Australian Standard®

GENERAL REQUIREMENTS FOR ROTATING ELECTRICAL MACHINES

Part 3—DIRECTION OF ROTATION AND MARKING OF TERMINALS

This part of this Australian standard was prepared by Committee EL/9, Rotating Electrical Machinery. It was approved on behalf of the Council of the Standards Association of Australia on 19 August 1982 and published on 8 November 1982.

PREFACE

This standard was prepared by the Association's Committee on Rotating Electrical Machinery.

In the preparation of this standard, reference was made to the following standards and acknowledgment is made of the assistance received therefrom:

IEC 34 Rotating Electrical Machines
34-8: Part 8—Terminal Markings and Direction of Rotation of Rotating Machines

BS 4999 General Requirements for Rotating Electrical Machines
Part 3—Terminal Markings and Direction of Rotation

This standard is in technical agreement with the IEC and BSI standards except that the text has been rearranged and clarified. CENELEC additional rules (in BS 4999: Part 3) are not included.

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Australian Standard

for

GENERAL REQUIREMENTS FOR ROTATING ELECTRICAL MACHINES

PART 3—DIRECTION OF ROTATION AND MARKING OF TERMINALS

FOREWORD

The marking of terminals specified in this part of the standard is in line with the principles specified in IEC 445, Identification of Apparatus Terminals and General Rules for a Uniform System of Terminal Marking, Using an Alphanumeric Notation. In particular, the following principles have been considered:

(a) Terminals which are intended to be connected directly or indirectly to supply conductors of a three-phase a.c. system are marked U, V, W, (and N for neutral) (see Figs 3.1 to 3.9).

(b) The reference letters for d.c. elements are chosen from the first part of the alphabet (see Fig. 3.13), and for a.c. elements from the second part (see Figs 3.10 and 3.11).

(c) The two end-points of a single element are distinguished by successive reference suffix numbers, e.g. 1 and 2, 5 and 6 (see Fig. 3.22).

(d) The intermediate points of a single element are distinguished by reference suffix numbers in a naturally ascending sequence 3, 4, 5 etc. The numbering commences at the point closest to the end point 1 (see Figs 3.2 and 3.19).

(e) Similar groups of elements having the same reference letters are distinguished by a numerical prefix (see Fig. 3.4).

(f) If no confusion is possible, the prefix or the suffix or both may be omitted.

This part of the standard applies to 'external' terminals, i.e. terminals at the disposal of the user for connection of the machine with the supply and with other apparatus and for other use. It can also be applied to internal terminals, the more so as the inherent logic of the system makes extension to almost any case possible. Accordingly it does not cover all cases in detail.

SPECIFICATION

3.1 SCOPE. This Part of the standard applies to a.c. rotating electrical machines without commutators and to d.c. machines with commutators. It defines the direction of rotation and specifies the marking of terminals and the relationship between the direction of rotation and the marking of terminals.

NOTE: Pending international standardization, this Part of the standard does not cover small power machines of sizes specified in AS 1360, Part 11, for which a different system may be used.

3.2 DEFINITION. For the purpose of this standard, the following definition applies:

Direction of rotation—the direction in which the rotor is seen to rotate when viewed as follows:

(a) Machine with one shaft extension—from the end with the shaft extension.

(b) Machine with two shaft extensions of different diameters—from the end with the shaft extension of larger diameter.

(c) Machine with two shaft extensions of the same diameter—

(i) machine with commutator and/or collector-rings at one end of the machine—from the opposite end.

(ii) machine with commutator and collector-rings at opposite ends of the machine—from the collector-ring end.

(iii) machine where (i) and (ii) lead to misunderstanding; or other type of machine—as agreed between the purchaser and the manufacturer.

(d) Machine with no shaft extensions—as for (c).

3.3 MARKING OF TERMINALS OF A.C. MACHINES WITHOUT COMMUTATORS. The terminals of a.c. machines without commutators shall be marked as follows:

(a) *Three-phase windings.* The terminals of three-phase primary windings of synchronous and asynchronous machines shall be marked as shown in Figs 3.1 to 3.9.

The terminals of three-phase secondary windings of asynchronous machines shall be marked as for primary windings except that the letters U, V, W and N shall be replaced by the letters K, L, M and Q respectively.

NOTE: The primary winding is usually on the stator; however, the above rules also cover the reverse situation.

(b) *Two-phase windings.* The terminals of two-phase windings shall be marked as for three-phase windings except that the letters W and M shall be omitted.

(c) *Single-phase windings.* The terminals of the windings of single-phase motors shall be marked as shown in Figs 3.10 and 3.11.

(d) *Excitation windings of synchronous machines.* The terminals of d.c. excitation windings of synchronous machines shall be marked as shown in Fig. 3.12, i.e. as for a d.c. separately excited field winding (see Fig. 3.21).

3.4 MARKING OF TERMINALS OF D.C. MACHINES WITH COMMUTATORS. The terminals of d.c. machines with commutators shall be marked as follows:

(a) *General.* The terminals of the windings of d.c. commutator machines shall be marked as shown in Figs 3.13 to 3.24.

(b) *Polarity of two excitation windings.* The terminals of two excitation windings shall be marked so that the magnetic fields are cumulative when, in each winding, the current passes from the terminal with the lower numerical suffix to the terminal with the higher numerical suffix, and vice versa.

(c) *Polarity of commutating, compensating and armature windings.* The terminals of commutating, compensating and armature windings shall be marked so that the magnetic fields of the commutating and compensating windings are of correct polarity with respect to each other and to the magnetic field of the armature winding when, in all these windings, current passes from the terminal with the lower numerical suffix to the terminal with the higher numerical suffix, and vice versa.

(d) *Armature-circuit interconnections.* The terminals of the armature circuit shall be marked as shown in Figs 3.25 to 3.28 depending on the presence and arrangement of commutating and compensating windings.

(e) *Two or more windings connected to the same terminal.* Where two or more windings are connected to the same terminal, the terminals shall be marked in a manner derived from the marking(s) applicable to one or more of the windings connected thereto (see Figs 3.29 to 3.32).

3.5 RELATIONSHIP BETWEEN DIRECTION OF ROTATION AND MARKING OF TERMINALS.

3.5.1 Polyphase A.C. Machines Without Commutators. For polyphase a.c. machines without commutators, the direction of rotation shall be clockwise if the alphabetical sequence of the terminal letters of a phase group corresponds to the time sequence of the terminal voltages.

NOTE: The reverse direction of rotation may be achieved by reverse time-sequence connection of supply voltage.

3.5.2 D.C. Machines With Commutators. For d.c. machines with commutators, the direction of rotation shall be as shown in Figs 3.29 to 3.35 if connections are made according to those Figures.

NOTES:

1. The polarity of the voltage applied to the machine terminals in Figs 3.29 to 3.35 has no effect on the direction of rotation.
2. The anticlockwise rotation shown in Fig. 3.30 can be reversed by reconnecting the shunt excitation winding as shown in Fig. 3.29.

3.5.3 Single-phase A.C. Motors Without Commutators. For single-phase a.c. motors without commutators, the direction of rotation shall be clockwise if connections are made according to Fig. 3.36.

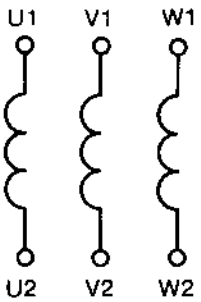


Fig. 3.1. SINGLE WINDING WITH SI. TERMINALS

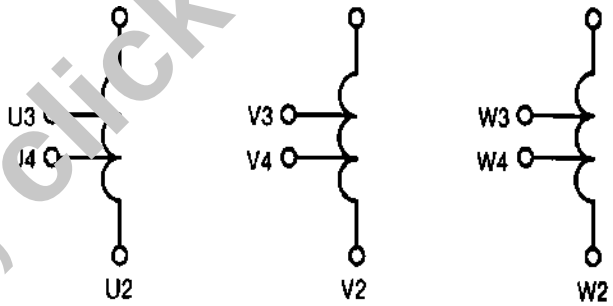
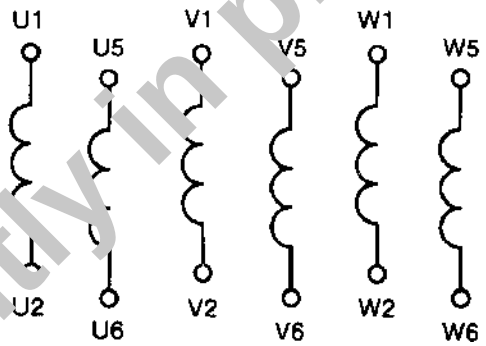
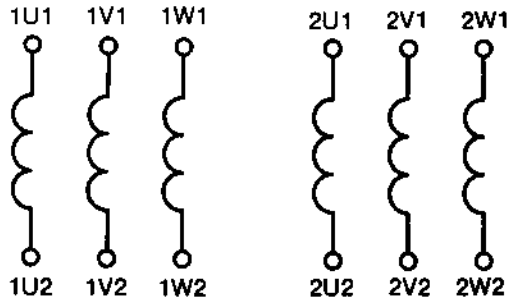


Fig. 3.2. TAPPED WINDING WITH 12 TERMINALS



The interrupted sequence 1, 2, 5, 6, is chosen to distinguish this winding from the tapped winding (Fig. 3.2).

Fig. 3.3. SPLIT WINDING INTENDED FOR SERIES-PARALLEL ARRANGEMENT WITH 12 TERMINALS



When used in change-pole motors with two separate windings for two speeds, the lower (higher) numerical prefix shall indicate the lower (higher) speed.

Fig. 3.4. PAIR OF SEPARATE WINDINGS NOT INTENDED FOR SERIES PARALLEL ARRANGEMENT, EACH WITH SIX TERMINALS