驗時，直流電裝置開關元件之輸出狀態變化不可大於 1 ms，交流電裝置開關元件之輸出狀態變化，不可大於半個周波。

性能準則 C: 暫時性之功能下降或性能喪失，應可自行恢復或需要系統重置。

Table H.1 – Immunity tests

Type of test	Test level required		Acceptance criteria
Electrostatic discharge immunity test IEC 61000-4-2	8 kV / air discharge or 4 kV / contact discharge		B
Radiated radio-frequency electromagnetic field immunity test (80 MHz to 1 GHz and 1,4 GHz to 2 GHz) IEC 61000-4-3	10 V/m		A
Electrical fast transient/burst immunity test IEC 61000-4-4	2 kV / 5 kHz on power ports [a] 1 kV / 5 kHz on signal ports [b]		B
Surge immunity test (1,2/50 µs – 8/20 µs) IEC 61000-4-5 [c]	2 kV (line to earth) 1 kV (line to line)		B
Conducted disturbances induced by radio-frequency fields immunity test (150 kHz to 80 MHz) IEC 61000-4-6	10 V		A
Power frequency magnetic field immunity test [d] IEC 61000-4-8	30 A/m		A
Voltage dips immunity test IEC 61000-4-11	Class 2 [e, f] 0 % during 0,5 cycle	Class 3 [e, f] 0 % during 0,5 cycle	B
	Class 2 [e, f, g] 0 % during 1 cycle 70 % during 25/30 cycles	Class 3 [e, f, g] 0 % during 1 cycle 40 % during 10/12 cycles 70 % during 25/30 cycles 80 % during 250/300 cycles	C
Voltage interruptions immunity test IEC 61000-4-11	Class 2 [e, f, g] 0 % during 250/300 cycles	Class 3 [e, f, g] 0 % during 250/300 cycles	C
Immunity to harmonics in the supply IEC 61000-4-13	No requirements [h]		

[a] Power port: the point at which a conductor or cable carrying the primary electrical power needed for the operation of the switching element or associated equipment is connected.

[b] Signal port: the point at which a conductor or cable carrying information for transferring data or signals is connected to the switching element.

[c] Not applicable for ports with a rated voltage of 24 V or less.

[d] Applicable only to equipment containing devices susceptible to power frequency magnetic fields.

[e] Class 2 applies to points of common coupling and in-plant points of common coupling in the industrial environment in general.

Class 3 applies to in-plant couplings in industrial environment only. This class should be considered when a major part of the load is fed through converters; welding machines are present; large motors are frequently started or loads vary rapidly.

The manufacturer shall state the applicable class.

[f] The given percentage means percentage of the rated operational voltage, e.g. 0 % means 0 V.

[g] The value before the solidus (/) is for 50 Hz and the value behind is for 60 Hz tests.

[h] Requirements are under study for the future.

表 H.1 抗擾性(耐受性)試驗(immunity test)

試驗種類	所需試驗程度		驗收準則
靜電放電抗擾試驗 IEC 61000-4-2	8kV/空氣中放電 或 4 kV/接觸放電		B
無線電頻率輻射電磁場抗擾試驗 (80 MHz 至 1 GHz 及 1.4 GHz 至 2 GHz) IEC 61000-4-3	10V/m		A
電氣快速瞬變/突波(burst)抗擾試驗 IEC 61000-4-4	電源埠 [a] 上 2kV/5 kHz 信號埠 [b] 上 1kV/5 kHz		B
湧浪(surge)抗擾試驗 (1.2/50 us至 8/20 us) IEC 61000-4-5[C]	2 kV(線路至接地) 1 kV(線路之間)		B
導體感應無線電頻率磁場抗擾試驗 (150 kHz 至 80 MHz) IEC 61000-4-6	10 V		A
電源頻率電磁場抗擾試驗 [d] IEC 61000-4-8	30A/m		A
電壓降抗擾試驗 IEC 61000-4-11	第 2 級 [e,f,] 在 0.5 周波內 0%	第 3 級 [e,f,] 在 0.5 周波內 0%	B
	第 2 級 [e,f,g] 在 1 周波內 0% 在 250 /300 周波內 70%	第 3 級 [e,f,g] 在 1 周波內 0% 在 10 /12 周波內 40% 在 25 /30 周波內 70% 在 250 /300 周波內 80%	C
電壓中斷抗擾試驗 IEC 61000-4-11	第 2 級 [e,f,g] 在 250 /300 周波內 0%	第 3 級 [e,f,g] 在 250 /300 周波內 0%	C
電源諧波抗擾試驗 IEC 61000-4-13	無要求 [h]		

註 (a) 電源埠：供連接操作開關元件或設備附件，所需主電源之導體或纜線之接點。

(b) 信號埠：將帶有傳輸數據或信號資料之導體或纜線，連接至開關元件之接點。

(c) 連接埠額定電壓 24V 以內者不適用。

(d) 僅適用於含有會受電源頻率磁場影響之裝置之設備。

(e) 第 2 級適用於之共同耦合點及一般工業環境中之內建共同耦合點。

第 3 級僅適用於工業環境中，工廠之內建共同耦合點。若為由變頻器供應主要負載電源、使用電焊機，以及大型馬達啟動頻繁或加載快速者，應考慮該級。

製造廠商應述明應用等級。

(f) 所列百分比代表額定操作電壓百分比，例：0%代表 0V。

(g) 斜線之前數值為 50 Hz，斜線之後數值為 60 Hz。

(h) 需求條件列入日後考量。

H.8.7.2.2 Electrostatic discharges

The test shall be performed according to IEC 61000-4-2 and Table H.1.

H.8.7.2.2 靜電放電

應依據 IEC 61000-4-2 及表 H.1 試驗。

H.8.7.2.3 Radiated radio-frequency electromagnetic fields

The test shall be performed according to IEC 61000-4-3 and Table H.1.

If the worst case direction is known, then the test need only be performed in that direction. Otherwise, the electromagnetic field shall be faced to the device under test in three mutually perpendicular directions.

H.8.7.2.3 射頻電磁場

應依據 IEC 61000-4-3 及表 H.1 試驗。

若已知最惡劣方位，則僅須試驗該方位即可。否則，電磁場應以 3 個相互垂直之方向，指向受測裝置(以進行試驗)。

H.8.7.2.4 Electrical fast transients/bursts

The test shall be performed according to IEC 61000-4-4 and Table H.1, with the connecting leads of the device placed in the capacitive coupling clamp.

NOTE The capacitive coupling is the preferred test method because it simulates the disturbances present during normal application as a result of parallel wires.

H.8.7.2.4 電氣快速瞬變/突波

應依據 IEC 61000-4-4 及表 H.1，將裝置之連接引線放在電容耦合夾上試驗。

備考： 電容耦合為較佳試驗方式，因其可模擬正常應用時，平行線路所導致之干擾。

H.8.7.2.5 Surges

The test shall be performed according to IEC 61000-4-5 and Table H.1, with the following additional requirements in order to simplify the test procedure without impairing the validity of the verification of the EMC requirements:

- the switching element is powered during the test.
- the impulse test shall be applied:
  a) between terminals intended to be connected to the power supply;
  b) between each output terminal and each terminal intended to be connected to the power supply.
- Three positive and three negative impulses shall be applied between each two points at intervals of not less than 5 s.

H.8.7.2.5 湧浪

試驗應依據 IEC 61000-4-5 及表 H.1 進行，同時須遵照下列附加要求以簡化試驗程序，而不致影響判定 EMC 需求之正確性。

- 開關元件在試驗中必須給電。
- 應於下列位置進行脈衝試驗。
  (a) 在連接電源用端子之間。
  (b) 在各輸出端子與連接電源用各端子之間。
- 在各組 2 端子之間施加 3 次正脈衝及 3 次負脈衝，施加間隔 5S 以上。

H.8.7.2.6 Conducted disturbances induced by radio-frequency fields

The test shall be performed according to IEC 61000-4-6 and Table H.1.

H.8.7.2.6無線電頻率電磁場感應干擾

應依據 IEC 61000-4-6 及表 H.1 進行試驗。

H.8.7.2.7 Power-frequency magnetic fields

The test shall be performed according to IEC 61000-4-8 and Table H.1.

Applicable only to equipment containing devices susceptible to power-frequency magnetic fields.

H.8.7.2.7電源頻率電磁場

應依據 IEC 61000-4-8 及表 H.1 進行試驗。

僅適用於設備中包含有易受電源頻率電磁場干擾之裝置者。

H.8.7.2.8 Voltage dips and interruptions

The test shall be performed according to IEC 61000-4-11 and Table H.1.

Applicable only to a.c. switching elements.

H.8.7.2.8電壓突降(dip)及中斷

應依據 IEC 61000-4-11 及表 H.1 進行試驗。

僅適用於交流電開關元件。

H.8.7.3 Emission

The test shall be performed under worst case conditions according to CISPR 11 Group 1, Class A, and 7.3.3.2 of IEC 60947-1.

These limits are given for switching elements exclusively intended for use in industrial environment A. When they can be used in domestic environment B, the following notice shall be included in the instructions for use:

NOTICE

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

H.8.7.3 發射

應依 CISPR11 Group 1, Class A，及 IEC 60947-1 之 7.3.3.2，以最差條件進行試驗。

該等限度專供工業環境 A 中之開關元件使用。若需使用於住宅環境 B，使用說明中應增列下列註解。

注意

本產品為 A 級產品。可能在住宅環境中引起無線電干擾；在有干擾情形下，使用者可能需要採取適當措施。

Annex J
(normative)

Special requirements for indicator lights and indicating towers

附錄 J

(規定)

指示燈與指示塔之特殊要求

J.1 General

J.1.1 Scope

This annex applies to indicator lights and indicating towers, which shall also comply with the relevant requirements of this standard.

J.1.2 Object

This annex gives additional requirements applicable to indicator lights, together with definitions and terms useful for stating the required characteristics of design and performance.

J.1 一般

J.1.1 範圍

本附錄適用於符合本標準相關特性之指示燈與指示塔。

J.1.2 目的

本附錄列出適用於指示燈之附加要求，含適用於描述設計與性能所需特色之定義與術語。

J.2 Definitions

The following additional definitions are applicable:

J.2 定義

下列附加定義可適用。

J.2.1
indicator light
light signal giving information either by lighting or extinguishing

J.2.1 指示燈

依點亮或熄滅顯示信號之燈。

J.2.2
lens of an indicator light
visible part, removable or not, constituting the surface intentionally made transparent or translucent

J.2.2 指示燈鏡片

可卸除或固定式，包括透明或半透明表面之可見部分。

J.2.3
bezel
holder of a lens

J.2.3 框座(bezel)

鏡片之固定座。

J.2.4
indicator light with a built-in voltage-reducing device
indicator light, the body of which contains a device (transformer, resistor, etc.) intended to supply, at the terminals of a lamp, a voltage different from the rated operational voltage of the light

J.2.4 內建降壓裝置之指示燈

指示燈本體內建降壓裝置(如變壓器、電阻等)，以便在燈泡接腳上供應異於其額定操作電壓之電源。

J.2.5
indicating tower
assembly including one or more signalling units giving information by visible or audible signals

NOTE Other elements, e.g. network interface elements may be added.

J.2.5 指示塔

含有 1 個或多個以視覺或聲音信號，提供資訊之信號單元所組成的總成。

備考： 可增加網路介面元件等其他元件。

J.3 Classification

Indicator lights may be classified by:

- the rated electrical power;
- the colour;
- the fixing hole diameter;
- the means of connection;
- the nature of the current applied and its frequency, if any (for example lights with built-in transformers);
- the type of lamp socket;
- Nature of light source (for example: filament lamp, LED).

J.3 分級

指示燈可分類如下。

- 額定電功率。
- 顏色。
- 固定孔直徑。
- 連接方式。
- 施加電流之性質與頻率(若有)(例：內建變壓器之指示燈) 。
- 燈座型式。
- 燈光性質(例：鎢絲燈、LED) 。

J.4 Characteristics

J.4.1 Rated operational voltage of an indicator light

A value of voltage, assigned by the manufacturer which determines the application of the indicator light.

J.4 特性

J.4.1 指示燈之額定操作電壓

製造廠商指定之電壓值，用以決定指示燈之應用方式。

J.4.2 Rated thermal power of an indicator light

The maximum lamp power which an indicator light is designed to tolerate under conditions specified for the temperature-rise test.

NOTE As the power of the light has an effect on the temperature rise, it may be necessary to limit the power according to the mounting conditions; the manufacturer of the indicator light may assign two values of rated power (see J.8.3.3.3):

- the rated power of the light for mounting on a steel plate;
- the rated power of the light for mounting in an insulating enclosure.

J.4.2 指示燈之額定熱功率

依溫升試驗指定狀態下，指示燈可承受之最大燈泡功率。

備考： 由於燈泡功率會影響溫升，可能須依安裝條件限制其功率。指示燈製造廠商可指定兩種額定功率數值。(參照 J.8.3.3.3)。

－ 指示燈裝設在鋼板上之額定功率。

－ 指示燈裝設在絕緣殼體內之額定功率。

J.4.3 Rated values of the lamp

Rated value of the lamp(s) indicated by the manufacturer and with which the indicator light operates without attaining temperatures likely to damage its parts.

NOTE 1 Rated power and voltage may be indicated by a type designation.

NOTE 2 It is assumed that a lamp does not dissipate a power higher than its rated power at its rated voltage.

J.4.3 燈泡之額定值

廠商標示之燈泡額定值，以該等額定值操作時，燈泡不可產生會損壞其部件之溫度。

備考 1. 可由型號表示額定功率與電壓。

備考 2. 燈泡在其額定電壓下發出之熱量，必須不會超過額定功率。

J.5 Product information

The applicable requirements are:

Items a) and b) of 5.1;

c) the following markings shall appear on the indicator light:
   1) rated voltage of the indicator light;
   2) rated voltage of the lamp (if different from the rated voltage of the indicator light).
   3) rated power of the lamp or its type designation, or rated current for a LED.

J.5 產品資訊

適用要求如下。

第 5.1 節之(a)及(b)。

(c) 指示燈上應顯示下列標示。

(1) 指示燈額定電壓。

(2) 燈泡額定電壓(若不同於指示燈額定電壓)。

(3) 燈泡額定功率或其型號，或 LED 之額定電流。

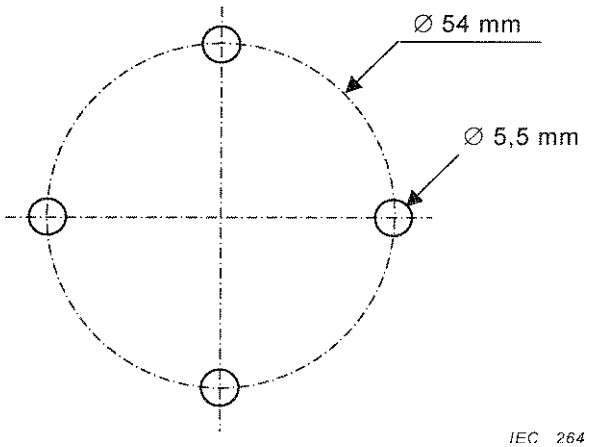
J.6 Normal service, mounting and transport conditions

There are no supplementary requirements.

J.6 正常服務、安裝與運輸條件

無補充要求。

The following mounting dimensions for the indicating tower socket are recommended:
建議使用下列安裝尺寸之指示塔插座。



J.7 Constructional and performance requirements

Clause 7 applies with the following additions:

J.7.1.12 Indicator lights with built-in transformers

The transformer shall have separate windings.

It is assumed that this condition is fulfilled if the indicator light passes the test described in 8.3.3.4.1.

J.7 結構與性能要求

適用第 7 節及下列追加規定。

J.7.1.12 內建變壓器之指示燈

變壓器須具有各別繞組。

指示燈若通過 8.3.3.4.1 所述試驗，視為符合條件。

J.7.2.1.6 Limits of operation

The limiting value of the supply voltage at the terminals of the indicator light shall be 1,1 times the rated operational voltage. This requirement is verified only for indicator lights with built-in transformer according to J.8.3.4.

J.7.2.1.6 操作限制

指示燈端子間供應電壓之極限，應為額定操作電壓之 1.1 倍。只有 J.8.3.4 所述內建變壓器之指示燈，需要符合這項要求。

J.7.2.5.1 Short-circuit withstandability of built-in transformer

The transformer shall be able to withstand permanently the short circuit of its secondary winding. It is assumed that this condition is fulfilled if the indicator light passes the test described in J.8.3.3.3.

J.7.2.5.1 內建變壓器之短路耐受性

該變壓器應可承受次級繞組之永久短路。指示燈若通過 8.3.3.3 所述試驗，視為符合條件。

J.8 Tests

J.8.3 Tests for indicator lights and indicating towers

The tests are type tests. No additional test (routine test or special test) is prescribed in this annex.

Each of the tests in J.8.3.3.3, J.8.3.3.4, J.8.3.4 and J.8.4 shall be made on new apparatus mounted in accordance with the test instructions.

J.8 試驗

J.8.3 指示燈與指示塔之試驗

各項試驗皆為型式試驗。本附錄未指定任何其他(例行或特殊)試驗。

J.8.3.3.3、J.8.3.3.4 及 J.8.3.4 等各項試驗，應依試驗說明，安裝新品進行試驗。

J.8.3.3.3 Temperature-rise tests

a) If the indicator light has the same rated thermal power (see J.4.2) regardless of mounting conditions, a single test is made in an insulated enclosure.

b) If the rated thermal power (see J.4.2) is dependent on the mounting conditions, two tests are made:

- on a steel plate, and
- in an insulated enclosure.

c) Mounting on a steel plate

Five indicator lights fitted with green lenses are fixed in accordance with the following diagram on a steel plate 2 mm thick, painted mat black:

J.8.3.3.3 溫升試驗

(a) 若指示燈在不同安裝狀態之額定熱功率(參照 J.4.2)相同，可在絕緣殼內進行單一試驗。

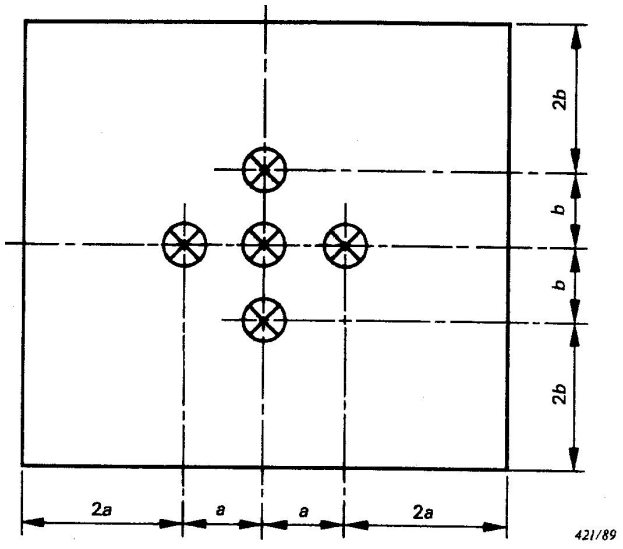
(b) 若指示燈之額定熱功率(參照 J.4.2)在不同安裝狀態下各異，應進行兩種試驗。

－ 裝在鋼板上。及

－ 裝在絕緣殼內。

(c) 裝在鋼板上

依照下圖將 5 枚綠色鏡片之指示燈裝在 2 mm 厚鋼板上，漆以平光黑漆。



Dimensions *a* and *b* are:

1) for indicator lights forming an integral part of a push-button range: in accordance with 6.3.1.3;

2) for other indicator lights: as stated by the manufacturer, but the values used shall be recorded in the test report.

圖中 a 與 b 之尺寸如下。

(1) 指示燈與按鈕形成整合個體者：依照 6.3.1.3 規範。

(2) 其他指示燈：依製造廠商說明，但使用數值應記錄於試驗報告。

The indicator lights are fitted with lamps as stated by the manufacturer and, if any, with built-in devices such as transformers, resistances, etc. The conductor sizes shall be as specified in 8.3.3.3.

The plate is located vertically on a table and the indicator lights are supplied at their rated voltage. The duration of the test shall be such that a steady-state temperature is reached.

依製造廠商說明裝設指示燈，及其內建裝備(若有，如變壓器、電阻等)；導電體(導線)尺寸應依 8.3.3.3 規定。

將鋼板垂直放在桌子上，並以額定電壓對指示燈供電。試驗之時間以達到穩定溫度值為準。

d) Mounting in an insulating enclosure

The test described in item c) is carried out again with the indicator lights mounted into an enclosure of insulating material, such as bakelite-coated paper 2 mm thick, the front face of which has the same dimensions as the steel plate and the depth of which is 110 mm. The indicator lights are fitted with lamps and mounted as stated by the manufacturer for this type of use; they are supplied at their rated operational voltage.

The duration of the test shall be such that a steady-state temperature is reached.

(d) 裝在絕緣殼內

將指示燈裝在絕緣材料殼內(如 2 mm 厚之電木紙，其正面尺寸同鋼板，深度為 110 mm)，進行(c) 項所述試驗。將裝上燈泡之指示燈，依製造廠商指示依該類使用方式進行安裝，並以額定操作電壓供電。

試驗之時間以達到穩定溫度值為準。

e) Results to be obtained

At the end of each of the tests described in items c) and d) the temperatures are measured:

- on the body of the indicator light;
- on the terminals;
- on the accessible part of the lens.

(e) 試驗結果

完成(c) 項與(d) 項試驗後，測量下列位置之溫度。

- 指示燈本體。
- 端子處。
- 鏡片之可及處。

f) For indicating towers, an arrangement of five visual signalling units shall be mounted in a vertical position. The upper three signalling units, or the maximum number stated by the manufacturer if greater than three, shall be equipped with the maximum power lamp of signalling units as stated by the manufacturer and powered at the rated voltage. After the steady state temperature is reached, the temperature shall be measured on top of the tower and on the lens of the centre element of the complete tower.

None of the corresponding temperature-rises shall exceed the limits referred to in 7.2.2 of IEC 60947-1.

(f) 對於指示塔，應將 5 枚視覺信號單元安裝在垂直位置。最上方 3 個信號單元(若數量大於 3，則為製造廠商指定之最大數量)，應裝以製造廠商指定之最大功率的信號單元用燈泡，並以額定操作電壓供電。達到穩定溫度後，應測量塔頂溫度，及整個塔中央單元之鏡片溫度。

任一溫升值不可超過 IEC 60947-1 之 7.2.2 所述的限度。

J.8.3.3.4 Dielectric tests

8.3.3.4 applies.

J.8.3.3.4.3 Indicator lights with built-in transformers

Two additional dielectric tests shall be made, the duration of each being 1 min:

- between the primary and secondary windings of the transformer with the test voltage value specified in 8.3.3.4;
- between the secondary windings of the transformer and the frame of the indicator light with a test voltage value of 1 000 V.

J.8.3.3.4 介電試驗

8.3.3.4 可適用。

J.8.3.3.4.3 內建變壓器之指示燈

須另外執行兩種介電試驗，每種各 1 min。

- 變壓器一級繞組及次級繞組之間，其試驗電壓值依 8.3.3.4 所述。
- 變壓器一級繞組及指示燈外框之間，其試驗電壓則為 1000V。

J.8.3.4 Short-circuit test (on built-in transformers, if any)

The test shall be made under the following conditions:

- primary voltage: $1{,}1 \times U_e$;
- ambient air temperature: 20 °C ± 5 °C;
- duration of the test: 1 h.

The transformer shall be short-circuited by a conductor of negligible impedance.

After the test and after cooling to ambient temperature, the transformer shall withstand the dielectric test defined in J.8.3.3.4.3.

J.8.3.4 短路試驗(若有，僅針對內建變壓器)

應依下列條件進行試驗。

- 一級繞組電壓：$1.1 \times U_e$
- 周遭氣溫：20°C± 5°C
- 試驗時間：1 h

應以導體或極小阻抗使變壓器短路。

完成試驗後，且降溫至周溫後，變壓器應可承受 J.8.3.3.4.3 所述介電試驗。

J.8.4 Shock and vibration

J.8.4.1 Direct mounting

J.8.4.1.1 General

An indicating tower with five signalling units shall be mounted as stated by the manufacturer without extension poles and the upper three units powered at the rated voltage.

The tests shall be performed as follows.

J.8.4 衝擊與振動

J.8.4.1 直接安裝

J.8.4.1.1 一般

應依製造廠商說明用 5 個信號單元安裝指示塔，且不含延長電極，使其上方 3 個單元以額定電壓供電。

以下列方式進行試驗。

J.8.4.1.2 Shock

In accordance with IEC 60068-2-27 with the following conditions.

Six shocks applied in each direction along three mutually perpendicular axes (a total of 36 shocks):

- pulse shape: half-sine;
- peak acceleration: 15 g_n;
- duration of the pulse: 11 ms.

J.8.4.1.2 衝擊

依照 IEC 60068-2-27 之下列條件。

沿 3 個相互垂直之各軸，各施以 6 次衝擊(總共 36 次衝擊)。

- 脈衝形狀：半正弦波
- 峰值加速度：15 g_n
- 脈衝時間：11 ms

J.8.4.1.3 Vibration

In accordance with IEC 60068-2-6 with the following conditions, along three mutually perpendicular axes:

- frequency range: 10 Hz to 55 Hz;
- amplitude: 0,5 mm;
- sweep cycle duration: 5 min;
- duration at resonant frequency or at 55 Hz: 30 min in each of the three axes (90 min in total).

J.8.4.1.3 振動

依據 IEC 60068-2-6 及下列條件，沿 3 個相互垂直之軸。

- 頻率範圍：10 Hz 至 55 Hz
- 振幅：0.5 mm
- 掃描循環時間：5 min
- 共振或 55 Hz 之測試時間：三個軸各軸 30 min(總共 90 min)

J.8.4.2 Indirect support mounting

If the product literature includes other allowable mounting conditions (e.g. pole mounting), the manufacturer shall state the severity level for shock and vibration tests at which the requirements of J.8.4.3 are met.

J.8.4.3 Results to be obtained

After the tests, no visible damage shall be observed and the signalling shall not be impaired.

J.8.5 Degree of protection for indicating towers

If the manufacturer declares a degree of protection, the test shall be conducted according to Annex C of IEC 60947-1 with all removable parts equipped as in normal service.

J.8.4.2 間接支撐安裝

若產品文件包含其他可用安裝方式(如安裝桿)，製造廠商應述明其可符合 J.8.4.3 要求之衝擊與振動之嚴重程度。

J.8.4.3 應獲致結果

試驗後，不得出現可見損壞，且信號不可受影響。

J.8.5 指示塔保護等級

若製造廠商指定保護等級，應依 IEC 60947-1 之附錄 C，將所有可卸除配件依正常使用安裝後進行試驗。

Annex K
(normative)

Special requirements for control switches with direct opening action

附錄 K

(規定)

直接開啟動作控制開關之特殊要求

K.1 General

K.1.1 Scope

This annex is applicable to control switches with direct opening action.

All control switches with direct opening action shall also comply with the relevant requirements of the standard and, where applicable, to those given in Annexes F, G, H and/or J.

K.1.2 Object

This annex gives additional requirements applicable to control switches with direct opening action, together with definitions and terms useful for stating the required characteristics of design and performance.

K.1 一般

K.1.1 範圍

本附錄適用於直接開啟動作之控制開關。

所有直接開啟動作控制開關，應符合本標準相關要求，及附錄 F、G、H 及/或 J 之相關適用要求。

K.1.2 目的

本附錄列出適用於直接開啟動作控制開關之新增要求，含適用於描述設計與性能所需特色之定義與術語。

K.2 Definitions

The following additional definitions apply:

K.2 定義

下列附加定義可適用。

K.2.1
control switch with direct opening action
control switch having one or more break-contact elements coupled to the switch actuator via non-resilient members so that full contact opening of the break-contact element(s) is obtained when the actuator is moved through the direct opening travel by applying the force stated by the manufacturer

K.2.1 直接開啟動作之控制開關

這種控制開關含有一或多組〝啟斷接點元件〞，以非彈性體構件連結在開關致動器上，使〝啟斷接點元件〞之接點在致動器經施加製造廠商指定力量，而移動〝直接開啟行程〞時，達成完整之開啟動作。

K.2.2
direct opening action (of a contact element)
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)

K.2.2 (接點元件之)直接開啟動作

這是指開關致動器藉由非彈性體構件之特定運動(例：不仰賴彈簧)，直接使接點完成分離動作。

K.2.3
direct opening travel
travel from the beginning of actuation of the actuator and the position when the direct opening action of the opening contacts is completed

K.2.4
direct opening force (or moment)
actuation force, or actuating moment for a rotary control switch, applied to the actuator for the direct opening action

K.2.3 直接開啟行程

致動器 [從致動點開始，到要開啟之接點完成〝直接開啟動作〞為止] 之行程。

K.2.4 直接開啟力(或力矩)

施加在致動器上，使旋轉控制開關產生〝直接開啟動作〞之致動力或致動力矩。

K.3 Classification

There are two types of control switches with direct opening action:

Type 1: Having one contact element only, this contact element is a direct opening break-contact element.

Type 2: Having one or more break-contact elements, and possibly, one or more make-contact elements and/or one or more change-over contact elements. All break-contact elements including the break part of change-over contact elements shall be direct opening break-contact elements.

K.3 分級

直接開啟動作之控制開關有 2 種。

第 1 種：只有一個接點元件，該接點元件為直接開啟之〝啟斷(break)接點元件〞。

第 2 種：有 1 個或多個啟斷接點元件，且可能有 1 個或多個投入(make)接點元件，及/或 1 個或多個切換(change-over)接點元件。所有〝啟斷接點元件〞及切換接點元件之〝啟斷部分〞，須為直接開啟之〝啟斷接點元件〞。

K.4 Characteristics

The following additional characteristics apply:

K.4.3.1.2 Rated insulation voltage

The minimum value of the rated insulation voltage of the contact elements shall be 250 V.

K.4 特性

K.4.3.1.2 額定絕緣電壓

接點元件之最低額定絕緣電壓應為 250V。

K.4.3.2.1 Conventional free air thermal current

The minimum value of the conventional free air thermal current of the contact elements shall be 2,5 A.

K.4.3.2.1 傳統自由空氣熱電流

接點元件之最低傳統自由空氣熱電流應為 2.5A。

K.4.4 Utilization categories for switching elements

The utilization categories shall be AC-15 or DC-13.

NOTE Additional utilization categories AC-14 and DC-14 are permitted.

K.4.4 開關元件之使用分類

其使用分類應為 AC-15 或 DC-13。

備考： 另可增加 AC-14 與 DC-14 使用分類。

K.5 Product information

Clause 5 is applicable with the following additions:

K.5.2 Marking

K.5.2.7 Direct opening action

Every contact element with direct opening action shall be indelibly and legibly marked on the outside by the symbol:  IEC 60617-S00226 (2001-07)

K.5.2.8 Electrical separation for change-over contact elements

Change-over contact elements with four terminals shall be indelibly and legibly marked with the relevant form Za or Zb as stated in Figure 4.

K.5 產品資料

適用第 5 節及下列追加規定。

K.5.2 標示

K.5.2.7 直接開啟動作

具直接開啟動作之每個接點元件的外部，應以不可磨滅且清晰可辨之方式標示下列符號。

 IEC 60617-S00226(2001-07)。

K.5.2.8 切換接點元件之電氣分離

附 4 端子之切換接點元件，應以不可磨滅且清晰可辨之方式，依圖 4 所述標示其相關型式 Za 或 Zb。

K.5.4 Additional information

K.5.4.1 Actuator travel and operating force

The manufacturer shall state the following:

K.5.4 附加資訊

K.5.4.1 致動器行程與操作力

製造廠商應說明下列事項。

a) the minimum direct opening travel;

b) the minimum force required to achieve direct opening action of all break contacts;

c) the maximum travel including travel beyond the minimum travel position (i.e. including overtravel);

d) for limit switches only the maximum speed of actuation;

e) for limit switches only the maximum frequency of actuation.

These statements shall appear in the marking or on the circuit diagram or other documents published by the manufacturers.

NOTE 1 See also K.7.1.5.3.

NOTE 2 Type 2 control switches may open with less travel than the direct opening travel stated by the manufacturer.

(a) 最小直接開啟行程。

(b) 使所有〝啟斷接點〞達成直接開啟動作所需之最小力量。

(c) 包含超越最小行程位置(如包含過行程)之最大行程。

(d) 致動器最大速度(僅適用於極限開關 (limit switch))。

(e) 致動器最高頻率(僅適用於極限開關 (limit switch))。

這些陳述應顯示於標示、線路圖，或廠商發布之其他文件中。

備考 1. 參照 K.7.1.5.3。

備考 2. 第 II 類控制開關之開啟行程，可小於製造廠商所述之直接開啟行程。

K.5.4.2 Short-circuit protection

The type of short-circuit protective device shall be stated either as marking on the switch or in the installation instructions.

K.5.4.2 短路保護

短路保護裝置之型式應於開關上以標示方式顯示，或以安裝說明書陳述。

K.6 Normal service, mounting and transport conditions

Clause 6 applies, with the following additions:

K.6 正常服務、安裝及運輸條件

適用第 6 節及下列追加規定。

K.6.1.1 Ambient air temperature

Subclause 6.1.1 of IEC 60947-1 applies, except for position switches with direct opening action, for which the upper and lower limits of temperature are respectively +70 °C and –25 °C, and the average temperature, measured over a period of 24 h, does not exceed +35 °C.

NOTE The choice of the connecting conductors may, if necessary, be subject to agreement between manufacturer and user (see note 1 of Table 2 of 60947-1).

K.6.1.1 周遭空氣溫度

適用 IEC 60947-1 之 6.1.1，但直接開啟動作之位置開關除外；後者之溫度上限與下限為+70°C 及-25°C，且其測量 24 h 之平均溫度不可超過 35°C。

備考： 必要時，連接導體之選擇可依廠商與使用者協議決定(參照 60947-1 表 2 之註(1)。

K.7 Constructional and performance requirements

Clause 7 applies with the following additions:

K.7.1.4.3.1 Robustness of the actuating system

In order to have sufficient robustness, the actuating system shall pass the test described in K.8.3.7.

K.7.1.4.3.2 Directness of opening action

A control switch with direct opening action shall pass the tests described in K.8.3.4, K.8.3.5 (in the case of a position switch with a direct opening action), and K.8.3.7 without any deformation that would reduce the impulse voltage withstand across the contact gap.

K.7 結構與性能要求

適用第 7 節及下列追加規定。

K.7.1.4.3.1 致動系統堅固性

為獲致充分堅固性，致動系統須通過 K.8.3.7 所述試驗。

K.7.1.4.3.2 開啟動作之直接性

直接開啟動作之控制開關，須通過 K.8.3.4、K.8.3.5(直接開啟動作之位置開關)，及 K.8.3.7 所述試驗，而不可產生變形，否則會降低耐受跨越接點間隙脈衝電壓之能力。

K.7.1.4.5 Automatic opening of cable operated control switches

Cable operated control switches with direct opening action shall return automatically to the open position in case of failure of the cable or its anchorage.

K.7.1.4.6 Conditions for direct opening action (see 2.4.10 of IEC 60947-1)

For parts of the travel that separates the contacts, there shall be a positive drive with no resilient member (for example springs) between the moving contacts and the point of the actuator to which the actuating force is applied.

K.7.1.4.5 纜線操作控制開關之自動開啟

直接開啟動作之纜線操作控制開關，在纜線或其固定方式故障時，應自動回到開啟位置。

K.7.1.4.6 直接開啟動作之條件(參照 IEC 60947-1 之 2.4.10)

對於分離接點之行程零件，在〝移動接點〞及〝致動器之施力點〞之間的正向傳動裝置，不可包含彈性體構件(如彈簧)。

K.7.1.4.6.1 Contact element types

Control switches with direct opening action may be provided with snap action or dependent action contact elements.

The break-contact elements shall be electrically separated from each other and from the operating make-contact elements.

When the control switch has form C or form Za change-over contact elements (see Figures 4 c) and 4 d)), only one contact element (make or break) shall be used. In the case of form Zb change-over contact elements, both contacts may be used.

K.7.1.4.6.1 接點元件種類

直接開啟動作控制開關，可配備急斷(snap)或從動(dependent)接點元件。其啟斷接點元件應相互電氣分離，並與作動之投入接點元件電氣分離。

控制開關若包含 C 型或 Za 型切換接點元件(參照圖 4(c) 及圖 4(d))，只可使用一種接點元件(投入或啟斷)。若為 Zb 型切換接點元件，兩種接點皆可使用。

K.7.1.5.3 Actuator travel indication

In order to facilitate the setting up of the switch actuator in relation to the external operating means, for example a cam, the switch may include means for indicating the minimum travel of the actuator required to ensure direct opening action, for example by the provision of a mark on the actuator plunger (see note 1, item a) of K.5.4.1).

K.4.1.5.3 致動器行程指示

為調整設定開關致動器與外部操作工具(如凸輪)之間的相對關係，開關上可配置指示裝置，例：依據致動器上之記號(參照 K5.4.1 註 1 之(a) 項)，以確認致動器完成其〝直接開啟動作〞之所需最小行程。

K.8 Tests

In addition to clause 8, and Annex C, the following applies:

K.8 試驗

除第 8 節及附錄 C 之外，適用下列追加規定。

K.8.3.1 Test sequences

Subclause 8.3.1 applies with the following additions:

- Test sequence VII (sample No. 7) – Mechanical operation of position switches with direct opening action.

  Test No. 1 – Mechanical operation at limits of temperature (see K.8.3.5).

  Test No. 2 – Verification of direct opening action (see K.8.3.6).
- Test sequence VIII (sample No. 8)
- Verification of robustness of the actuating system (see K.8.3.7).

K.8.3.1 試驗程序

適用 8.3.1 及下列追加規定。

- 試驗程序 VII(7 號樣本)－ 直接開啟動作位置開關之機械操作。

  試驗編號 1 － 極限溫度下之機械操作(參照 K.8.3.5)。

  試驗編號 2 － 確認直接開啟動作(參照 K.8.3.6)。
- 試驗程序 VIII(8 號樣本)。
- 確認致動系統牢固性(參照 K.8.3.7)。

K.8.3.4 Performance under conditional short-circuit current

Subclause 8.3.4 applies with the following additions:

K.8.3.4 有條件短路電流下之性能

適用 8.3.4 及下列追加規定。

K.8.3.4.2.1 Verification of conditional short-circuit current

The test shall be made as stated in 8.3.4.2, except that the current is made by a direct opening contact element and not by the additional switching device and the test is made on the device by making the current three times by the same contact element in a single phase circuit.

For type 2 control switches, the contact element shall be chosen at random.

K.8.3.4.2.1 確認有條件短路電流

本試驗應依 8.3.4.2 所述方式為之，唯其電流係以直接開啟接點元件接通，而非使用外加之開關裝置，且其裝置試驗時，係以單一相位電路中之同一接點元件導通電流 3 次。

對於第 2 種控制開關，則隨機選定其接點元件。

K.8.3.4.4.1 Operation ability after the test

After each test, the opening contact element shall open by the application of the force stated by the manufacturer through the direct opening travel (see items a) and b) of K.5.4.1).

The open position of the contact element shall be verified by the application of an impulse test voltage of 2 500 V across the contact gap.

K.8.3.4.4.1 試驗後之操作能力

每次試驗之後，〝開啟接點元件〞應透過直接開啟行程(參照 K.5.4.1 之(a)項及(b)項)，由製造廠商指定力量而完成開啟。

應以 2500V 脈衝試驗電壓跨接施加在接點間隙兩端，以確認接點元件確實位於開啟狀態。

K.8.3.5 Verification of mechanical operation of position switches at limits of temperature

This test applies only to position switches with direct opening action. The position switch shall be conditioned at +70 °C for 8 h.

At the end of the conditioning period and at the same temperature, the contacts shall be loaded with the maximum rated operational current for 10 min. The contacts shall then be operated 10 times by the application of the force stated by the manufacturer according to item b) of K.5.4.1.

The test shall be repeated after conditioning at –25 °C but without application of the current.

After completion of this test, the open position of the contacts shall be verified according to K.8.3.6.

K.8.3.5 確認位置開關在極限溫度之機械操作

本試驗僅適用於直接開啟動作之位置開關。位置開關須以+70°C 整備調理 8 h。整備時間結束時，應於該相同溫度以最大額定操作電流加載於接點上 10 min。然後依據 K5.4.1 之(b)項，以廠商指定作用力操作接點 10 次。

以-25°C 整備之後，不加載電流重複試驗。

完成此項試驗後，應依 K.8.3.6 驗證接點之開啟位置。

K.8.3.6 Verification of direct opening action

When the position switch is in the position corresponding to the direct opening travel stated in item a) of K.5.4.1, the contact gap shall withstand an impulse voltage of 2 500 V.

For position switches suitable for isolation, the value of the impulse withstand voltage shall be in accordance with Table 14 of IEC 60947-1 corresponding to the rated impulse withstand voltage U_{imp} declared by the manufacturer.

K.8.3.6 驗證直接開啟位置

當位置開關位於 K.5.4.1 之(a) 項所述〝直接開啟行程〞的對應位置時，其接點間隙應可承受 2500V 之脈衝電壓。

適用於隔離用途之位置開關，其可承受脈衝電壓值，應依 IEC 60947-1 之表 14，對應於製造廠商宣稱之額定脈衝電壓承受值 U_{imp}。

K.8.3.7 Verification of robustness of the actuating system

The closed break contact(s) shall be loaded with a force F_1 of 10 N (see Figure K.1). A force (moment) F_2, higher than F_1, stated by the manufacturer, shall be applied to the actuator through the direct opening travel.

After this test, the actuating system and/or contacts shall remain functional and shall withstand an impulse test voltage in accordance with K.8.3.6.

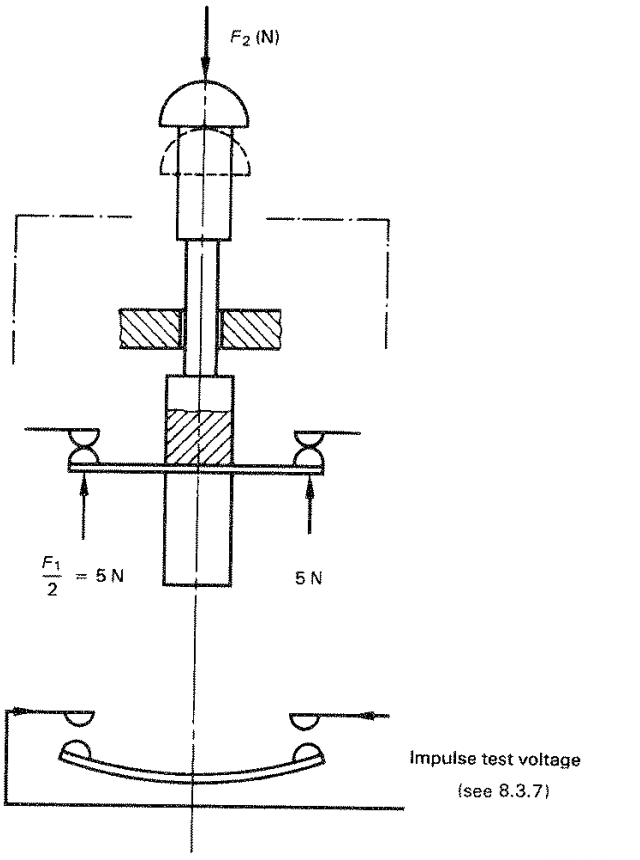
For position switches suitable for isolation, the value of the impulse withstand voltage shall be in accordance with Table 14 of IEC 60947-1 corresponding to the rated impulse withstand voltage U_{imp} declared by the manufacturer.

K.8.3.7 確認致動系統之牢固性

使閉合之啟斷接點承受 10N 之力量 F_1(參照圖 K.1)。在直接開啟行程上，依製造廠商說明以大於 F_1 之力量 F_2 (力矩)施加在致動器上。

試驗之後，致動系統及/或接點應維持原有功能，且能承受 K.8.3.6 所述之脈衝試驗電壓。

適用於隔離用途之位置開關，其可承受脈衝電壓值，應依 IEC 60947-1 之表 14，對應於製造廠商宣稱之額定脈衝電壓承受值 U_{imp}。



脈衝試驗電壓
(參照 8.3.7)

NOTE – F_1 = Required opening force = 10 N.
F_2 = Force (moment) stated by the manufacturer.

Figure K.1 – Verification of robustness of the actuating system

備考：F_1 = 所需開啟力 = 10 N

F_2 = 製造廠商陳述之力量(力矩)

圖 K.1 確認致動系統牢固性

Annex L
(normative)

Special requirements for mechanically linked contact elements

附錄 L
(規定)

機械連結接點元件之特殊要求

L.1 General

L.1.1 Scope

This annex applies to mechanically linked auxiliary contact elements included in control circuit devices where actuating force is provided internally, such as contactor-relays.

Linkage between the auxiliary and main contacts is not covered by this annex.

NOTE 1 A typical application of mechanically linked contact elements is e.g. self-monitoring in machine control circuits.

NOTE 2 Mechanically linked contact elements have previously been referred to as forced contacts, positively activated contacts, or linked contacts, or, in French: "contacts forcés" or in German: "Zwangsgeführte Kontakte".

NOTE 3 Control circuit devices actuated externally (e.g. push-button or limit-switches) do not have an actuating force limited to a maximum value (see L.8.4 a) 2)), so they cannot have mechanically linked contact elements. For such devices, safety applications generally use contacts with "direct opening action" (see Annex K).

L.1 一般

L.1.1 範圍

本附錄適用於控制電路裝置(例：電磁開關)中，以內部致動力致動之機械連接式輔助接點元件。

本附錄不涵蓋輔助接點與主接點之間的連結。

備考 1. 機械連接式輔助接點元件之典型應用，有如機械控制電路中之自我監控。

備考 2. 機械連接式輔助接點元件，之前稱為強制接點、正向啟動接點，或相連接點；法文為〝 contacts forces〞, 德文為 〝Zwangsgefuhrte Contakte〞。

備考 3. 外部致動之控制電路裝置(如按鈕或極限開關)，沒有致動力之最高限制(參照 L.8.4 (a) (2))，因此不能有機械連接接點元件。該等裝置之安全應用，通常使用〝直接開啟動作〞之接點(參照附錄 K)。

L.1.2 Object

This annex provides additional specifications (definition, requirements and tests) which shall be used for stating the required design characteristics, marking and performance of mechanically linked contact elements.

L.1.2 目的

本附錄提供使用於描述機械連結接點元件之設計特性、標示及性能之附加規範(定義、要求及試驗)。

L.2 Definition

The following additional definition applies:

L.2 定義

下列附加定義可適用。

L.2.1
mechanically linked contact elements
combination of *n* Make contact element(s) and m Break contact element(s) designed in such a way that they cannot be in closed position simultaneously under conditions defined in L.8.4

NOTE 1 One control circuit device may have more than one group of mechanically linked contact elements.

NOTE 2 See also L.7.1.9.

L.2.1 機械連結接點元件

n 個〝投入〞接點元件及 m 個〝啟斷〞接點元件之組合設計，其設計方式使該等接點在依 L.8.4 定義之條件下，不會同時在閉合位置。

備考 1. 一個控制電路裝置可具有不只一組之機械連結接點元件。

備考 2. 同時參照 L.7.1.9。

L.3 Classification

Clause 3 applies.

L.4 Characteristics

All mechanically linked contact elements shall also comply with the relevant requirements given in this standard.

L.5 Product information

Clause 5 applies with the following addition:

L.3 分級

適用第 3 節。

L.4 特性

所有機械連結接點元件，應同時符合本標準之相關要求。

L.5 產品資料

適用第 5 節及下列追加規定。

L.5.2.7 Mechanically linked contact elements identification and marking

Mechanically linked contact elements shall be clearly identified:

- on the control circuit device itself;
- or in the manufacturer's documentation;
- or both.

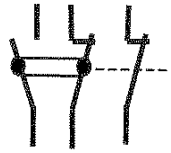
The mechanical linkage shall be identified in circuit diagrams by a double parallel line connecting a filled circle on each of the mechanically linked contact symbols. An example is given in Figure L.1.

L.5.2.7 機械連結接點元件之識別及標示

機械連結接點元件應可明顯辨別。

- 從控制電路裝置本身。
- 從廠商文件。
- 或兩者兼具。

線路圖中應以一條平行雙線，連接每個機械連結接點符號上之實心圓點。圖 L.1 為其範例。



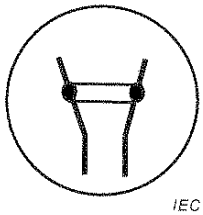
IEC 1510/99

Figure L.1 – Example of representation of NO and NC contacts which are mechanically linked and NC non-linked contact

圖 L.1　機械連結之 NO 與 NC 接點的表示實例，以及未連結之 NC 接點的表示實例

If devices containing some or all mechanically linked contacts are marked, the symbol shown in Figure L.2 shall be used.

應使用圖 L.2 所示符號標示，具有部分或全部機械連結接點之裝置。



IEC 1511/99

Figure L.2 – Symbol for device containing mechanically linked contacts

圖 L.2　附機械連結接點之裝置符號

L.6 Normal service, mounting and transport conditions

There are no supplementary requirements.

L.6　正常服務、安裝及運輸條件

無補充要求。

L.7 Constructional and performance requirements

Clause 7 applies with the following addition:

L.7　結構與性能要求

適用第 7 節及下列追加規定。

L.7.1.9 Requirements for mechanically linked contact elements

While any of the *n* Make contact element(s) is closed, none of the *m* Break contact element(s) shall be closed.

While any of the *m* Break contact element(s) is closed, none of the *n* Make contact element(s) shall be closed.

L.7.19　機械連結接點之要求

當 n 個〝投入〞接點元件中有任何接點為閉合時，m 個〝啟斷〞接點元件中，不可有任何接點產生閉合。

當 m 個〝啟斷〞接點元件中有任何接點為閉合時，n 個〝投入〞接點元件中，不可有任何接點產生閉合。

L.8 Tests

Clause 8 applies with the following addition:

L.8 試驗

適用第 8 節及下列追加規定。

L.8.4 Special test for mechanically linked contact elements

This special test shall be carried out on a sample of (m + n) products where m is the number of break contact element(s) and n is the number of make contact element(s).

A different sample is used for each test.

L.8.4 機械連結接點之特殊試驗

應就(m+n)產品樣本進行本項特殊試驗。其中 m 為〝啟斷〞接點元件數，n 為〝投入〞接點元件數。

每次試驗應使用不同樣本。

The tests shall be carried out on products in new and clean condition. The test procedure shall be as follows:

a) Test of NC contact:
   1) the NC contact element shall be maintained in the closed position e.g. by welding or gluing each point of contact (e.g. for double breaking contact, welding is done at the two contacts points). The thickness of welding or gluing shall be such that the distance between contacts is not modified by more than 0,02 mm;
   2) an actuating force shall be applied by energising the operating coil at 110 % of its rated voltage;
   3) while applying the force, an impulse test voltage of 2,5 kV (1,2/50 µs at sea level; correction should be made according to Table 12 of IEC 60947-1) shall be applied across every NO contact. There shall be no disruptive discharge.

   NOTE 1 This test ensures a minimum gap of 0,6 mm in accordance with Table 13 of IEC 60947-1.

應對清潔之新品產品進行試驗。試驗程序如下。

(a) 試驗常閉(NC)接點

(1) 應使 NC 接點元件維持其閉合位置，例：利用焊接或將各接觸點黏結(例：對將雙啟斷接點之兩個接觸點焊接在一起)。其焊接或黏結厚度，應使接點間距變化不超過 0.02 mm。

(2) 對操作線圈以其 110%額定電壓通電，以產生致動力。

(3) 一邊施加致動力，一邊以 2.5kV(海平面高程時 1.2/50µs，應依 IEC 60947-1 表 12 修正)之脈衝試驗電壓，跨接試驗每個 NO 接點。不可產生擊穿放電。

備考 1. 本試驗可依 IEC 60947-1 表 13 驗證 0.6 mm 以上之間隙。

b) Test of NO contact:
   1) an actuating force shall be applied by energising the operating coil at its rated voltage;
   2) the NO contact element shall be maintained in the closed position e.g. by welding or gluing each point of contact (e.g. for double breaking contact, welding is done at the two contacts points). The thickness of welding or gluing shall be such that the distance between contacts is not modified by more than 0,02 mm;
   3) an actuating force shall be applied by de-energising the operating coil;

4) with the operating coil de-energised, an impulse test voltage of 2,5 kV (1,2/50 µs at sea level; correction should be made according to Table 12 of IEC 60947-1) shall be applied across every NC contact. There shall be no disruptive discharge.

NOTE 2 This test ensures a minimum gap of 0,6 mm in accordance with Table 13 of IEC 60947-1.

(b) 試驗常開(NO)接點

(1) 對操作線圈以其額定電壓通電，以產生致動力。

(2) 應使 NO 接點元件維持其閉合位置，例：利用焊接或將各接觸點黏結(例：對將雙啟斷接點之兩個接觸點焊接在一起)。其焊接或黏結厚度，應使接點間距變化不超過 0.02 mm。

(3) 解除操作線圈之通電電壓，以產生致動力。

(4) 操作線圈保持解除電壓狀態，以 2.5kV(海平面高程時 1.2/50µs，應依 IEC 60947-1 表 12 修正)之脈衝試驗電壓，跨接試驗每個 NC 接點。不可產生擊穿放電。

備考 2. 本試驗可依 IEC 60947-1 表 13 驗證 0.6 mm 以上之間隙。

Annex M
(normative)

Terminal marking, distinctive number and distinctive letter for control circuit devices

附錄 M

(規定)

端子標示、控制電路裝置使用識別編號與字母

M.1 Scope

This annex applies to control switches and contactor relays irrespective of their construction, having terminal marking.

The use of this annex is required where terminal marking is a requirement in this standard, or is usual practice.

M.1 範圍

本附錄適用於有端子記號、各種結構之控制開關與電磁開關。

本標準或一般慣例要求使用端子標示者，須使用本附錄。

M.2 Terminal marking rule

M.2.1 General

Terminal marking in accordance with this annex is based, in principle, on a two-digit number.

M.2.2 Function digit

Subclause L.3.2.1 of IEC 60947-1 applies.

M.2 端子標示規則

M.2.1 一般

以本標準為依據之端子標示，通常為兩位數號碼。

M.2.2 功能碼

IEC 60947-1 之 L.3.2.1 可適用。

M.2.3 Sequence digit

The tens digit is a continuous sequence number beginning with 1 (except for control switches designated 01 and contactor relays designated 01E), independent of the contact function.

Terminals belonging to the same contact are marked with the same sequence digit.

For contactor relays having 10 contact elements, the sequence digit 0 is used instead of 10.

The sequence digit may be omitted from the terminal marking only if additional information provided by the manufacturer or the user clearly gives such digit.

EXAMPLE For control switches

M.2.3 程序碼

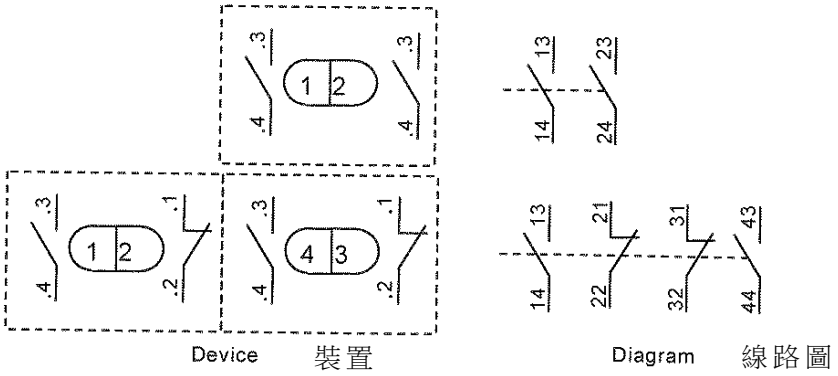
十位數碼為從 1 開始之連續號碼(定名為 01 之控制開關及定名為 01E 之電磁開關除外)，而與接點功能無關。

同一接點之端子標示為同一序號。

具有 10 個接點元件之電磁開關，以序號〝0〞取代 10。

若廠商提供其他資料或使用者另有明確序號規定者，端子標示中可省略該等序號。

範例：控制開關



NOTE The dots before the function number shown in these examples are used merely to show the digit relationship, and do not need to be used in practice.

備考： 上述範例中功能編號之前之點號，只是用以顯示其位數關係，實際作業中無須使用。

M.2.4 Numbering method

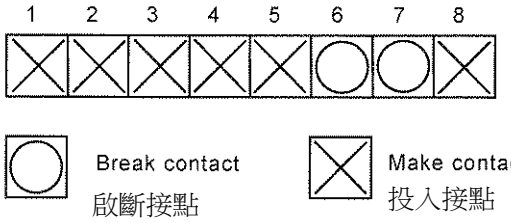
The contact terminals shall be numbered sequentially from left to right on the device; for devices with tiers of terminals, the numbering shall begin with the tier nearest to the mounting level.

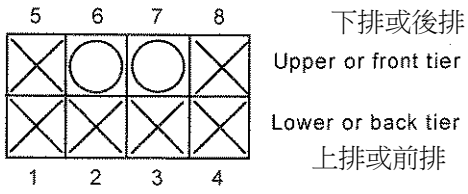
EXAMPLE Contact numbering methods on contactor relays of various constructional types, but with the same distinctive number 62 E

M.2.4 編號方式

裝置上之接點端子應由左而右編號。有數排端子之裝置，應從最接近安裝高度之排開始編號。

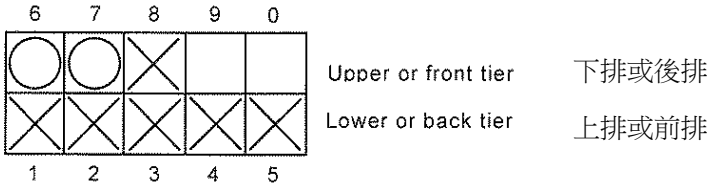
範例：相同於辨識編號為 62E 之各種構造形式電磁開關的接點編號方式





The prescribed numbering method does not allow blank contact cells inside a contact series.

這種編號方式不允許接點序列中有空白格。



M.3 Distinctive number and distinctive letter

M.3.1 General

The quantity and type of the contact elements of a control switch according to this annex are indicated by a distinctive number. Contacts of contactor relays are indicated by a distinctive number followed by a distinctive letter.

M.3 辨識編號與辨識文字

M.3.1 一般

控制開關接點元件之數量與型式，依本附錄賦予辨識編號。電磁開關之各接點以辨識編號後隨辨識文字標示之。

M.3.2 Distinctive number

The first digit of the distinctive number gives the quantity of make contact elements and the second digit the quantity of break contact elements. The third digit, if any, shall give the quantity of change-over contact elements in control switches.

M.3.2 辨識編號

辨識編號之第 1 碼代表投入接點元件的數量，其第 2 碼為啟斷接點元件之數量。第 3 碼(若有)為控制開關的切換接點元件數量。

M.3.3 Distinctive letter

The distinctive letter indicates the location of the contact elements of a contactor relay in relation to each other and their terminal marking.

Clause M.5 defines the arrangement of contactor relays indicated by the distinctive letter E.

Clause M.6 gives information on permissible deviations, indicated by the distinctive letters X, Y or Z.

For new designs, the arrangement indicated by the distinctive letter E is preferred.

M.3.3 辨識文字

辨識文字顯示電磁開關中，接點元件之間之相互關係及其端子記號。

M.5 定義標示辨識文字 E 之電磁開關的排列。

M.6 提供許可偏移之資料，以辨識文字 X、Y 或 Z 顯示之。

新設計中，應使用以辨識文字 E 顯示之排列方式。

M.4 Terminal numbering sequence

For control switches having the same distinctive number, the terminal marking is specified in Table M.1.

The position of the contact elements of the control switch need not correspond to that shown on diagrams of Table M.1.

M.4 端子編號順序

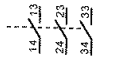
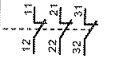
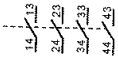
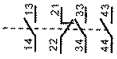
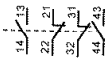
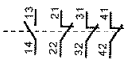
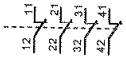
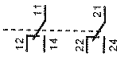
相同辨識編號之控制開關，其端子記標如表 M.1 所示。

控制開關之接點元件位置，可能不同於表 M.1 所示接線圖。

Table M.1 – Diagrams of control switches

Distinctive number	Contact elements	Distinctive number	Contact elements	Distinctive number	Contact elements	Distinctive number	Contact elements	Distinctive number	Contact elements

表 M.1 控制開關電路圖

辨識編號	接點元件	辨識編號	接點元件	辨識編號	接點元件	辨識編號	接點元件	辨識編號	接點元件
10								01	
20		11						02	
30		21		12				03	
40		31		22		13		04	
001									
002									

M.5 Contactor relays designated by the distinctive letter E

For contactor relays having the same distinctive number and the distinctive letter E, independently of their construction, the sequence of the contact elements within the device is specified in accordance with the diagrams of Table M.2.

As a result of this the sequence number becomes a location number and allows a given contact element terminal of a contactor relay in the equipment to be quickly found solely by counting the contacts.

M.5 以辨識文字 E 定名之電磁開關

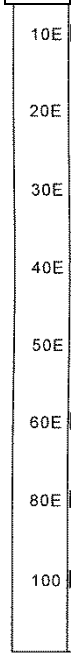
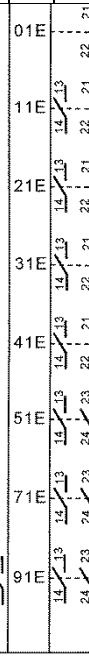
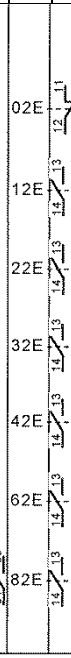
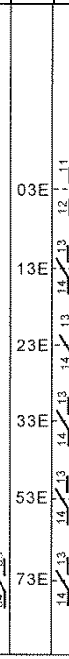
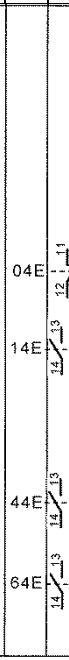
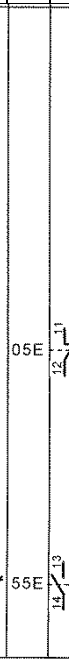
具有相同辨識編號及辨識文字 E 之電磁開關，不論構造方式，其接點元件順序應依表 M.2 所述之安排方式。

因此之故，其順序編號成為位置編號，並可僅藉由計算接點順序，就能快速找到設備內電磁開關接點元件之端子。

Table M.2 – Diagrams of contactor relays designated by the distinctive letter E

	Coil	Contact elements		Contact elements		Contact elements		Contact elements		Contact elements		Contact elements

表 M.2　標示辨識字母 E 之電磁繼電器(contactor relay)接線圖

	線圈	接點元件		接點元件		接點元件		接點元件		接點元件		接點元件
												

M.6 Contactor relays designated by distinctive letters X, Y or Z

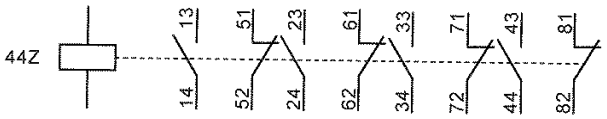
M.6.1 Contactor relays designated by the distinctive letter Z

If the location of the contact elements within the device (but not the terminal marking) differs from the provisions of Clause M.5, the device shall be designated by the distinctive letter Z instead of the distinctive letter E.

M.6 以辨識文字 X、Y 或 Z 定名之電磁開關

M.6.1 以辨識文字 Z 定名之電磁開關

若裝置內接點元件之位置(而非端子標示)與 M.5 所述者不同，該裝置應以辨識文字 Z 定名，而非以辨識文字 E 定名。



M.6.2 Contactor relays designated by the distinctive letter X

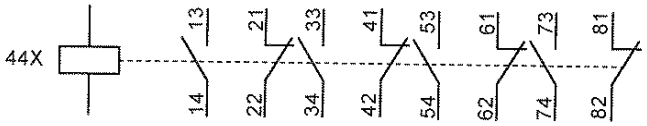
If the location of the contact elements within the device and the terminal marking both differ from the requirements of Clause M.5, the device shall be designated by the distinctive letter X instead of the distinctive letter E.

Such a device shall still comply with the requirements of Clauses M.2 and M.3.

M.6.2 以辨識文字 X 定名之電磁開關

若裝置內接點元件之位置及端子標示都與 M.5 所述者不同，該裝置應以辨識文字 X 定名，而非以辨識文字 E 定名。

該等裝置仍須符合 M.2 與 M.3 之要求。



M.6.3 Contactor relays designated by the distinctive letter Y

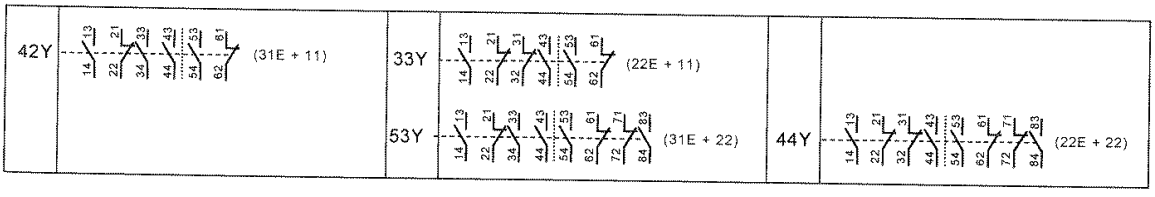
Devices consisting of combinations of contact elements and terminal marking in accordance with Table M.3 shall be designated by the distinctive letter Y instead of the distinctive letter E.

M.6.3 以辨識文字 Y 定名之電磁開關

裝置包含接點元件連同依據表 M.3 之端子標示者，應以辨識文字 Y 定名，而非以辨識文字 E 定名。

Table M.3 – Diagrams of contactor relays designated by the distinctive letter Y

表 M.3 標示辨識字母 Y 之電磁繼電器(contactor relay)接線圖



Bibliography

IEC 61810 (all parts), *Electromechanical elementary relays*

參考資料

IEC 61810 (all parts)　　Electromechanical elementary relays

相對應國際標準

IEC 60947-5-1:2009　Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices

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採購規格指定爲正字標記產品，可保障採購規格之妥善、週延性，驗收時只需查驗生產廠商所送交之產品是否具有正字標記證書即可，亦毋須逐項檢驗，可減少產品送驗之人力、物力、財力和時間。

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