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Specification for Rotating electrical machines of particular types or for particular applications —

**Part 11: Small-power electric motors
and generators**

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*Incorporating
Amendment Nos. 1, 2,
3 and 4*

Co-operating organizations

The Electrical Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Associated Offices Technical Committee	Department of Trade and Industry
Association of Consulting Engineers*	Electric Cable Makers' Confederation
Association of Manufacturers of Domestic Electrical Appliances	Electrical Contractors' Association (Incorporated)*
Association of Mining Electrical and Mechanical Engineers	Electrical Contractors' Association of Scotland
Association of Supervisory and Executive Engineers*	Electrical Research Association*
British Electrical and Allied Manufacturers' Association	Electricity Council, the Central Electricity Generating Board and the Area Boards in England and Wales*
British Electrotechnical Approvals Board for Household Equipment	Electronic Engineering Association
British Radio Equipment Manufacturers' Association	Engineering Equipment Users' Association*
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	Oil Companies Materials Association*
	Post Office
	South of Scotland Electricity Board*

The Government department and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard.

Association of Electrical Machinery Trades	Ministry of Defence (Army Department)
Engineer Surveyors' Association	Ministry of Defence (Navy Department)
Lloyd's Register of Shipping	Machine Tool Trades Association
London Transport Executive	Rotating Electrical Machines Association

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Foreword

This British Standard revises and supersedes the 1962 edition of BS 170 and supersedes BS 2048-1:1961, which is withdrawn. It is primarily intended to cover light type single-phase electric motors but may also be used for 3-phase or d.c. machines, particularly where mechanical interchangeability of machines suitable for different supplies is of importance.

[Text deleted]

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 21 and a back cover.

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Section 1. Construction and electrical performance

1 Scope

Section 1 of this British Standard specifies the performance of a.c., d.c. and universal rotating electrical machines of any continuous rated output up to and including 0.75 kW or kVA per 1 000 rev/min (synchronous speed for induction machines), and rated voltages up to 250 V d.c. or single-phase a.c., and up to 650 V three-phase a.c. It also applies to short-time rated machines having an equivalent continuous rating to the above. It is primarily intended to cover light type single-phase electric motors but may also be used for three-phase of d.c. machines, particularly where mechanical interchangeability of machines suitable for different supplies is of importance.

Section 2 specifies a range of metric dimensions affecting interchangeability. These dimensions are optional whereas the requirements of Section 1 are mandatory. It is therefore important when enquiring or ordering to state whether the machine is to comply with the dimensional requirements of Section 2 in addition to the constructional and electrical performance requirements of Section 1.

It is primarily intended to cover light type single-phase electric motors but may also be used for three-phase or d.c. machines, particularly where mechanical interchangeability of machines suitable for different supplies is of importance.

NOTE 1 It is recognized that in practice there is some overlap between this standard and BS EN 50347 and that therefore certain ratings of machines may be constructed to comply with either one or the other but not necessarily with both.

NOTE 2 The titles of the publications referred to are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the definitions given in Appendix C apply.

3 General

3.1 Types of machine

The principal types of machine covered by this standard are:

- 1) *Single-phase a.c. machines*
 - split-phase
 - capacitor start, induction run
 - capacitor start, capacitor run (two value capacitor)
 - capacitor start and run (single value capacitor permanently in circuit)
 - shaded pole
 - series commutator
- 2) *Polyphase a.c. machines*
 - cage induction
- 3) *D.C. machines*
 - compound
 - shunt
 - series
 - separately excited
- 4) *A.C./D.C. machines*
 - universal series commutator

3.2 Degrees of protection by enclosure

Types of protective enclosure selected from BS EN 60034-5 are:

(IP 00)	open or non-protected	(IP 45)	hose proof
(IP 20)	protected	(IPW 44)	weather proof ¹⁾
(IP 22)	drip proof	(IP 58)	submersible
(IP 44)	totally enclosed ¹⁾	(BS EN 60079-7)	flameproof

¹⁾ For some types of totally enclosed machine it may be necessary for Category IP 54 to be used.

3.3 Methods of cooling

Methods of cooling selected from BS EN 60034-6 are:

IC 00	free convection
IC 01	self ventilated
IC 00 41	totally enclosed free convection
IC 01 41	totally enclosed fan ventilated
IC 08	drip proof, air over motor ²⁾
IC 08 41	totally enclosed, air over motor ²⁾

3.4 Dimensions

A machine complying with the requirements of this specification is not restricted as to dimensions. If, however, one of the standard frame sizes specified in Clauses 23 to 27 is quoted on the nameplate then the machine shall comply with all the dimensional requirements of those clauses for the particular size of machine and method of mounting.

3.5 Information to be given with enquiry and order

The information to be supplied by the purchaser with his enquiry or order is given in Appendix B.

4 Ratings

4.1 General

The assignment of rating shall be made by the manufacturer to indicate the capabilities of the machine and marked on the rating plate³⁾ in accordance with Clause 21. Since electrical machines have a time-rate of temperature rise, and since the rise of temperature in accordance with this standard is limited, a qualifying term shall be included in the rating to give an indication of the duration for which the machine may run at the assigned values while complying with this standard. Where a machine is manufactured for general purposes, it shall be capable of supplying its rating indefinitely and the qualifying terms shall signify this.

4.2 Classes of rating

In assigning the rating, the manufacturer shall select one of the following rating classes:

- 1) *Continuous rating (CR)*: A statement of the load and conditions, assigned to the machines by the manufacturer, at which the machine may be operated for an unlimited period while complying with the requirements of this standard.
- 2) *Short-time rating (STR)*: A statement of the load time and conditions, assigned to the machine by the manufacturer, at which the machine may be operated for a limited period, starting at the ambient temperature, while complying with the requirements of this standard. The preferred times for short-time ratings are 5, 10, 15, 30 and 60 minutes. The value of short-time shall be marked on the rating plate.

4.3 Output ratings

4.3.1 D.C. generators. The rated output of d.c. generators shall be expressed in watts (W)⁴⁾.

4.3.2 A.C. generators. The rated output of a.c. generators shall be either the apparent electric power expressed in volt amperes (VA)⁴⁾ together with the power factor; or the real power expressed in watts (W)⁴⁾.

4.3.3 Motors. The rated output available at the motor shaft shall be expressed in watts (W)⁴⁾.

4.4 Motors for multiple ratings

4.4.1 Multi-speed motors. For multi-speed motors, a definite rating shall be assigned for each speed.

²⁾ Such machines are used for driving fans, the air from which is drawn over the frame, thus cooling it.

³⁾ When the motors are used for driving fans and are mounted in the air-stream, the output rating should be agreed between the manufacturer and the purchaser. The letter symbols A.O.M. (air over motor) should be added to the rating referred to on the rating plate.

⁴⁾ Large outputs may be expressed in kW or kVA.

4.4.2 Variable-speed motors. For variable-speed motors, definite ratings shall be assigned for the highest and lowest speed of the range specified. If ratings at intermediate speeds are important they shall be specified.

4.5 Voltage ratings

4.5.1 Rated voltage. The rated voltage is the voltage between the line terminals of the machine at rated output.

4.5.2 Generators rated for specified operation over a limited range of voltage. The requirements for a.c. and d.c. generators are described separately below.

4.5.2.1 D.C. generators. For d.c. generators rated to run over a limited range⁵⁾ of voltage the rated output and current shall relate to the highest voltage of the range, unless otherwise specified.

4.5.2.2 A.C. generators. For a.c. generators rated to operate over a limited range⁵⁾ of voltage the rated output and power factor shall relate to any voltage within the range unless otherwise specified.

4.5.3 Motors rated for specified operation over a limited range of voltage. The requirements for a.c. and d.c. motors are specified separately below.

4.5.3.1 D.C. motors. For d.c. motors rated to operate over a limited range⁵⁾ of voltage, the rated output shall relate to the mean voltage of the range unless otherwise specified.

4.5.3.2 A.C. motors. For a.c. motors rated to operate over a limited range⁵⁾ of voltage, the rated output shall relate to the mean voltage in the range.

5 General conditions

5.1 Preferred voltages

The preferred voltages are:

for d.c. machines	100–250 V
for a.c. machines	
single-phase	240 V
polyphase	415 V

5.2 Preferred frequency

The preferred frequency for alternating current machines is 50 Hz.

5.3 Preferred number of phases for alternating current machines

The preferred number of phases for alternating current machines is either one or three.

5.4 Machines for non-preferred voltages, frequency and number of phases

Machines for use on systems employing voltages, frequencies and phases other than those specified in 5.1, 5.2 and 5.3, but which comply in all other respects with the requirements of this standard, come within the scope of this standard.

5.5 Waveform (a.c. machines)

The voltage waveform of an a.c. generator shall be virtually sinusoidal.

NOTE Where the waveform is of importance the deviation from a true sine wave and the load at which this should occur should be the subject of agreement between the manufacturer and the purchaser.

A.C. motors shall be capable of working on a supply having a waveform which is virtually sinusoidal.

NOTE Where the waveform is not sinusoidal (e.g. where a motor is fed from a static inverter) the performance of the motor should be the subject of agreement between the manufacturer and the purchaser.

⁵⁾ A limited voltage range is to be understood as being a range (maximum minus minimum) of the order of 10 % of the mean voltage.