



BSI Standards Publication

# Letter symbols to be used in electrical technology —

Part 7: Power generation, transmission  
and distribution

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This British Standard is the UK implementation of EN 60027-7:2010. It is identical to IEC 60027-7:2010.

The UK participation in its preparation was entrusted to Technical Committee SS/7, General metrology, quantities, units and symbols.

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

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| Date | Text affected |
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**Letter symbols to be used in electrical technology -  
Part 7: Power generation, transmission and distribution  
(IEC 60027-7:2010)**

Symboles littéraux à utiliser  
en électrotechnique -  
Partie 7: Production, transport  
et distribution de l'énergie électrique  
(CEI 60027-7:2010)

Formelzeichen für die Elektrotechnik -  
Teil 7: Energieerzeugung, -übertragung  
und -verteilung  
(IEC 60027-7:2010)

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**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

The text of document 25/391/CDV, future edition 1 of IEC 60027-7, prepared by IEC TC 25, Quantities and units, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60027-7 on 2010-09-01.

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The following dates were fixed:

- |                                                                                                                                          |       |            |
|------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2011-06-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn                                               | (dow) | 2013-09-01 |

Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 60027-7:2010 was approved by CENELEC as a European Standard without any modification.

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## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

| <u>Publication</u> | <u>Year</u> | <u>Title</u>                                 | <u>EN/HD</u>             | <u>Year</u> |
|--------------------|-------------|----------------------------------------------|--------------------------|-------------|
| IEC 60027-1        | 1995        | Letter symbols to be used in electrical      | EN 60027-1               | 2006        |
| + A1               | 1997        | technology -                                 | -                        | -           |
| + A2               | 2005        | Part 1: General                              | + A2 <sup>1)</sup>       | 2007        |
| IEC 60027-2        | 2005        | Letter symbols to be used in electrical      | EN 60027-2 <sup>2)</sup> | 2007        |
|                    |             | technology -                                 |                          |             |
|                    |             | Part 2: Telecommunications and electronics   |                          |             |
| IEC 60038          | 2009        | IEC standard voltages                        | -                        | -           |
| IEC 60050-121      | 1998        | International Electrotechnical Vocabulary    | -                        | -           |
| + A1               | 2002        | (IEV) -                                      | -                        | -           |
|                    |             | Part 121: Electromagnetism                   |                          |             |
| IEC 60050-131      | 2002        | International Electrotechnical Vocabulary    | -                        | -           |
| + A1               | 2008        | (IEV) -                                      | -                        | -           |
|                    |             | Part 131: Circuit theory                     |                          |             |
| IEC 60050-141      | 2004        | International electrotechnical vocabulary -  | -                        | -           |
|                    |             | Part 141: Polyphase systems and circuits     |                          |             |
| IEC 60050-151      | 2001        | International Electrotechnical Vocabulary    | -                        | -           |
|                    |             | (IEV) -                                      |                          |             |
|                    |             | Part 151: Electrical and magnetic devices    |                          |             |
| IEC 60050-195      | 1998        | International Electrotechnical Vocabulary    | -                        | -           |
| + A1               | 2001        | (IEV) -                                      | -                        | -           |
|                    |             | Chapter 195: Earthing and protection against |                          |             |
|                    |             | electric shock                               |                          |             |
| IEC 60050-411      | 1996        | International Electrotechnical Vocabulary    | -                        | -           |
| + A1               | 2007        | (IEV) -                                      | -                        | -           |
|                    |             | Chapter 411: Rotating machinery              |                          |             |
| IEC 60050-421      | 1990        | International electrotechnical vocabulary    | -                        | -           |
|                    |             | (IEV) -                                      |                          |             |
|                    |             | Chapter 421: Power transformers and          |                          |             |
|                    |             | reactors                                     |                          |             |
| IEC 60050-441      | 1984        | International Electrotechnical Vocabulary    | -                        | -           |
| + A1               | 2000        | (IEV) -                                      | -                        | -           |
|                    |             | Chapter 441: Switchgear, controlgear and     |                          |             |
|                    |             | fuses                                        |                          |             |

<sup>1)</sup> EN 60027-1 includes A1 to IEC 60027-1.

<sup>2)</sup> EN 60027-2 is superseded by EN 80000-13:2008, which is based on IEC 80000-13:2008.

| <u>Publication</u> | <u>Year</u>  | <u>Title</u>                                                                                                                                                                                 | <u>EN/HD</u>             | <u>Year</u> |
|--------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------|
| IEC 60050-442      | 1998         | International Electrotechnical Vocabulary - Part 442: Electrical accessories                                                                                                                 | -                        | -           |
| IEC 60050-448      | 1995         | International Electrotechnical Vocabulary (IEV) - Chapter 448: Power system protection                                                                                                       | -                        | -           |
| IEC 60050-466      | 1990         | International electrotechnical vocabulary (IEV) - Chapter 466: Overhead lines                                                                                                                | -                        | -           |
| IEC 60050-601 + A1 | 1985<br>1998 | International Electrotechnical Vocabulary (IEV) - Chapter 601: Generation, transmission and distribution of electricity - General                                                            | -<br>-                   | -<br>-      |
| IEC 60050-603 + A1 | 1986<br>1998 | International electrotechnical vocabulary - Chapter 603: Generation, transmission and distribution of electricity - Power system planning and management                                     | -<br>-                   | -<br>-      |
| IEC 60050-604 + A1 | 1987<br>1998 | International Electrotechnical Vocabulary (IEV) - Chapter 604: Generation, transmission and distribution of electricity - Operation                                                          | -<br>-                   | -<br>-      |
| IEC 60050-811      | 1991         | International electrotechnical vocabulary (IEV) - Chapter 811: Electric traction                                                                                                             | -                        | -           |
| IEC 60909-0        | 2001         | Short-circuit currents in three-phase a.c. systems - Part 0: Calculation of currents                                                                                                         | EN 60909-0               | 2001        |
| IEC/TR 60909-1     | 2002         | Short-circuit currents in three-phase e.c. systems - Part 1: Factors for the calculation of short-circuit currents according to IEC 60909-0                                                  | -                        | -           |
| IEC/TR 60909-2     | 2008         | Short-circuit currents in three-phase a.c. systems - Part 2: Data of electrical equipment for short-circuit current calculations                                                             | -                        | -           |
| IEC 60909-3        | 2003         | Short-circuit currents in three-phase a.c. systems - Part 3: Currents during two separate simultaneous line-to-earth short-circuits and partial short-circuit currents flowing through earth | EN 60909-3 <sup>3)</sup> | 2003        |
| IEC 62428          | 2008         | Electric power engineering - Modal components in three-phase a.c. systems - Quantities and transformations                                                                                   | EN 62428                 | 2008        |
| IEC 80000-6        | 2008         | Quantities and units - Part 6: Electromagnetism                                                                                                                                              | EN 80000-6               | 2008        |

<sup>3)</sup> EN 60909-3 is superseded by EN 60909-3:2010, which is based on IEC 60909-3:2009.

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## LETTER SYMBOLS TO BE USED IN ELECTRICAL TECHNOLOGY –

### Part 7: Power generation, transmission, and distribution

#### 1 Scope

This part of IEC 60027 is applicable to generation, transmission, and distribution of electric energy. It gives names and letter symbols for quantities and units. In addition, rules for multiple subscripts and their succession are given.

This part of IEC 60027 is an addition to IEC 60027-1. Therefore letter symbols already given in IEC 60027-1 are repeated only if they have a special meaning in the field of power generation, transmission, and distribution or if they are used in this field with special subscripts.

Guidance on the use of capital and lower case letters, is given in IEC 60027-1, 2.1, and guidance on the representation of complex quantities, is given in IEC 60027-1, 1.6. Therefore in many cases only  $U$  is given instead of  $\underline{U}$ ,  $|\underline{U}| = U$  or  $u$ .

#### 2 Normative references

The following referenced documents are indispensable for the application 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 60027-1:1992, *Letter symbols to be used in electrical technology – Part 1: General*  
Amendment 1:1997  
Amendment 2:2005

IEC 60027-2:2005, *Letter symbols to be used in electrical technology – Part 2: Telecommunications and electronics*

IEC 60038:2009, *IEC standard voltages*

IEC 60050-121:1998, *International Electrotechnical Vocabulary – Part 121: Electromagnetism*  
Amendment 1 (2002)

IEC 60050-131:2002, *International Electrotechnical Vocabulary – Part 131: Circuit theory*  
Amendment 1 (2008)

IEC 60050-141:2004, *International Electrotechnical Vocabulary – Part 141: Polyphase systems and circuits*

IEC 60050-151:2001, *International Electrotechnical Vocabulary – Part 151: Electrical and magnetic devices*

IEC 60050-195:1998, *International Electrotechnical Vocabulary – Part 195: Earthing and protection against electric shock*  
Amendment 1 (1998)

IEC 60050-411:1996, *International Electrotechnical Vocabulary – Chapter 411: Rotating machines*

Amendment 1 (2007)

IEC 60050-421:1990, *International Electrotechnical Vocabulary – Chapter 421: Power transformers and reactors*

IEC 60050-441:1984, *International Electrotechnical Vocabulary – Chapter 441: Switchgear, controlgear and fuses*

Amendment 1 (2000)

IEC 60050-442:1998, *International Electrotechnical Vocabulary – Part 442: Electrical accessories*

IEC 60050-448:1995, *International Electrotechnical Vocabulary – Chapter 448: Power system protection*

IEC 60050-466:1990, *International Electrotechnical Vocabulary – Chapter 466: Overhead lines*

IEC 60050-601:1985, *International Electrotechnical Vocabulary – Chapter 601: Generation, transmission and distribution of electricity – General*

Amendment 1 (1998)

IEC 60050-603:1986, *International Electrotechnical Vocabulary – Chapter 603: Generation, transmission and distribution of electricity – Power system planning and management*

Amendment 1 (1998)

IEC 60050-604:1987, *International Electrotechnical Vocabulary – Chapter 604: Generation, transmission and distribution of electricity – Operation*

Amendment 1 (1998)

IEC 60050-811:1991, *International Electrotechnical Vocabulary – Chapter 811: Electric traction*

IEC 60909-0:2001, *Short-circuit currents in three-phase AC systems – Part 0: Calculation of currents*

IEC/TR 60909-1:2002, *Short-circuit currents in three-phase AC systems – Part 1: Factors for the calculation of short-circuit currents according to IEC 60909-0*

IEC/TR 60909-2:2008, *Short-circuit currents in three-phase AC systems – Part 2: Data of electrical equipment for short-circuit current calculations*

IEC 60909-3:2003, *Short-circuit currents in three-phase AC systems – Part 3: Currents during two separate simultaneous line-to-earth short circuits and partial short-circuit currents flowing through earth*

IEC 62428:2008, *Electric power engineering – Modal components in three-phase a.c. systems – Quantities and transformations*

IEC 80000-6:2008, *Quantities and units – Part 6: Electromagnetism*

### 3 Letter symbols for AC, three-phase AC, and other network quantities

| Item number | Quantities                        |                                                |              |                |                                                                                                                                                                                    | Units                      |                   |                |
|-------------|-----------------------------------|------------------------------------------------|--------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------------|----------------|
|             | IEV and/or IEC number             | Name of quantity                               | Chief symbol | Reserve symbol | Remarks                                                                                                                                                                            | Unit, coherent with the SI | Name              | Symbol         |
| 101         |                                   | line-to-earth capacitance of a line            | $C_{Li}$     | $C_{LiE}$      | $i = 1, 2, 3$ in three-phase AC networks                                                                                                                                           |                            | farad             | F              |
| 102         |                                   | line-to-line capacitance of a line             | $C_{LiLk}$   | $C_{LiLk}$     | $i, k = 1, 2, 3$ with $i \neq k$ in three-phase AC networks                                                                                                                        |                            | farad             | F              |
| 103         | 131-14-29<br>60027-2              | hybrid matrix                                  | $H$          |                | Names and symbols for the elements are given in IEC 60027-2.                                                                                                                       |                            | one, ohm, siemens | $1, \Omega, S$ |
| 104         |                                   | electric current                               | $I$          |                | The general symbol $I$ is used in case of three-phase AC networks if the three currents are equal or nearly equal.                                                                 |                            | ampere            | A              |
| 105         | 441-17-06<br>441-17-07<br>60909-0 | prospective breaking current, breaking current | $I_b$        | $I_a$          | Current of the first opening pole of a switching device (circuit breaker) or a fuse.                                                                                               |                            | ampere            | A              |
| 106         |                                   | capacitive charging current                    | $I_C$        |                | $I_C = \omega C \frac{U_n}{\sqrt{3}}$ where $\omega$ is the angular frequency, $C$ is the positive-sequence capacity, and $U_n$ is the nominal voltage of the three-phase AC line. |                            | ampere            | A              |
| 107         |                                   | capacitive earth-fault current                 | $I_{Ce}$     |                | $I_{Ce}$ is the capacitive single line-to-earth fault current in a network with isolated neutral (IEV 601-02-24).                                                                  |                            | ampere            | A              |
| 108         | 131-11-22                         | direct current                                 | $I_d$        | $I_{DC}$       | average value, for instance in the case of a direct current link<br>For the qualifier DC, see IEC 60050-151, 151-15-02                                                             |                            | ampere            | A              |
| 109         | 442-01-23                         | earth fault current                            | $I_e$        |                | See items 107 and 121.                                                                                                                                                             |                            | ampere            | A              |
| 110         |                                   | field (excitation) current                     | $I_F$        | $I_f$          | Current in the field winding of a machine.                                                                                                                                         |                            | ampere            | A              |

| Item number | Quantities            |                                                                |              |                |                                                                                                                                                                                                                                                                                                                                   | Units                      |        |         |
|-------------|-----------------------|----------------------------------------------------------------|--------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------|---------|
|             | IEV and/or IEC number | Name of quantity                                               | Chief symbol | Reserve symbol | Remarks                                                                                                                                                                                                                                                                                                                           | Unit, coherent with the SI |        | Remarks |
|             |                       |                                                                |              |                |                                                                                                                                                                                                                                                                                                                                   | Name                       | Symbol |         |
| 111         |                       | no-load field (excitation) current                             | $I_{0F}$     | $I_{f0}$       |                                                                                                                                                                                                                                                                                                                                   | ampere                     | A      |         |
| 112         | 60909-0               | steady-state short-circuit current at a short-circuit location | $I_k$        | $I_{k3}$       | The steady state short-circuit current in the r.m.s. value of a three-phase short-circuit current at a short-circuit location in a network, which remains after the decay of all transient phenomena.<br>Short-circuit currents with subscript k in solidly earthed or impedance earthed networks (IEV 601-02-25, IEC 601-02-26). | ampere                     | A      |         |
| 113         | 60909-1               | transient short-circuit current at a short-circuit location    | $I'_k$       | $I'_{k3}$      | The transient short circuit current is the r.m.s. value of a three-phase short-circuit current at a short-circuit location after the decay of the subtransient short-circuit current.                                                                                                                                             | ampere                     | A      |         |
| 114         | 60909-0               | subtransient short-circuit current at a short-circuit location | $I''_k$      | $I''_{k3}$     | The initial symmetrical short-circuit current at a short-circuit location is the r.m.s. value of the AC component of a prospective three-phase short-circuit current.                                                                                                                                                             | ampere                     | A      |         |
| 115         | 121-11-13 MOD         | line conductor current                                         | $I_{Li}$     |                | $i = 1, 2, 3$ in three-phase AC networks.                                                                                                                                                                                                                                                                                         | ampere                     | A      |         |
| 116         | 411-48-16<br>60909-0  | locked rotor current                                           | $I_{LR}$     | $I_{an}$       | $I_{LR}$ is the highest r.m.s. current of an asynchronous motor with locked rotor at the most unfavourable position fed with rated voltage and frequency of the rotor.                                                                                                                                                            | ampere                     | A      |         |
| 117         |                       | magnetizing current                                            | $I_m$        | $I_\mu$        | $I_m$ is the magnetizing current of a machine, a reactor, a transformer, etc. IEC 60027-1, Table 6, Subscript m, mag.                                                                                                                                                                                                             | ampere                     | A      |         |
| 118         | 60909-0               | peak short-circuit current at a short-circuit location         | $i_p$        | $i_{p3}$       | The peak short circuit current is the maximum possible instantaneous value of the prospective three-phase short-circuit current.                                                                                                                                                                                                  | ampere                     | A      |         |
| 119         |                       | thermal continuous permissible current                         | $I_{per}$    | $I_d$          |                                                                                                                                                                                                                                                                                                                                   | ampere                     | A      |         |

