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2007-06

Rotating electrical machines –

**Part 8:
Terminal markings and direction of rotation**

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**Partie 8:
Marques d'extrémité et sens de rotation**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ROTATING ELECTRICAL MACHINES –

Part 8: Terminal markings and direction of rotation

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International Standard IEC 60034-8 has been prepared by IEC technical committee 2: Rotating machinery.

This third edition of IEC 60034-8 cancels and replaces the second edition published in 2002 and constitutes a technical revision.

The main change with respect to the previous edition is listed below:

- changed terminal markings for d.c. machines in Clause A.4.

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

FDIS	Report on voting
2/1434/FDIS	2/1451/RVD

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

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

A list of all the parts of the IEC 60034 series, under the general title *Rotating electrical machines*, can be found on the IEC website.

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

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INTRODUCTION

The revision of this part of IEC 60034 provides worldwide uniformity in the electrical connections for rotating electrical machines and applies the recommendations of the basic safety publication IEC 60445 in specifying marking requirements.

These standardized connections will then permit the safe interchange of electric machines with their control and protective devices using standardized terminal markings.

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ROTATING ELECTRICAL MACHINES –

Part 8: Terminal markings and direction of rotation

1 Scope

This part of IEC 60034 applies to a.c. and d.c. machines and specifies

- a) rules for the identification of winding connection points;
- b) marking of winding terminals;
- c) direction of rotation;
- d) relationship between terminal markings and direction of rotation;
- e) terminal marking of auxiliary devices;
- f) connection diagrams of machines for common applications.

Turbine-type synchronous machines are excluded from this standard.

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 60034-8:2007](#)

IEC 60034-1, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60417-1, *Graphical symbols for use on equipment – Part 1: Overview and application*

IEC 60445, *Basic and safety principles for man-machine interface, marking and identification – Identification of equipment terminals and conductor terminations*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60034-1 and the following apply.

3.1

terminal marking

permanent identification of the external termination of winding leads or auxiliary leads at the disposal of the user for connection of the machine to the supply or apparatus that indicates the function of the termination

3.2

connecting points

all current transfer points that are used to permanently interconnect winding or winding element ends internally

3.3**tapping points**

intermediate connections to a portion of a winding element

3.4**winding leads**

insulated conductors that make the electrical connection between a winding and its termination

3.5**winding**

assembly of turns or coils having a defined function in an electrical rotating machine

[IEV 411-37-01]

3.6**winding phase**

one or more winding elements associated with a particular phase

3.7**winding element**

part of a winding, all the turns or coils in that part being permanently connected together

3.8**separate windings**

two or more windings, each having a separate function, and not interconnected, used only separately, whether fully or in part

3.9**multi-speed motor**

motor, which can be operated at any one of two or more definite speeds

3.10**constant power**

when a multi-speed motor provides approximately constant power over the speed range

3.11**constant torque**

when a multi-speed motor provides approximately constant torque over the speed range

3.12**variable torque**

when output torque of a multi-speed motor is proportional to approximately the square of the speeds

3.13**phase sequence**

order in which the voltages successively reach their maximum positive values between supply conductors

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3.14

D-end

that end of the machine which accommodates the shaft end

[IEV 411-43-36]

NOTE For machines having two shaft ends, the D-end is the end

- a) having the larger diameter;
- b) opposite the external fan when the shaft ends are of the same diameter.

4 Symbols

4.1 General

- L Supply conductor
- PE Protective earthing terminal
- ——— User available terminal, marking mandatory
- Internal connection point
- (...) Internal terminal marking (showing element symbol), optional
- [.... ,] Grouping of user joined terminals
- ; Separation of terminals or groups of terminals

4.2 DC and single-phase commutator machines

- A Armature winding
- B Commutating winding
- C Compensating winding
- D Series excitation winding
- E Shunt excitation winding
- F Separately excited winding
- H Direct-axis auxiliary winding
- J Quadrature-axis auxiliary winding

4.3 AC machines without commutator

- F DC excitation winding
- K Secondary winding
- L Secondary winding
- M Secondary winding
- N Star point (neutral conductor) of the primary winding
- Q Star point (neutral conductor) of a secondary winding
- U Primary winding
- V Primary winding
- W Primary winding
- Z Auxilliary windings

NOTE The primary and secondary symbol allocations are irrespective of whether the primary winding is located in the stator or rotor.

4.4 Auxiliary devices

BA	AC brakes
BD	DC brakes
BW	Brush-wear detector
CA	Capacitors
CT	Current transformer
HE	Heaters
LA	Lightning arrestor
PT	Potential transformer
R	Resistance thermometers
SC	Surge capacitor
SP	Surge protectors
S	Switches including plugging switches
TB	Thermostats opening on increase of temperature
TC	Thermocouples
TM	Thermostats closing on increase of temperature
TN	Thermistors, negative temperature coefficient
TP	Thermistors, positive temperature coefficient

NOTE This table standardizes the most commonly used auxiliary devices. The designation of other devices may be chosen by the manufacturer.

5 Direction of rotation (standards.iteh.ai)

The direction of rotation shall be that of the shaft observed when facing the D-end.

Machines with terminal markings according to this standard shall have a clockwise direction of rotation.

For other configurations, including unidirectional machines, an arrow located on the enclosure shall show the direction of rotation.

6 Rules for terminal markings

6.1 General

6.1.1 Application

A terminal marking shall identify all winding and auxiliary device terminations accessible to the user.

NOTE External line connections and winding arrangements used for common applications are shown in Annex A.

6.1.2 Marking instructions

All three-phase a.c. machines with more than three terminals and all other machines (and auxiliary devices) with more than two terminals shall have connecting instructions consistent with this standard.

6.1.3 Alphanumeric marking notation

The terminal marking comprises upper-case Latin characters and Arabic numerals. The characters shall be arranged without spaces.

Each winding, winding phase or auxiliary circuit shall be assigned a letter symbol(s) in accordance with Clause 4.

To prevent confusion with the numerals 1 and 0, the letters “I” and “O” shall not be used.

6.1.4 Duplicate winding terminals

Several leads of a machine can have the same marking only if each of them is capable of completely fulfilling the same electrical function, so that either one of them can be used for the connection. See Figure 9.

6.1.5 Shared terminals

When several leads or conductors are provided to share the current, the terminal markings shall be identified by an additional numerical suffix separated by a hyphen. See Figure 10.

Some multi-speed motors having two or more independent windings may produce circulating currents in the de-energized winding. In this case, the terminal markings for the open delta connection shall be identified by an additional numerical suffix separated by a hyphen. See Figure A.15.

6.1.6 Omissions

Numerical suffixes and/or prefixes may be omitted if there is no risk of confusion. See Figure 2.

When two or more elements are connected to the same terminal its marking shall be determined from one of the elements. The order of precedence shall be determined by the lower suffix. See Figure 8.

When two or more functionally different elements are connected internally, the combination of elements shall be considered a single element and the terminal marking shall have the alpha notation of the primary element function. See Figure 24.

6.1.7 Earthing terminal

The termination for the protective earthing conductor shall be marked with the letters PE according to IEC 60445 (or marked with symbol IEC 60417-5019:2006-08). No other terminals shall be so marked.

6.2 Suffixes

6.2.1 Winding elements

The ends of each winding element are distinguished by a numerical suffix, in accordance with IEC 60445, as follows (see Figure 5):

- 1 and 2 for the first winding element (see Figure 1),
- 3 and 4 for the second winding element,
- 5 and 6 for the third winding element,
- 7 and 8 for the fourth winding element.

In all winding elements, the end closer to the supply connection shall be marked with the lower of the two numbers.

6.2.2 Internal connections

When several ends of winding elements are joined, the terminal marking shall use the lower suffix; see Figure 8.

6.2.3 Tapping points

Tapping points of a winding element shall be marked in the sequence in which they occur in the winding element, as follows (see Figure 6):

- 11, 12, 13, etc. for the first winding element,
- 31, 32, 33, etc. for the second winding element,
- 51, 52, 53, etc. for the third winding element,
- 71, 72, 73, etc. for the fourth winding element.

The tap closest to the beginning of the winding shall be marked with the lowest suffix.

6.3 Prefixes

Winding elements that are separate (or belong to different current systems), but have a similar, but independent, function, shall be marked with the same letter, but distinguished by a numerical prefix.

Each of the terminals shall be marked with a numerical prefix corresponding to the separate winding (or current system) to which it belongs, as follows (see Figure 7):

first winding	1
second winding	2
third winding	3
fourth winding	4
and so on...	

With multi-speed machines, the sequence of the prefixes corresponds to the sequence of increasing speeds. See Figure A.19.

6.4 Winding identification for categories of machines

6.4.1 Three-phase machines

The letter symbols shall be U, V, and W for the first, second and third primary winding phase respectively and N when a neutral conductor is used (see Figure 3) and K, L, and M and Q when a secondary winding is used. See Figure 11.

6.4.2 Two-phase machines

The terminal markings of a two-phase machine shall be derived from the markings for three-phase machines, with the letter symbols W and M omitted.

6.4.3 Single-phase machines

The letter symbols assigned shall be U for the primary winding and Z for the auxiliary winding. See Figure 12.