

General requirements for rotating electrical machines —

Part 143: Specification for tests

UDC 621.313-13:621.313.001.4:621.317

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Power Electrical Engineering Standards Committee (PEL/-) to Technical Committee PEL/1, upon which the following bodies were represented:

Association of Consulting Engineers
 Association of Electrical Machinery Trades
 Association of Manufacturers Allied to the Electrical and Electronic Industry (BEAMA Ltd.)
 Association of Supervisory and Executive Engineers
 Bureau of Engineer Surveyors
 ERA Technology Ltd.
 Electricity Supply Industry in England and Wales
 Engineer Surveyors Section of ASTMS
 Engineering Equipment and Materials Users Association
 Health and Safety Executive
 Ministry of Defence
 National Coal Board
 Power Generation Association (BEAMA Ltd.)
 Rotating Electrical Machines Association (BEAMA Ltd.)
 South of Scotland Electricity Board

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Foreword

This Part of BS 4999 has been prepared under the direction of the Power Electrical Engineering Standards Committee and supersedes BS 4999-60:1976 which is withdrawn.

The requirements contained in several clauses of BS 4999-60:1976 have been omitted from this new Part, as they are now included in BS 4999-101 which is based on Publication 34-1 of the International Electrotechnical Commission. No technical changes have been made to the remaining clauses of BS 4999-60:1976, but, editorially, the Part number has not been included in the point numbering system as in Part 60.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 and 2, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of BS 4999 specifies test requirements for, and includes tables of tests applicable to, industrial rotating electrical machines. Test requirements for particular types of machine may be called for in the appropriate Parts of BS 5000.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Test arrangements

The tests specified in this Part of BS 4999 will normally be made at the manufacturer's works, but when normal test arrangements are inapplicable, as may be the case, for example, with certain large or special machines, the tests to be made and the manner of their application should be agreed between the manufacturer and the purchaser at the time of ordering.

NOTE The presence of the purchaser or his representative during tests made to demonstrate compliance with this Part of BS 4999 is a matter for special arrangement before the order is placed.

2.1 Classification of tests

Tests are classified as follows.

2.1.1 Basic tests. Basic tests are those listed in column 3 of Table 1, Table 2 or Table 3 for particular types of machine. These tests are intended to establish compliance with selected, widely applicable requirements of this standard.

Table 1 — Tests on induction machines

No.	Test	Basic	Duplicate	Routine check
1	Resistance of windings (cold)	Yes	Yes	—
2	No load losses and current	Yes	Yes	Yes
3	Locked rotor			
	— current	Yes	Yes	—
	— torque	Yes	—	—
4	Open circuit secondary induced voltage at standstill (wound rotor)	Yes	Yes	Yes
5	Temperature rise	Yes	—	—
6	Power factor and any tests to establish efficiency	Yes	—	—
7	Momentary overload	Yes	—	—
8	High voltage	Yes	Yes	Yes
9	Vibration	Yes	—	—

2.1.2 Duplicate tests. Duplicate tests are those tests of performance applied to a machine that is of the same design and construction as one previously made and tested, and are sufficient to demonstrate that the machine is in accordance with the original design. The tests are listed in column 4 of Table 1, Table 2 and Table 3.

2.1.3 Routine check tests. Routine check tests are those tests applied to a machine to show that it has been assembled correctly, is able to withstand the appropriate high-voltage tests and is in sound working order both electrically and mechanically. They are listed in column 5 of Table 1, Table 2 and Table 3.

Records of these tests will not be provided.

Table 2 — Tests on synchronous machines (including synchronous induction machines)

No.	Test	Basic	Duplicate	Routine check
1	Resistance of windings (cold)	Yes	Yes	—
2	No load losses	Yes (note 1)	Yes (note 1)	Yes (note 1)
3	Locked rotor			
	— current	Yes ^a	Yes ^a	—
	— torque	Yes ^a	—	—
4	Open circuit secondary induced voltage at standstill (wound rotor)	Yes ^b	Yes ^b	Yes ^b
5	Temperature rise	Yes	—	—
6	Tests to establish efficiency	Yes	—	—
7	Momentary overload	Yes	—	—
8	High voltage	Yes	Yes	Yes
9	Vibration	Yes	—	—
10	Short circuit saturation	Yes (note 2)	Yes (note 2)	—
11	Short circuit losses	Yes (note 2)	—	—

NOTE 1 For any synchronous machine the no load losses test may be conducted in either of two ways:
a) driven as a generator on open circuit;
b) motoring at unity power factor on no load.

NOTE 2 As an alternative a zero power factor test may be carried out in place of the short circuit saturation and short circuit losses tests.

^a Motor
^b Synchronous induction machine.

Table 3 — Tests on d.c. machines

No.	Test	Basic	Duplicate	Routine check
1	Resistance of windings (cold)	Yes	Yes	—
2	No load losses and current	Yes	Yes	Yes
3	Temperature rise	Yes	—	—
4	Tests to establish efficiency	Yes	—	—
5	Momentary overload	Yes	—	—
6	Commutation	Yes	Yes	—
7	High voltage	Yes	Yes	Yes
8	Vibration	Yes	—	—

NOTE In the case of d.c. machines intended to operate with a voltage ripple greater than 0.04 per unit peak-to-peak amplitude, special arrangements should be made.

3 Application of tests

Basic tests shall be taken on the first machine on any order; however, the manufacturer may submit, in lieu of basic tests, routine check tests supported by the results of earlier basic tests on a similar machine, unless basic tests were specified and agreed at the time of ordering. For this purpose a similar machine shall be of the same major external dimensions, enclosure, method of cooling and insulation class; the electrical and magnetic loadings of the new machine shall not exceed those values at which the earlier machine would have reached its maximum permissible temperature rise as deduced from the existing tests results. For larger machines these conditions may be difficult to meet and it should therefore be possible, by agreement, to offer tests on machines of comparable size.

Routine check tests shall be performed on all other machines unless duplicate tests have been specified and agreed at the time of ordering.

Evidence of compliance with other Parts of BS 4999 shall be provided by the manufacturer when this has been agreed at the time of ordering. It shall also be agreed whether or not the evidence shall include additional tests.

4 Test certificate

When test certificates are required, they shall be requested at the time of ordering.

5 Temperature rise tests

In addition to the conditions for tests specified in BS 4999-101, the conditions specified in 5.1 and 5.2 shall apply.

5.1 Temperature rise test for machines rated for operation over a small specified range of voltage

When a machine is specified to operate over a small specified range of voltage, e.g. from 380 V to 415 V, the temperature rise test at rated conditions shall be carried out at the voltage specified in 5.1.1 to 5.1.3 unless otherwise specified.

5.1.1 D.C. machines. For d.c. motors the test shall be carried out at the mean voltage of the range; for d.c. generators the test shall be made at the highest voltage.

5.1.2 A.C. motors. For a.c. motors the test shall be carried out at the mean voltage of the range.

5.1.3 A.C. generators and synchronous condensers. For a.c. generators and synchronous condensers the test shall be carried out at any one voltage in the range, as specified.

5.2 Temperature rise test for machines having more than one rating

When a machine has more than one rating, the temperature rise test shall be carried out at that rating which produces the greatest temperature rise. In cases where this cannot be determined beforehand, the machine shall be tested separately at each of its ratings.

6 Vibration tests

Vibration tests to establish compliance with BS 4999-142 shall be carried out on the completely assembled machine running on no-load, at rated voltage and rated speed or at the highest speed of its speed range.

7 Special cases for high-voltage tests

7.1 Where two or more machines operate in series, the test voltage shall be based on the rated voltage or the highest r.m.s. voltage reached between any part of the winding and the frame, or between any two parts of the winding, whichever is the greater.

7.2 For balanced two-phase windings having one terminal in common, the rated voltage for the purpose of calculating the test voltage shall be taken as 1.4 times the voltage of each phase.

7.3 High-voltage tests on machines having graded insulation systems should be the subject of special agreement.

Publications referred to

BS 4999, *General requirements for rotating electrical machines.*

BS 4999-101, *Specification for rating and performance.*

BS 4999-142, *Specification for mechanical performance: vibration.*

BS 5000, *Rotating electrical machines of particular types or for particular applications.*

IEC Publication 34-1, *Rotating electrical machines*¹⁾.

IEC Publication 34-1-1, *Rating and performance.*

¹⁾ Referred to in the foreword only.

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