

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Low-voltage switchgear and controlgear –
Part 5-8: Control circuit devices and switching elements – Three-position
enabling switches**

**Appareillage à basse tension –
Partie 5-8: Appareils et éléments de commutation pour circuits de commande –
Interrupteurs de commande de validation à trois positions**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –**Part 5-8: Control circuit devices and switching elements –
Three-position enabling switches**

FOREWORD

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International Standard IEC 60947-5-8 has been prepared by subcommittee 121A: Low-voltage switchgear and controlgear, of IEC technical committee 121: Switchgear and controlgear and their assemblies for low voltage.

This second edition cancels and replaces the first edition published in 2006. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) due to the increasing range of useful applications of three-position enabling switches, note of scope, operational characteristics and tests are reviewed;
- b) figures for example of devices incorporating enabling switch are added in Annex A;
- c) new Annex B for procedure to determine reliability data for the switch used in functional safety applications is added.

The text of this document is based on the following documents:

FDIS	Report on voting
121A/358/FDIS	121A/369/RVD

Full information on the voting for the approval of this document can be found in the report on voting indicated in the above table.

This document should be used in conjunction with IEC 60947-1:2020 and IEC 60947-5-1:2016.

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 or Annex A of IEC 60947-1:2020.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60947 series, under the general title *Low-voltage switchgear and controlgear*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition or [IEC 60947-5-8:2020](http://standards.iteh.ai/catalog/standards/sist/bc3bb9b2-dfa9-42b8-ab2b-bc35f271f7ef/iec-60947-5-8-2020)
- amended.

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LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 5-8: Control circuit devices and switching elements – Three-position enabling switches

1 Scope

This part of IEC 60947 series specifies requirements for three-position enabling switches.

These switches are used as components of enabling devices to provide signals that,

- a) when activated, allow machine operation to be initiated by a separate start control, and
- b) when de-activated,
 - initiate a stop function, and
 - prevent initiation of machine operation.

NOTE 1 The enabling control function is described in 9.2.3.9 of IEC 60204-1:2016 but the application of three-position enabling switches is not limited to a component of the enabling device described in IEC 60204-1.

NOTE 2 This document does not deal with enabling devices.

These switches are intended to be connected to circuits which rated voltage does not exceed 250 V AC 50 Hz/60 Hz or 300 V DC.

EXAMPLE Devices incorporating three-position enabling switches are:

- push-button enabling devices;
- grip actuated enabling devices;
- foot actuated enabling devices.

See Annex A for more typical examples.

This document does not apply to:

- three-position enabling switches for non-electrical control circuits, for example hydraulic, pneumatic;
- enabling switches without three-position mechanism;
- emergency stop devices (see IEC 60947-5-5).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-1:2007, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-6:2007, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60947-1:2020, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 60947-5-1:2016, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in Clause 3 of IEC 60947-1:2020 and Clause 2 of IEC 60947-5-1:2016, and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

Alphabetical index of definitions

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A	
Actuating system	3.3
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Enabling device	3.1

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Three-position enabling switch.....	3.2
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3.1 enabling device

manually operated control device used in conjunction with a start control and which, when continuously actuated, allows a machine operation

3.2 three-position enabling switch

three-position switch having enabling contact(s)

3.3 actuating system

<three-position enabling switch> all the mechanical parts which transmit the actuating force to the contact elements

[SOURCE: IEC 60050-441:2000, 441-15-21, modified – "all the operating means of a control switch" replaced by "all the mechanical parts", note to entry deleted.]

3.4 actuator

<three-position enabling switch> part of the actuating system which is actuated by a part of the human body

EXAMPLE A button.

3.5

auxiliary contact

contact of a three-position enabling switch that provides an auxiliary function

Note 1 to entry: Auxiliary contacts can be normally open and/or normally closed.

3.6

enabling contact

contact of a three-position enabling switch, which is closed when the actuator is in the mid position (partly depressed, position 2 in Figure 1) and is open when the actuator is in the rest position (not pressed, position 1 in Figure 1) and in the fully depressed position (position 3 in Figure 1)

4 Classification

4.1 Contact elements

Subclause 3.1 of IEC 60947-5-1:2016 applies.

4.2 Three-position enabling switch

Three-position enabling switches may be classified according to the contact element and the nature of the actuating system, e.g. three-position enabling switches, form B.

5 Characteristics

5.1 Summary of characteristics

[IEC 60947-5-8:2020](#)

[https://standards.iteh.ai/catalog/standards/sist/bc3bb9b2-dfa9-42b8-ab2b-](https://standards.iteh.ai/catalog/standards/sist/bc3bb9b2-dfa9-42b8-ab2b-bc35f271f7ef/iec-60947-5-8-2020)

5.1.1 General

[bc35f271f7ef/iec-60947-5-8-2020](https://standards.iteh.ai/catalog/standards/sist/bc3bb9b2-dfa9-42b8-ab2b-bc35f271f7ef/iec-60947-5-8-2020)

Subclause 4.1.1 of IEC 60947-5-1:2016 applies except for following type of equipment (see 5.2).

5.1.2 Operation of an enabling switch

Subclause 4.1.2 of IEC 60947-5-1:2016 applies.

5.2 Type of three-position enabling switch

5.2.1 Number of poles

The number of poles shall be stated by the manufacturer.

5.2.2 Kind of current

Alternating current or direct current.

5.3 Rated and limiting values for switching elements

Subclause 4.3 of IEC 60947-5-1:2016 applies.

5.4 Utilization categories for switching elements

Subclause 4.4 of IEC 60947-5-1:2016 applies.

5.5 Vacant

5.6 Vacant

5.7 Vacant

5.8 Vacant

5.9 Vacant

5.10 Electrically separated contact elements

Subclause 4.10 of IEC 60947-5-1:2016 applies.

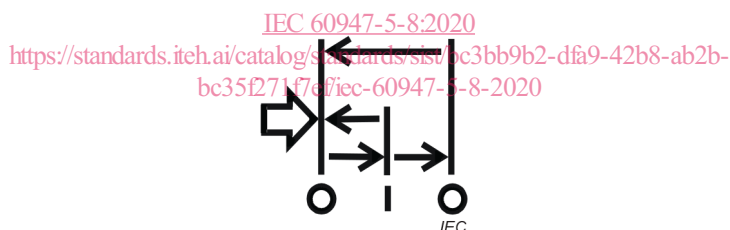
6 Product information

6.1 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.
- c) "IEC 60947-5-8" if the manufacturer claims compliance with this document.
- d) Three-position enabling switches shall be indelibly and legibly marked by the following symbol:



NOTE If it is not possible to affix the marking to the switch due to size constraints, then the symbol can be put in the instructions for installation, operation and maintenance.

Basic rated values and utilization

- e) Actuating forces and travel of the actuator.
- f) Rated operational voltage(s) (see 4.3.2.2 of IEC 60947-5-1:2016).
- g) Utilization category and rated operational currents at the rated operational voltages of the switching element.
- h) Rated insulation voltage (see 4.3.2.3 of IEC 60947-5-1:2016).
- i) Rated impulse withstand voltage U_{imp} in accordance with 5.3.1.3 of IEC 60947-1:2020.
- j) IP code (see Annex C of IEC 60947-1:2020).
- k) Pollution degree (see 6.1.3.2 of IEC 60947-5-1:2016).
- l) Type and maximum ratings of short-circuit protective device (see 8.3.4.3 of IEC 60947-5-1:2016).
- m) Conditional short-circuit current if less than 1 000 A.
- n) Indication of contact elements of same polarity.
- o) Mechanical and/or electrical durability.

6.2 Marking

6.2.1 General

Marking of data specified in items a), b), c) and d) of 6.1 is mandatory on the nameplate of the three-position enabling switch 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 easily removable parts.

Whenever space permits, data under items e) to o) of 6.1 shall be included on the nameplate, or on the three-position enabling switch or otherwise in the manufacturer's published literature.

6.2.2 Terminal identification and marking

Subclause 5.2.2 of IEC 60947-5-1:2016 applies.

6.2.3 Functional markings

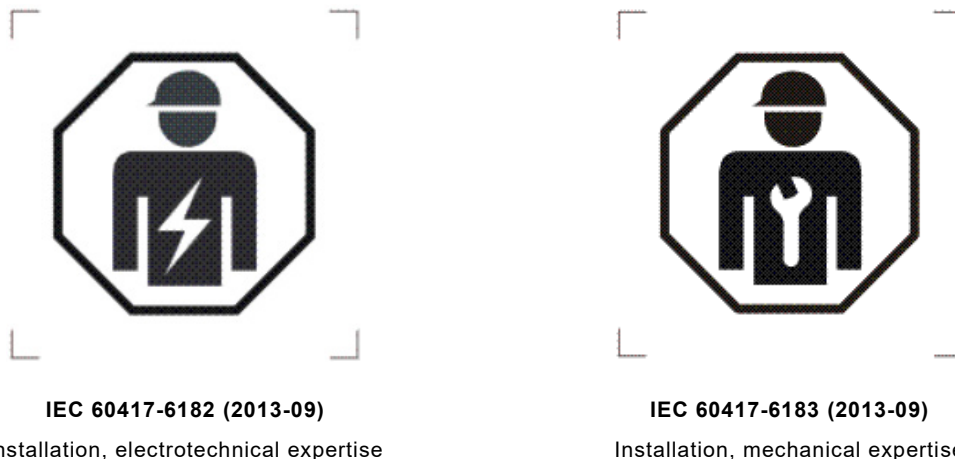
To avoid confusion with emergency stop devices, the actuator of an enabling switch shall not be coloured red (see IEC 60204-1).

6.3 Instructions for installation, operation and maintenance

Subclause 6.3 of IEC 60947-1:2020 applies with the following additions.

Manufacturers are encouraged to use graphical symbols as set out in international standards. Examples include ISO 7000 and IEC 60417.

EXAMPLE Following symbols can be used for "skilled person"



6.4 Additional information

Subclause 5.4 of IEC 60947-5-1:2016 applies.

7 Normal service, mounting and transport conditions

7.1 General

Clause 7 of IEC 60947-1:2020 applies with the following additions.

7.1.3.2 Pollution degree

An enabling switch is intended for installation under environmental conditions of pollution degree 3. If it can be demonstrated that the micro-environment of a device to which the enabling switch (or part of) is exposed is different to pollution degree 3, then the pollution degree of the enabling switch can be adapted.

7.3 Mounting

Means shall be provided to allow the three-position enabling switch to be securely installed in its intended mounting position.

7.4 Special application

Environmental conditions (e.g. moisture, corrosive atmosphere, UV radiation) may cause additional requirements.

8 Constructional and performance requirements

8.1 Constructional requirements

8.1.1 General

Subclause 8.1.1 of IEC 60947-1:2020 applies.

8.1.2 Materials

8.1.2.1 General material requirements

Subclause 7.1.2.1 of IEC 60947-5-1:2016 applies. <https://standards.iteh.ai/catalog/standards/sist/bc3bb9b2-dfa9-42b8-ab2b-bc35f271f7ef/iec-60947-5-8-2020>

8.1.2.2 Glow-wire testing

Subclause 7.1.2.2 of IEC 60947-5-1:2016 applies.

8.1.2.3 Test based on flammability category

Subclause 7.1.2.3 of IEC 60947-5-1:2016 applies.

8.1.2.4 Biological and chemical effects

Under agreement between manufacturer and user, the manufacturer may provide a list of relevant materials in order to let the user verify that the product is suitable for the application.

NOTE 1 Additional requirements can be relevant in conjunction with special applications/branches e.g. for food and beverage, chemical industry, marine.

NOTE 2 Three-position enabling switches can be utilized in applications where a human operator can be in contact with the device for substantial periods, with bare hands. Due consideration can be given to the biological and chemical effects of skin contact with materials that emit substances when touched, for example, polycyclic aromatic hydrocarbons (PAH).

8.1.3 Current-carrying parts and their connections

Subclause 7.1.3 of IEC 60947-5-1:2016 applies.

8.1.4 Clearances and creepage distances

Subclause 8.1.4 of IEC 60947-1:2020 applies.

8.1.5 Actuator

8.1.5.1 Insulation

Subclause 8.1.5.1 of IEC 60947-1:2020 applies.

8.1.5.2 Direction of movement

Subclause 8.1.5.2 of IEC 60947-1:2020 applies.

8.1.5.3 Actuating force (or torque)

The force (or torque) 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.

See 8.1.17 for the actuating force on each operation.

8.1.6 Indication of the contact position

Subclause 8.1.6 of IEC 60947-1:2020 applies.

8.1.7 Vacant

8.1.8 Terminals

Subclause 8.1.8 of IEC 60947-1:2020 applies.

8.1.9 Vacant

8.1.10 Provisions for protective earthing

Subclause 8.1.10 of IEC 60947-1:2020 applies.

8.1.11 Enclosures for equipment

Subclause 8.1.11 of IEC 60947-1:2020 applies.

8.1.12 Degrees of protection of enclosed equipment

Subclause 8.1.12 of IEC 60947-1:2020 applies.

8.1.13 Vacant

8.1.14 Class II three-position enabling switches

Subclause 7.1.14 of IEC 60947-5-1:2016 applies.

8.1.15 Requirements for three-position enabling switches with integrally connected cables

Subclause 7.1.15 of IEC 60947-5-1:2016 applies.

8.1.16 Three-position operation

The three positions are designated as follows (see Figure 2):

- position 1: OFF state of the contact (actuator is not pressed);
- position 2: ON state of the contact (actuator is pressed to the normal enabling position);

- position 3: OFF state of the contact (actuator is fully depressed).

The three-position enabling switch pressed to position 2 shall return to position 1 when released. The three-position enabling switch shall change from position 2 to position 3 when pressed further. When released from position 3 to position 1, the switching element shall not close when the actuator passes through position 2.

Figure 1 illustrates the three positions and the corresponding contact states.

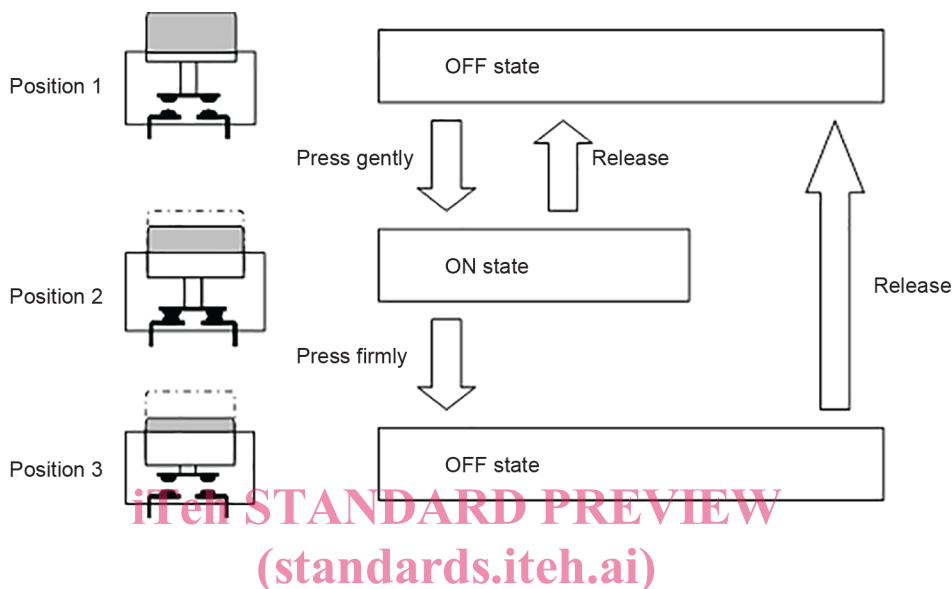


Figure 1 – Operation of three-position enabling switches

The operational stroke and force to actuate the three-position enabling switch from position 1 to position 2 and from position 2 to position 3 shall be stated by the manufacturer.

8.1.17 Operational characteristics

The three-position enabling switch shall be designed and manufactured to satisfy the following operational characteristics.

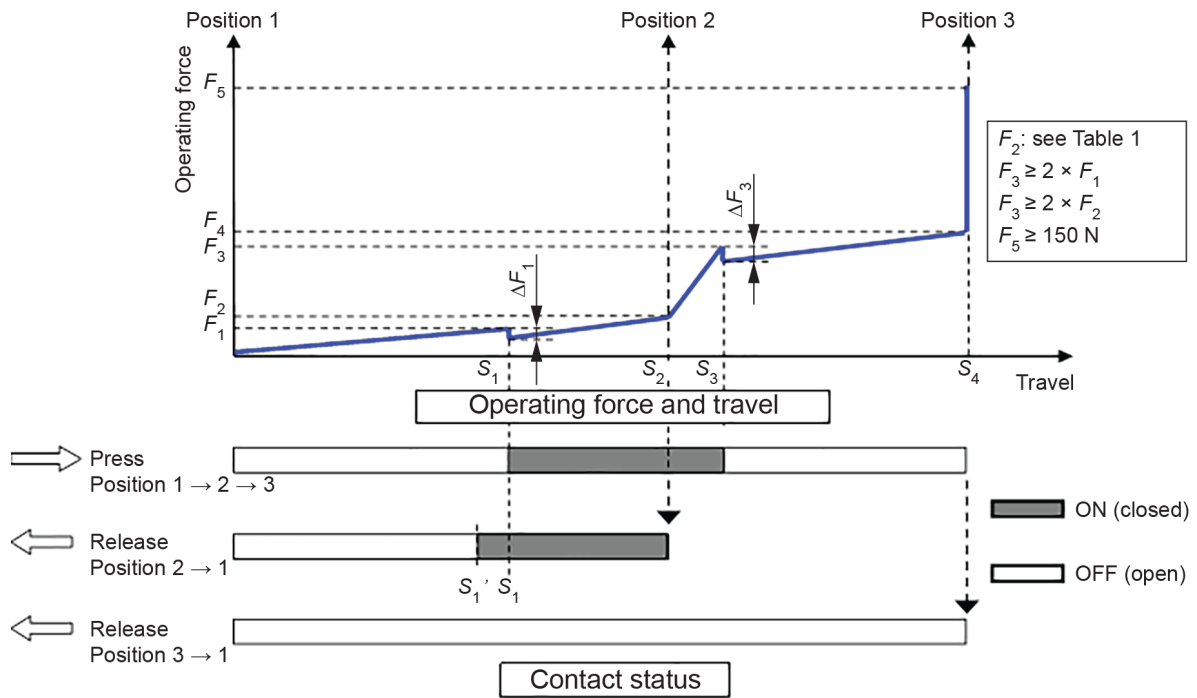
- To reduce physiological strain during actuation of three-position enabling switches, the value of F_2 shall be as stated in Table 1 or lower. Manufacturer shall declare a maximum F_2 value.
- To reduce the possibility of inadvertent shifting of three-position enabling switches to position 3, F_3 shall be equal to or greater than 2 times the larger values of F_1 and F_2 .
- F_5 shall be 150 N or greater (see 9.2.3).

NOTE 1 To prevent inadvertent shifting of the three-position enabling switch to position 1, S_1' can be set smaller than S_1 .

NOTE 2 To provide operator with tactile sensation of contact shifting, operating force dips ΔF_1 and ΔF_3 can be provided.

NOTE 3 The torque value is not specified in this document because there is no known enabling switch using torque for actuation.

Figure 2 shows the operational characteristics of the three-position enabling switch when the switch is pressed.



IEC

Key

- F_1 Force to turn on the enabling contacts from position 1 to position 2
- F_2 Force to maintain the switch in position 2
- F_3 Force to turn off the enabling contacts from position 2 to position 3
- F_4 Full stroke force (position 3)
- F_5 Maximum rated operating force
- ΔF_1 Operating force dip across point S_1
- ΔF_3 Operating force dip across point S_3
- S_1 Point where the switch shifts from position 1 to position 2. Enabling contacts turn ON
- S_1' Point where the switch returns from position 2 to position 1. Enabling contacts turn OFF
- S_2 Point where the switch is maintained in position 2
- S_3 Point where the switch shifts from position 2 to position 3. Enabling contacts turn OFF
- S_4 Full stroke point

Figure 2 – Operating force, travel and enabling contact status

When released from position 3 to position 1, the enabling contacts shall not close.

Table 1 – Force values for F_2

Designated use of the three-position enabling switch	Maximum value of F_2 N
Actuation of the enabling device by finger	10
Actuation of the enabling device by hand	20
Actuation of the enabling device by foot	25