

**DRAFT SOUTH AFRICAN STANDARD (DSS):  
PUBLIC ENQUIRY STAGE**Document number: **61/1804-1/2**Reference: **SANS 1804-1**Date of circulation: **2007/04/24**Closing date: **2007/06/27**

Number and title:

**SANS 1804-1: 2007****Induction motors Part 1: IEC requirements**

Remarks:

**None****PLEASE NOTE:**

- The technical committee, StanSA **IC61** responsible for the preparation of this standard has reached consensus that the attached document should become a South African standard. It is now made available by way of public enquiry to all interested and affected parties for public comment, and to the technical committee members for record purposes. Any comments should be sent by the indicated closing date, either by mail, or by fax, or by e-mail to

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- The public enquiry stage will be repeated if the technical committee agrees to significant technical changes to the document as a result of public comment. Less urgent technical comments will be considered at the time of the next amendment.

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# **SOUTH AFRICAN NATIONAL STANDARD**

## **Induction motors**

### **Part 1: IEC requirements**

Draft South Africa

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Published by Standards South Africa  
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tel: 012 428 7911 fax: 012 344 1568 international code + 27 12  
[www.stansa.co.za](http://www.stansa.co.za)  
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**SANS 1804-1:2007**

Edition 2

**Table of changes**

Change No.	Date	Scope

**National foreword**

This South African standard was approved by National Committee StanSA TC 61, *Rotating machinery*, in accordance with procedures of Standards South Africa, in compliance with annex 3 of the WTO/TBT agreement.

This edition supersedes edition 1.2 (SABS 1804-1:2001).

Draft South Africa

**Contents**

	Page
Foreword	
<b>1</b> Scope .....	3
<b>2</b> Normative references .....	3
<b>3</b> Definitions .....	3
<b>4</b> Requirements .....	
<b>5</b> Marking.....	
<b>Annexes</b>	
<b>A</b> Applicability of the requirements specified in SABS IEC 60034 and SABS IEC 60072 .....	
<b>B</b> Bibliography .....	

Draft South Africa

**SANS 1804-1:2007**

Edition 2

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Draft South Africa

## Induction motors

### Part 1: IEC requirements

#### 1 Scope

**1.1** This part of SANS 1804 specifies requirements for induction motors that are intended to comply with the mandatory requirements of SANS 60034 and SANS 60072.

**1.2** This part of SANS 1804 also covers those requirements of SANS 60034 and SANS 60072 that need to be specified by the purchaser or agreed upon between the manufacturer and the purchaser.

NOTE 1 When a motor is to be installed and used under abnormal conditions (for example, in the presence of high humidity, corrosive atmospheres, or high or low temperatures, or both), advice on its rating, installation and use should be sought from the manufacturer.

NOTE 2 Induction motors for use in hazardous areas have to comply with the requirements of relevant standards such as SANS 60079-0, SANS 60079-1, SANS 60079-15, SANS 61241-0 and SANS 61241-1.

NOTE 3 The purchaser's attention is drawn to the limitations imposed by distribution authorities concerning permissible starting currents of motors. In cases of doubt, the relevant bylaws should be consulted.

#### 2 Normative references

The following documents contain provisions which, through reference in this text, constitute provisions of this part of SANS 1804. All documents are subject to revision and, since any reference to a document is deemed to be a reference to the latest edition of that document, parties to agreements based on this part of SANS 1804 are encouraged to take steps to ensure the use of the most recent editions of the documents indicated below. Information on currently valid national and international standards can be obtained from Standards South Africa.

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

SANS 60034-2/IEC 60034-2 (SABS IEC 60034-2), *Rotating electrical machines – Part 2: Methods for determining losses and efficiency of rotating electrical machinery from tests (excluding machines for traction vehicles)*.

SANS 60034-2A/IEC 60034-2A (SABS IEC 60034-2A), *Rotating electrical machines – Part 2: Methods for determining losses and efficiency of rotating electrical machinery from tests (excluding machines for traction vehicles) – First supplement: Measurement of losses by the calorimetric method*.

**SANS 1804-1:2007**

Edition 2

SANS 60034-5/IEC 60034-5 (SABS IEC 60034-5), *Rotating electrical machines – Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification.*

SANS 60034-6/IEC 60034-6 (SABS IEC 60034-6), *Rotating electrical machines – Part 6: Methods of cooling (IC Code).*

SANS 60034-7/IEC 60034-7 (SABS IEC 60034-7), *Rotating electrical machines – Part 7: Classification of types of construction, mounting arrangements and terminal box position (IM Code.)*

SANS 60034-8/IEC 60034-8, *Rotating electrical machines – Part 8: Terminal markings and direction of rotation of rotating machines.*

SANS 60034-9/IEC 60034-9, *Rotating electrical machines – Part 9: Noise limits.*

SANS 60034-11/IEC 60034-11, *Rotating electrical machines – Part 11: Thermal protection*

SANS 60034-12/IEC 60034-12, *Rotating electrical machines – Part 12: Starting performance of single-speed three-phase cage induction motors.*

SANS 60034-14/IEC 60034-14, *Rotating electrical machines – Part 14: Mechanical vibration of certain machines with shaft heights 56 mm and higher - Measurement, evaluation and limits of vibration severity.*

SANS 60034-15/IEC 60034-15 (SABS IEC 60034-15), *Rotating electrical machines – Part 15: Impulse voltage withstand levels of rotating a.c. machines with form-wound stator coils.*

SANS 60034-17/IEC 60034-17, *Rotating electrical machines – Part 17: Cage induction motors when fed from converters - Application guide.*

SANS 60034-18-1/IEC 60034-18-1, *Rotating electrical machines – Part 18: Functional evaluation of insulation systems – Section 1: General guidelines.*

SANS 60034-18-21/IEC 60034-18-21, *Rotating electrical machines – Part 18: Functional evaluation of insulation systems – Section 21: Test procedures for wire-wound windings – Thermal evaluation and classification.*

SANS 60034-18-22/IEC 60034-18-22, *Rotating electrical machines – Part 18: Functional evaluation of insulation systems – Section 22: Test procedures for wire-wound windings – Classification of changes and insulation component substitutions.*

SANS 60034-18-31/IEC 60034-18-31, *Rotating electrical machines – Part 18: Functional evaluation of insulation systems – Section 31: Test procedures for form-wound windings – Thermal evaluation and classification of insulation systems used in machines up to and including 50 MVA and 15 kV.*

SANS 60034-18-32/IEC 60034-18-32, *Rotating electrical machines – Part 18: Functional evaluation of insulation systems – Section 32: Test procedures for form-wound windings – Electrical evaluation of insulation systems used in machines up to and including 50 MVA and 15 kV.*

SANS 60034-18-33/IEC 60034-18-33, *Rotating electrical machines – Part 18: Functional evaluation of insulation systems – Section 33: Test procedures for form-wound windings – Multifactor functional evaluation – Endurance under combined thermal and electrical stresses of insulation systems used in machines up to and including 50 MVA and 15 kV.*

SANS 60072-1/IEC 60072-1, *Dimensions and output series for rotating electrical machines – Part 1: Frame numbers 56 to 400 and flange numbers 55 to 1 080.*

SANS 60072-2/IEC 60072-2, *Dimensions and output series for rotating electrical machines – Part 2: Frame numbers 355 to 1 000 and flange numbers 1 180 to 2 360.*

SANS 60072-3/IEC 60072-3, *Dimensions and output series for rotating electrical machines – Part 3: Small built-in motors – Flange numbers BF10 to BF50.*

NOTE SANS 60034-3, SANS 60034-4, SANS 60034-10 and IEC 60034-16 apply to synchronous machines.

### **3 Definitions**

For the purposes of this document, the definitions given in the relevant parts of SANS 60034 apply.

### **4 Requirements**

Induction motors shall comply with those design, constructional, physical and electrical requirements of the relevant parts of SANS 60034 and SANS 60072 that are indicated in the appropriate of columns 4, 5 and 6 of table A.1 (see annex A) as being applicable and in column 7 as being mandatory, and also with those optional requirements that are specified by the purchaser or agreed upon between the purchaser and the manufacturer.

### **5 Marking**

The marking of all motors shall comply with the applicable mandatory requirements for marking as specified in table A.1 (see annex A).

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**Annex A**

(normative)

**Applicability of the requirements  
specified in SANS 60034 and SANS 60072**

Table A.1 indicates the applicability of IEC requirements to induction motors.

Columns 1 to 3 list the requirements given in SANS 60034 and SANS 60072.

Columns 4 to 6 indicate the applicability (Y) or the non-applicability (N) of the requirements to the different types of induction motor.

Column 7 indicates whether the applicable requirement is mandatory (M) or optional (O).

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Table A.1 — Applicability of IEC requirements to induction motors

1 SANS number	2 Title/Heading	3 Clause	4 Three- phase		6 Single- phase	7 Mandatory or optional
			LV	MV		
			60034-1	<b>Rating and performance</b>		
	Scope	1	Y	Y	Y	M
	Normative references	2	Y	Y	Y	M
	Terms and definitions	3	Y	Y	Y	M
	<b>Duty</b>	4				
	Declaration of duty	4.1	Y	Y	Y	M
	Duty types	4.2	Y	Y	Y	M
	Duty type S1 – Continuous running duty	4.2.1	Y	Y	Y	O
	Duty type S2 – Short-time duty	4.2.2	Y	Y	Y	O
	Duty type S3 – Intermittent periodic duty	4.2.3	Y	Y	Y	O
	Duty type S4 – Intermittent periodic duty with starting	4.2.4	Y	Y	Y	O
	Duty type S5 – Intermittent periodic duty with electric braking	4.2.5	Y	Y	Y	O
	Duty type S6 – Continuous-operation periodic duty	4.2.6	Y	Y	Y	O
	Duty type S7 – Continuous-operation periodic duty with electric braking	4.2.7	Y	Y	Y	O
	Duty type S8 – Continuous-operation periodic duty with related load/speed changes	4.2.8	Y	Y	Y	O
	Duty type S9 – Duty with non-periodic load and speed variations	4.2.9	Y	Y	Y	O
	Duty type S10 – Duty with discrete constant loads	4.2.10	Y	Y	Y	O
	<b>Rating</b>	5				
	Assignment of rating	5.1	Y	Y	Y	M
	Classes of rating	5.2	Y	Y	Y	M
	Rating for continuous running duty	5.2.1	Y	Y	Y	O
	Rating for short-time duty	5.2.2	Y	Y	Y	O
	Rating for periodic duty	5.2.3	Y	Y	Y	O
	Rating for non-periodic duty	5.2.4	Y	Y	Y	O
	Rating for duty with discrete constant loads	5.2.5	Y	Y	Y	O
	Rating for equivalent loading	5.2.6	Y	Y	Y	O
	Selection of a class of rating	5.3	Y	Y	Y	M
	Allocating of outputs to class of rating	5.4	Y	Y	Y	M
	Rated output	5.5	Y	Y	Y	M
	D.C. generators	5.5.1	N	N	N	–
	A.C. generators	5.5.2	N	N	N	–
	Motors	5.5.3	Y	Y	Y	M
	Synchronous condensers	5.5.4	Y	Y	Y	M
	Rated voltage	5.6	Y	Y	Y	M
	D.C. generators	5.6.1	N	N	N	–
	A.C. generators	5.6.2	N	N	N	–
	Co-ordination of voltages and outputs	5.7	N	Y	N	O
	Machines with more than one rating	5.8	Y	Y	Y	O

**SANS 1804-1:2007**

Edition 2

**Table A.1** (continued)

1 SANS number	2 Title/Heading	3 Clause	4		6 Single- phase	7 Mandatory or optional
			5 Three- phase			
			LV	MV		
60034-1	<b>Site operating conditions</b>	6				
	General	6.1	Y	Y	Y	O
	Altitude	6.2	Y	Y	Y	O
	Maximum ambient air temperature	6.3	Y	Y	Y	O
	Minimum ambient air temperature	6.4	Y	Y	Y	O
	Water coolant temperature	6.5	Y	Y	Y	O
	Storage and transport	6.6	Y	Y	Y	M
	Purity of hydrogen coolant	6.7	N	Y	N	O
	<b>Electrical operating conditions</b>	7				
	Electrical supply	7.1	Y	Y	Y	M
	Form and symmetry of voltages and currents	7.2	Y	Y	Y	M
	A.C. motors	7.2.1	Y	Y	Y	M
	A.C. generators	7.2.2	N	N	N	—
	Synchronous machines	7.2.3	N	N	N	—
	D.C. motors supplied from static power converters	7.2.4	N	N	N	—
	Voltage and frequency variations during operation	7.3	Y	Y	Y	M
	Three-phase a.c. machines operating on unearthed systems	7.4	Y	Y	N	M
	Voltage (peak and gradient) withstand levels	7.5	Y	Y	Y	M
	<b>Thermal performance and tests</b>	8				
	Thermal class	8.1	Y	Y	Y	M
	Reference coolant	8.2	Y	Y	Y	M
	Conditions for thermal tests	8.3	Y	Y	Y	M
	Electrical supply	8.3.1	Y	Y	Y	M
	Temperature of machine before test	8.3.2	Y	Y	Y	O
	Temperature of coolant	8.3.3	Y	Y	Y	O
	Measurement of coolant temperature during test	8.3.4	Y	Y	Y	M
	Temperature rise of a part of a machine	8.4	Y	Y	Y	M
	Methods of measurement of temperature	8.5	Y	Y	Y	O
	Resistance method	8.5.2	Y	Y	Y	O
	Embedded temperature detector (ETD) method	8.5.3	Y	Y	Y	O
	Thermometer method	8.5.4	Y	N	Y	O
	Determination of winding temperature	8.6	Y	Y	Y	M
	Choice of method	8.6.1	Y	Y	Y	O
	Determination by resistance method	8.6.2	Y	Y	Y	O
	Determination by ETD method	8.6.3	Y	Y	Y	O
	Determination by thermometer method	8.6.4	Y	N	Y	O
Duration of thermal tests	8.7	Y	Y	Y	M	
Rating for continuous running duty	8.7.1	Y	Y	Y	O	
Rating for short-time duty	8.7.2	Y	Y	Y	O	
Rating for periodic duty	8.7.3	Y	Y	Y	O	
Ratings for non-periodic duty and for duty with discrete constant loads	8.7.4	Y	Y	Y	O	
Determination of the thermal equivalent time constant of machines of duty type S9	8.8	Y	Y	Y	O	

Table A.1 (continued)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
60034-1	Measurement of bearing temperature	8.9	Y	Y	Y	O
	Limits of temperature and of temperature rise	8.10	Y	Y	Y	O
	Indirect cooled windings	8.10.1	Y	Y	Y	M
	Direct cooled windings	8.10.2	Y	Y	Y	M
	Adjustments to take account of hydrogen purity on test	8.10.3	N	Y	N	M
	Permanently short-circuited windings, magnetic cores and all structural components (other than bearings) whether or not in contact with insulation	8.10.4	Y	Y	Y	M
Commutators and slip-rings, open or enclosed and their brushes and brushgear	8.10.5	Y	Y	M	M	
	<b>Other performance and tests</b>	9				
	Routine tests	9.1	Y	Y	Y	M
	Withstand voltage test	9.2	Y	Y	Y	M
	Occasional excess current	9.3	Y	N	Y	M
	General	9.3.1	Y	N	Y	M
	Generators	9.3.2	N	N	N	M
	A.C. motors (except commutator motors)	9.3.3	Y	N	Y	M
	Commutator machines	9.3.4	N	N	N	M
	Momentary excess torque for motors	9.4	Y	Y	Y	M
	Polyphase induction motors and d.c. motors	9.4.1	Y	Y	N	M
	Polyphase synchronous motors	9.4.2	Y	Y	N	O
	Other motors	9.4.3	N	N	N	M
	Pull-up torque	9.5	N	N	Y	M
	Safe operating speed of cage induction motors	9.6	Y	Y	Y	M
	Overspeed	9.7	Y	Y	Y	M
	Short-circuit current for synchronous machines	9.8	Y	Y	Y	M
	Short-circuit withstand test for synchronous machines	9.9	N	N	M	M
	Commutation test for commutator machines	9.10	N	N	N	M
	Total harmonic distortion (THD) for synchronous machines	9.11	N	N	N	M
	General	9.11.1	N	N	N	M
	Limits	9.11.2	N	N	N	M
	Tests	9.11.3	N	N	N	M
	<b>Rating plates</b>	10				
	General	10.1	Y	Y	Y	M
	Marking	10.2	Y	Y	Y	M
	<b>Miscellaneous requirements</b>	11				
	Protective earthing of machines	11.1	Y	Y	Y	M
	Shaft-end key(s)	11.2	Y	Y	Y	M
	<b>Tolerances</b>	12	Y	Y	Y	O

**SANS 1804-1:2007**

Edition 2

**Table A.1** (continued)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
	<b>Electromagnetic compatibility (EMC)</b>					
	General	13.1	Y	N	Y	M
	Immunity	13.2	Y	N	Y	M
	Emission	13.3	Y	N	Y	M
	Immunity tests	13.4	Y	N	Y	M
	Emission tests	13.5	Y	N	Y	M
	<b>Safety</b>		Y	Y	Y	M
			LV	MV		
60034-2	<b>Methods for determining losses and efficiency of rotating electrical machinery from tests (excluding machines for traction vehicles)</b>					
	<b>Section 1 – General</b>					
	Scope	1	Y	Y	Y	O
	Object	2	Y	Y	Y	O
	General	3	Y	Y	Y	O
	List of symbols	3.1	Y	Y	Y	O
	Definitions	4	Y	Y	Y	O
	Reference temperature	5	Y	Y	Y	O
	<b>Section 2 – D.C. machines</b>					
	Losses to be included	6	N	N	N	–
	Excitation circuit losses	6.1	N	N	N	–
	Constant losses	6.2	N	N	N	–
	Load losses	6.3	N	N	N	–
	Determination of efficiency	7	N	N	N	–
	Summation of losses	7.1	N	N	N	–
	Total loss measurement	7.2	N	N	N	–
	Direct measurement of efficiency	7.3	N	N	N	–
	<b>Section 3 – Polyphase induction motors</b>					
	Losses to be included	8	Y	Y	N	M
	Constant losses	8.1	Y	Y	N	M
	Load losses	8.2	Y	Y	N	M
	Additional load losses	8.3	Y	Y	N	M
	Determination of efficiency	9	Y	Y	N	M
	Summation of losses	9.1	Y	Y	N	O
	Total loss measurement	9.2	Y	Y	N	O
	Direct measurement of efficiency	9.3	Y	Y	N	O

Table A.1 (continued)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
60034-2	<b>Section 4 – Synchronous machines</b>					
	Losses to be included	10	N	N	N	–
	Constant losses	10.1	N	N	N	–
	Load losses	10.2	N	N	N	–
	Excitation circuit losses	10.3	N	N	N	–
	Additional load losses	10.4	N	N	N	–
	Determination of efficiency	11	N	N	N	–
	Summation of losses	11.1	N	N	N	–
	Total loss measurement	11.2	N	N	N	–
	Direct measurement of efficiency	11.3	N	N	N	–
		<b>Section 5 – Methods of test</b>				
	General	12	Y	Y	Y	O
	Calibrated machine test	13	Y	Y	Y	O
	Zero power factor test	14	N	N	N	–
	Retardation method	15	Y	Y	Y	O
	General	15.1	Y	Y	Y	O
	Composition of retardation tests	15.2	Y	Y	Y	O
	Retardation test procedure	15.3	Y	Y	Y	O
	Taking of measurements	15.4	Y	Y	Y	O
	Electrical back-to-back test	16	Y	Y	Y	O
	Calorimetric test	17	Y	Y	Y	O
	Schedule of preferred tests					
	D.C. machines	18	Y	Y	N	O
	Polyphase induction motors	18.1	N	N	N	–
	Synchronous machines	18.2	Y	Y	N	O
		18.3	N	N	N	–

**SANS 1804-1:2007**

Edition 2

**Table A.1** (continued)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
60034-2A	<b>Methods for determining losses and efficiency of rotating electrical machinery from tests (excluding machines for traction vehicles) — Measurement of losses by the calorimetric method</b>					
	<b>Section 1 – General</b>					
	Determination of losses $P_1$ by measurement of the volume rate of flow and rise in temperature of the cooling medium	1	Y	Y	Y	○
	Losses $P_1$ measured electrically using the calorimetric calibration method	2	Y	Y	Y	○
	General	3	Y	Y	Y	○
	Generation of losses for calibration	3.1	Y	Y	Y	○
	Measurement of actual losses	3.2	Y	Y	Y	○
	Conditions to be met during calibration and test	3.3	Y	Y	Y	○
		3.4	Y	Y	Y	○
	Stable conditions	4	Y	Y	Y	○
	Losses $P_2$ not transmitted to the cooling medium	5	Y	Y	Y	○
	Losses external to the reference surface $P_e$	6	Y	Y	Y	○
	<b>Section 2 – Water as the cooling medium</b>					
	Application and basic relationship	7	Y	Y	Y	○
	Measurement of water flow	8	Y	Y	Y	○
	Recommendations for measurement of quantity of water	8.1	Y	Y	Y	○
	Measurement of the temperature rise of the water	9	Y	Y	Y	○
Positioning of thermometer pockets	9.1	Y	Y	Y	○	
Installation of the measuring device inside the thermometer pocket	9.2	Y	Y	Y	○	

Table A.1 (continued)

1	2	3	4	5	6	7	
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional	
			LV	MV			
60034-2A	Measuring accuracy	10	Y	Y	Y	O	
	<b>Section 3 . Air as the cooling medium</b>						
	Application and basic relationship	11	Y	Y	Y	O	
	Determination of the mass rate of flow	12	Y	Y	Y	O	
	Measurement of the airflow	12.1	Y	Y	Y	O	
	Measurement of air density	12.2	Y	Y	Y	O	
	Measurement of the temperature rise of the air	13	Y	Y	Y	O	
	Measurement with open-circuit ventilation	13.1	Y	Y	Y	O	
	Measurement with closed-circuit ventilation	13.2	Y	Y	Y	O	
	Determination of the specific heat capacity of the air	14	Y	Y	Y	O	
	Measuring accuracy	15	Y	Y	Y	O	
	<b>Section 4 . Practical considerations</b>						
	Preparations for calorimetric measurements with liquid coolants	16	Y	Y	Y	O	
Connections and equipment for calorimetric measurements with liquid coolants	17	Y	Y	Y	O		
60034-5	<b>Classification of degrees of protection provided by the integral design of rotating electrical machines (IP code)</b>						
	Scope and object	1	Y	Y	Y	M	
	Normative references	2	Y	Y	Y	M	
	Designation	3	Y	Y	Y	O	
	Single characteristic numerals	3.1	Y	Y	Y	O	



**SANS 1804-1:2007**

Edition 2

**Table A.1** (continued)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
60034-5	Supplementary letters	3.2	Y	Y	Y	O
	Degrees of protection , first characteristic numeral	4	Y	Y	Y	O
	Indicates the degree of protection	4.1	Y	Y	Y	M
	Compliance of an enclosure	4.2	Y	Y	Y	M
	External fans	4.3	Y	Y	Y	O
	Drain holes	4.4	Y	Y	Y	O
	Degrees of protection , second characteristic numeral	5	Y	Y	Y	
	Indicates the degree of protection	5.1	Y	Y	Y	M
	Compliance of an enclosure	5.2	Y	Y	Y	M
	Marking	6	Y	Y	Y	M
	General requirements for tests	7				
	Adequate clearance	7.1	Y	Y	Y	M
	Low-voltage machines (rated voltages not exceeding a.c.: 1 000 V and d.c.:1 500 V)	7.1.1	Y	N	Y	M
	High-voltage machines (rated voltages exceeding a.c.: 1 000 V and d.c.:1 500 V)	7.1.2		N	N	M
	Tests for first characteristic numeral	8	Y	Y	Y	M
	Tests for second characteristic numeral	9	Y	Y	Y	M
	Test conditions	9.1	Y	Y	Y	M
	Acceptance conditions	9.2	Y	Y	Y	M
	Requirements and tests for open weather-protected machines	10	Y	Y	Y	M

Table A.1 (continued)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
60034-6	<b>Methods of cooling (IC Code)</b>					
	Scope	1	Y	Y	Y	M
	Definitions	2	Y	Y	Y	M
	Designation system	3	Y	Y	Y	M
	Arrangement of the IC Code	3.1	Y	Y	Y	M
	Application of designations	3.2	Y	Y	Y	O
	Designation of same circuit arrangements for different parts of a machine	3.3	Y	Y	Y	O
	Designation of different circuit arrangements for different parts of a machine	3.4	Y	Y	Y	O
	Designation of direct cooled winding	3.5	Y	Y	Y	O
	Designation of stand-by or emergency cooling conditions	3.6	Y	Y	Y	O
	Combined designations	3.7	Y	Y	Y	O
	Replacement of characteristic numerals	3.8	Y	Y	Y	O
	Examples of designations and sketches	3.9	Y	Y	Y	O
	Characteristic numeral for circuit arrangement	4	Y	Y	Y	O
	Characteristic letter for coolant	5	Y	Y	Y	O
	Designated coolants	5.1	Y	Y	Y	O
	Any other coolant	5.2	Y	Y	Y	O
	Coolant not yet selected	5.3	Y	Y	Y	O
	Replacement of temporarily used letter Y	5.4	Y	Y	Y	O
	Characteristic numeral for method of movement	6	Y	Y	Y	O
60034-7	<b>Classification of types of construction and mounting arrangements (IM Code)</b>					
	<b>Section 1 – Scope and definitions</b>					
	Scope	1.1	Y	Y	Y	M
	Definitions	1.2	Y	Y	Y	M
	<b>Section 2 – Code I (alphanumeric designation)</b>					
	Designation of machines with horizontal shafts	2.1	Y	Y	Y	O
	Designation of machines with vertical shafts	2.2	Y	Y	Y	O
	<b>Section 3 – Code II (all-numeric designation)</b>					
	Designation	3.1	Y	Y	Y	O
	Significance of the first numeral	3.2	Y	Y	Y	O
	Significance of the fourth numeral	3.3	Y	Y	Y	O
	Significance of the second and third numerals	3.4	Y	Y	Y	O
	Examples of designations	3.5	Y	Y	Y	O

**SANS 1804-1:2007**

Edition 2

**Table A.1** (continued)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
60034-8	<b>Terminal markings and direction of rotation of rotating machines</b>					
	Scope	1	Y	Y	Y	M
	Normative references	2	Y	Y	Y	M
	Terms and definitions	3	Y	Y	Y	M
	Symbols	4	Y	Y	Y	M
	Direction of rotation	5	Y	Y	Y	M
	Rules for terminal markings	6	Y	Y	Y	M
	General	6.1	Y	Y	Y	M
	Application	6.1.1	Y	Y	Y	M
	Marking instructions	6.1.2	Y	Y	Y	M
	Alphanumeric marking notation	6.1.3	Y	Y	Y	M
	Duplicate winding terminals	6.1.4	Y	Y	Y	M
	Shared terminals	6.1.5	Y	Y	Y	M
	Omissions	6.1.6	Y	Y	Y	M
	Earthing terminal	6.1.7	Y	Y	Y	M
	Suffixes	6.2	Y	Y	Y	M
	Winding elements	6.2.1	Y	Y	Y	M
	Internal connections	6.2.2	Y	Y	Y	M
	Tapping points	6.2.3	Y	Y	Y	M
	Prefixes	6.3	Y	Y	Y	M
	Winding identification for categories of machines	6.4	Y	Y	Y	M
	Three phase machines	6.4.1	Y	Y	N	M
	Two phase machines	6.4.2	N	N	Y	M
	Single phase machines	6.4.3	N	N	Y	M
	Multiple three-phase group (e.g. six phase) machines	6.4.4	Y	Y	N	M
	Synchronous machines	6.5	Y	Y	N	M
	DC machines	6.6				
	Relation between terminal markings and direction of rotation	6.7	Y	Y	Y	M
	Multi-phase machines	6.7.1	Y	Y	N	M
	Multi-phase, multi speed machines	6.7.2	Y	Y	N	M
	Single phase machines	6.7.3	N	N	Y	M
	Multi three-phase group (e.g. six phase) machines	6.7.4	Y	Y	N	M
	DC machines	6.7.5	N	N	N	-
	Terminal marking figures	6.8	Y	Y	Y	M
	Three-phase asynchronous machines	6.8.1	Y	Y	N	M
	Single-phase asynchronous machines	6.8.2	N	N	Y	M
	Multiple three-phase group (six phase) machines	6.8.3	Y	Y	N	M
	DC machines	6.8.4	N	N	N	-
	Auxiliary terminal marking rules	7	Y	Y	Y	M
	General	7.1	Y	Y	Y	M
	Marking	7.2	Y	Y	Y	M
	Power related devices	7.2.1	Y	Y	Y	M
	Thermal and measurement devices	7.2.2	Y	Y	Y	M
	Switches	7.2.3	Y	Y	Y	M

Table A.1 (continued)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
60034-9	<b>Noise limits</b>					
	Scope and object	1	Y	Y	Y	M
	Normative references	2	Y	Y	Y	M
	Terms and definitions	3	Y	Y	Y	M
	Methods of measurement	4	Y	Y	Y	
	Sound level measurement and calculation of sound power level	4.1	Y	Y	Y	O
	The maximum permissible sound power levels	4.2	Y	X	X	O
	Other methods of precision or engineering grade accuracy	4.3	Y	X	X	O
	A simpler but less accurate method	4.4	Y	Y	Y	O
	Test conditions	5	X	Y	Y	M
Noise level limits	6	Y	Y	Y	M	
60034-11	<b>Rules for protection of rotating electrical machines</b>					
	Scope	1	Y	N	Y	O
	Normative references	2	Y	N	Y	O
	Terms and definitions	3	Y	N	Y	M
	Thermal protection limits	4	Y	N	Y	O
	Protection against thermal overloads with slow variation	5	Y	Y	Y	O
	Protection against thermal overloads with rapid variation	5	Y	Y	Y	O
	Restart after tripping	6	Y	Y	Y	O
	Type tests	7	Y	Y	Y	O
	General	8	Y	Y	Y	O
	Verification of temperature due to thermal overloads with slow variation	8.1	Y	Y	Y	O
Verification of temperature due to thermal overloads with rapid variation	8.2	Y	Y	Y	O	
	8.3	Y	Y	Y	O	
Routine tests	9	Y	Y	Y	O	

**SANS 1804-1:2007**

Edition 2

**Table A.1** (continued)

1 SANS number	2 Title/Heading	3 Clause	4		6 Single- phase	7 Mandatory or optional
			5 Three-phase			
			LV	MV		
60034-12	<b>Starting performance of single-speed three-phase cage induction motors for voltages up to and including 1000 V</b>					
	Scope	1	Y	N	N	M
	Normative references	2	Y	N	N	M
	Definitions	3	Y	N	N	M
	Symbols	4	Y	N	N	M
	Designation	5	Y	N	N	M
	General	5.1	Y	N	N	M
	Design N	5.2	Y	N	N	M
	Design NY	5.3	Y	N	N	M
	Design H	5.4	Y	N	N	M
	Design HY	5.5	Y	N	N	M
	Design N requirements	6	Y	N	N	M
	Torque characteristics	6.1	Y	N	N	M
	Locked rotor apparent power	6.2	Y	N	N	M
	Starting requirements	6.3	Y	N	N	M
	Design NY starting requirements	7	Y	N	N	M
	Design H requirements	8	Y	N	N	M
Starting torque	8.1	Y	N	N	M	
Locked rotor apparent power	8.2	Y	N	N	M	
Starting requirements	8.3	Y	N	N	M	
Design HY starting requirements	9	Y	N	N	M	
60034-14	<b>Mechanical vibration of certain machines with shaft heights 56 mm and higher – measurement, evaluation and limits of vibration</b>					
	Scope	1	Y	Y	N	M
	Normative references	2	Y	Y	N	M
	Terms and definitions	3	Y	Y	N	M
	Measurement quantities	4	Y	Y	N	M
	General	4.1	Y	Y	N	M
	Vibration magnitude	4.2	Y	Y	N	M
	Relative shaft vibration	4.3	Y	Y	N	M
	Measurement equipment	5	Y	Y	N	M
	Machine mounting	6	Y	Y	N	M
	General	6.1	Y	Y	N	M
	Free suspension	6.2	Y	Y	N	O
	Rigid mounting	6.3	Y	Y	N	O
	Active environment determination	6.4	Y	Y	N	M
	Conditions of measurement	7	Y	Y	N	M
	Key	7.1	Y	Y	N	M
	Measurement positions	7.2	Y	Y	N	M
	Test conditions	7.3	Y	Y	N	M
	Vibration transducer	7.4	Y	Y	N	M
	Limits of bearing housing vibration	8	Y	Y	N	M
Limits of vibration magnitude	8.1	Y	Y	N	M	
Limits of vibration velocity with twice frequency for a.c. machines	8.2	Y	Y	N	M	
Axial vibration	8.3	Y	Y	N	M	
Limits of relative shaft vibration	9	N	Y	N	M	

Table A.1 (continued)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
60034-15	<b>Impulse voltage withstand levels of rotating a.c. machines with form-wound stator coils</b>					
	Scope	1	N	Y	N	M
	Normative references	2	N	Y	N	M
	Definitions	3	N	Y	N	M
	Impulse voltage withstand levels	4	N	Y	N	M
	Tests	5	N	Y	N	M
	Random sample tests	5.1	N	Y	N	M
Routine tests	5.2	N	Y	N	M	
60034-17	<b>Guide for the application of cage induction motors when fed from converters</b>					
	Scope	1	Y	N	N	O
	Reference documents	2	Y	N	N	O
	Characteristics of the motor	3	Y	N	N	O
	Frequency spectrum of voltage and/or currents	4	Y	N	N	O
	Additional losses	5	Y	N	N	O
	Torque deratings during converter operation	6	Y	N	N	O
	Oscillating torques	7	Y	N	N	O
	Magnetically excited noise	8	Y	N	N	O
	Service life of the insulation system	9	Y	N	N	O
Shaft voltages	10	Y	N	N	O	
60034-18-1	<b>Functional evaluation of insulation systems</b>					
	<b>General guidelines</b>					
	Scope	1	Y	Y	Y	O
	Normative references	2	Y	Y	Y	O
	Definitions	3	Y	Y	Y	M
	General aspects of functional evaluation	4	Y	Y	Y	O
	Effects of aging factors	4.1	Y	Y	Y	O
	Reference insulation system	4.2	Y	Y	Y	O
	Functional tests	4.3	Y	Y	Y	O
	Thermal functional tests	5	Y	Y	Y	O
	General aspects of thermal functional tests	5.1	Y	Y	Y	O
	Test objects and test specimens	5.2	Y	Y	Y	O
	Thermal functional test procedures	5.3	Y	Y	Y	O
	Thermal aging subcycle	5.4	Y	Y	Y	O
	Diagnostic subcycle	5.5	Y	Y	Y	O
	Analysing, reporting, and classification	5.6	Y	Y	Y	O
	Electrical functional tests	6	Y	Y	Y	O
	General aspects of electrical functional tests	6.1	Y	Y	Y	O
	Test objects	6.2	Y	Y	Y	O
	Electrical functional test procedures	6.3	Y	Y	Y	O
Analysing and reporting	6.4	Y	Y	Y	O	
Mechanical functional tests	7	Y	Y	Y	O	
Environmental functional tests	8	Y	Y	Y	O	
Multifactor functional tests	9	Y	Y	Y	O	

**SANS 1804-1:2007**

Edition 2

**Table A.1** (continued)

1 SANS number	2 Title/Heading	3 Clause	4		6 Single- phase	7 Mandatory or optional	
			5 Three- phase				
			LV	MV			
60034-18-21	<b>Test procedures for wire-wound windings – Thermal evaluation and classification</b>						
	Scope	1	Y	Y	Y	O	
	Normative references	2	Y	Y	Y	O	
	General considerations	3	Y	Y	Y	O	
	Relationship to section 1	3.1	Y	Y	Y	O	
	Standard procedures	3.2	Y	Y	Y	O	
	Reference insulation system	3.3	Y	Y	Y	O	
	Test objects	3.4	Y	Y	Y	O	
	Verification of diagnostic tests	3.5	Y	Y	Y	O	
	Thermal aging test procedure	3.6	Y	Y	Y	O	
	Aging temperatures and subcycle lengths	3.7	Y	Y	Y	O	
	Procedure 1 – Motorette test procedure	4	Y	Y	Y	O	
	General	4.1	Y	Y	Y	O	
	Test objects	4.2	Y	Y	Y	O	
	Thermal aging subcycle	4.3	Y	Y	Y	O	
	Diagnostic subcycle	4.4	Y	Y	Y	O	
	Analysing, reporting and classification	4.5	Y	Y	Y	O	
	Procedure 2 – Motor test procedure	5	Y	Y	Y	O	
	General	5.1	Y	Y	Y	O	
	Test objects	5.2	Y	Y	Y	O	
	Thermal aging subcycle	5.3	Y	Y	Y	O	
	Diagnostic subcycle	5.4	Y	Y	Y	O	
	Analysing, reporting and classification	5.5	Y	Y	Y	O	
	60034-18-21	Procedure 3 – Test procedure for stator windings in slots	6	Y	Y	Y	O
		General	6.1	Y	Y	Y	O
		Test objects	6.2	Y	Y	Y	O
		Thermal aging subcycle	6.3	Y	Y	Y	O
Diagnostic subcycle		6.4	Y	Y	Y	O	
Analysing, reporting and classification		6.5	Y	Y	Y	O	
Procedure 4 – Test procedure for pole windings		7	N	N	N	–	
General		7.1	N	N	N	–	
Test objects		7.2	N	N	N	–	
Thermal aging subcycle		7.3	N	N	N	–	
Diagnostic subcycle		7.4	N	N	N	–	
Analysing, reporting and classification		7.5	N	N	N	–	
Procedure 5 – Test procedure for rotor windings in slots		8	Y	Y	N	O	
General		8.1	Y	Y	N	O	
Test objects		8.2	Y	Y	N	O	
Thermal aging subcycle		8.3	Y	Y	N	O	
Diagnostic subcycle		8.4	Y	Y	N	O	
Analysing, reporting and classification		8.5	Y	Y	N	O	

Table A.1 (continued)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
60034-18-22	<b>Test procedures for wire-wound windings – Classification of changes and insulation component substitutions</b>					
	Scope	1	Y	Y	Y	O
	Normative references	2	Y	Y	Y	O
	General	3	Y	Y	Y	O
	Category I insulation components	3.1	Y	Y	Y	O
	Category II insulation components	3.2	Y	Y	Y	O
	Definition of generic identity	3.3	Y			O
	Documentation	4	Y	Y	Y	O
	General substitution procedures	5	Y	Y	Y	O
	Component substitution category	6	Y	Y	Y	O
	Category I component substitution	6.1	Y	Y	Y	O
	Category II component substitution	6.2	Y	Y	Y	O
	Sealed tube test procedure	7	Y	N	N	–
	General	7.1	N	N	N	–
	Test apparatus	7.2	N	N	N	–
	Sample preparation	7.3	N	N	N	–
	Contents of tubes	7.4	N	N	N	–
	Preparation of tubes	7.5	N	N	N	–
	Thermal conditioning	7.6	Y	Y	Y	O
	Opening procedure	7.7	Y	Y	Y	O
	Evaluation of samples	7.8	Y	Y	Y	O
	Requirement	7.9	Y	Y	Y	O

Draft South Africa



**SANS 1804-1:2007**

Edition 2

**Table A.1** (continued)

1 SANS number	2 Title/Heading	3 Clause	4		6 Single- phase	7 Mandatory or optional
			Three- phase			
			LV	MV		
60034-18-31	<b>Test procedures for form-wound windings – Thermal evaluation and classification of insulation systems used in machines up to and including 50 MVA and 15 kV</b>					
	Scope	1	Y	Y	N	O
	Normative references	2	Y	Y	N	O
	General considerations	3	Y	Y	N	O
	Relationship to section 1	3.1	Y	Y	N	O
	Designation of test procedures	3.2	Y	Y	N	O
	Reference insulation system	3.3	Y	Y	N	O
	Verification of diagnostic tests	3.4	Y	Y	N	O
	Test objects and test specimens	4	Y	Y	N	O
	Construction of test objects	4.1	Y	Y	N	O
	Number of test specimens	4.2	Y	Y	N	O
	Quality assurance tests	4.3	Y	Y	N	O
	Initial diagnostic tests	4.4	Y	Y	N	O
	Thermal aging subcycles	5	Y	Y	N	O
	Aging temperatures and subcycle lengths	5.1	Y	Y	N	O
	Means of heating	5.2	Y	Y	N	O
	Aging procedures	5.3	Y	Y	N	O
	Diagnostic subcycle	6	Y	Y	N	O
	Mechanical test	6.1	Y	Y	N	O
	Moisture test	6.2	Y	Y	N	O
	Voltage test	6.3	Y	Y	N	O
	Other diagnostic tests	6.4	Y	Y	N	O
	Analysing, reporting and classification	7	Y	Y	N	O
60034-18-32	<b>Test procedures for form-wound windings – Electrical evaluation of insulation systems used in machines up to and including 50 MVA and 15 kV</b>					
	Scope	1	Y	Y	N	O
	Normative references	2	Y	Y	N	O
	General considerations	3	Y	Y	N	O
	Relationship to section 1	3.1	Y	Y	N	O
	Selection and designation of test procedures	3.2	Y	Y	N	O
	Reference insulation system	3.3	Y	Y	N	O
	General characteristics of test procedures	3.4	Y	Y	N	O
Extent of tests	3.5	Y	Y	N	O	

Table A.1 (continued)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
60034-18-32	Test objects	4	Y	Y	N	O
	Construction of test objects	4.1	Y	Y	N	O
	Number of turns	4.2	Y	Y	N	O
	Number of test specimens	4.3	Y	Y	N	O
	Quality assurance tests	4.4	Y	Y	N	O
	Initial diagnostic tests	4.5	Y	Y	N	O
	Electrical aging subcycle	5	Y	Y	N	O
	Voltage levels and intended test levels	5.1	Y	Y	N	O
	Test temperatures during electrical endurance testing	5.2	Y	Y	N	O
	Aging procedure	5.3	Y	Y	N	O
	Diagnostic subcycle	6	Y	Y	N	O
	Voltage tests	6.1	Y	Y	N	O
	Other diagnostic tests	6.2	Y	Y	N	O
	Analysing the data, reporting and evaluation	7	Y	Y	N	O
	Full evaluation	7.1	Y	Y	N	O
	Reduced evaluation	7.2	Y	Y	N	O
	60034-18-33	<b>Test procedures for form-wound windings – Multifactor functional evaluation – Endurance under combined thermal and electrical stresses of insulation systems used in machines up to and including 50 MVA and 15 kV</b>				
Scope		1	Y	Y	N	O
Normative references		2	Y	Y	N	O
General		3	Y	Y	N	O
Relationship to section 1		3.1	Y	Y	N	O
Designation of test procedures		3.2	Y	Y	N	O
Reference insulation system		3.3	Y	Y	N	O
Verification of diagnostic tests		3.4	Y	Y	N	O
Characteristics of test procedures		3.5	Y	Y	N	O
Means of heating and definition of thermal stress level		3.6	Y	Y	N	O
Means of electrical aging		3.7	Y	Y	N	O
Definition of aging subcycle duration		3.8	Y	Y	N	O
Reference operating conditions		3.9	Y	Y	N	O

**SANS 1804-1:2007**

Edition 2

**Table A.1** (continued)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
60034-18-33	Test objects	4	Y	Y	N	O
	Construction of test objects	4.1	Y	Y	N	O
	Number of test specimens	4.2	Y	Y	N	O
	Quality assurance tests	4.3	Y	Y	N	O
	Initial diagnostic tests	4.4	Y	Y	N	O
	Aging subcycle	5	Y	Y	N	O
	Aging stress levels	5.1	Y	Y	N	O
	Duration and number of aging subcycles	5.2	Y	Y	N	O
	Procedure 1: aging subcycle with aging stresses applied simultaneously	5.3	Y	Y	N	O
	Procedure 2: aging subcycle with sequentially applied thermal and electrical stresses	5.4	Y	Y	N	O
	Procedure 3: aging subcycle when single-point procedure is applicable	5.5	Y	Y	N	O
	Diagnostic subcycle	6	Y	Y	N	O
	Mechanical tests	6.1	Y	Y	N	O
	Moisture tests	6.2	Y	Y	N	O
	Voltage tests	6.3	Y	Y	N	O
	Other diagnostic tests	6.4	Y	Y	N	O
	Analysing the data, reporting and evaluation	7	Y	Y	N	O
	Analysing the data	7.1	Y	Y	N	O
	Reporting	7.2	Y	Y	N	O
	Evaluation	7.3	Y	Y	N	O
60072-1	<b>Frame numbers 56 to 400 and flange numbers 55 to 1 080</b>					
	Scope	1	Y	Y	Y	O
	Letter-symbols for dimensions	2	Y	Y	Y	O
	Designation of machines	3	Y	Y	Y	O
	Location of the terminal box	4	Y	Y	Y	O
	Machines with feet	4.1	Y	Y	Y	O
	Machines with flange only	4.2	Y	Y	Y	O

Table A.1 (continued)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
60072-1	Position of holes in the mounting flange	5	Y	Y	Y	O
	Fixing dimensions	6	Y	Y	Y	O
	Foot-mounted machines	6.1	Y	Y	Y	O
	Flange-mounted machines	6.2	Y	Y	Y	O
	Shaft extension, keys and keyway dimensions. Greatest permissible torques on continuous duty for a.c. motors	7	Y	Y	Y	
	Tolerances for flange-mounted machines	8				
	Shaft extension run-out	8.1	Y	Y		M
	Concentricity of spigot diameter and perpendicularity of mounting face of flange to shaft	8.2	Y	Y		M
	Methods of measurement	8.3				M
	Tolerances for machines other than flange-mounted machines	8.4	Y	Y		M
	Preferred rated output values	9	Y	Y	Y	O
Dimensional sketches	10	Y	Y	Y	O	
60072-2	<b>Frame numbers 355 to 1 000 and flange numbers 1 180 to 2 360</b>					
Scope	1	Y	Y	N	O	
Letter-symbols for dimensions	2	Y	Y	N	O	
Designation of machines	3	Y	Y	N	O	
Foot-mounted machines	3.1	Y	Y	N	O	
Flange-mounted machines	3.2	Y	Y	N	O	
Foot-mounted and flange-mounted machines	3.3	Y	Y	N	O	
Fixing dimensions	4	Y	Y	N	M	
Shaft-heights	4.1	Y	Y	N	M	
A dimensions	4.2	Y	Y	N	O	

**SANS 1804-1:2007**

Edition 2

**Table A.1** (concluded)

1	2	3	4	5	6	7
SANS number	Title/Heading	Clause	Three-phase		Single-phase	Mandatory or optional
			LV	MV		
60072-2	B dimensions	4.3	Y	Y	N	O
	C dimensions	4.4	Y	Y	N	O
	Mounting flange dimensions	4.5	Y	Y	N	M
	Shaft extension dimensions, keys and keyways. Greatest permissible torques on continuous duty for a.c. motors	5	Y	Y	N	M
	Preferred rated output values	6	Y	Y	N	O
	Dimensional sketches	7	Y	Y	N	O
	Principal dimensions, machines with undefined shape, and with feet down	7.1	Y	Y	N	M
	Principal dimensions, machines with undefined shape, and with feet up	7.2	Y	Y	N	M
	Principal dimensions, machines with defined shape, and with feet down	7.3	Y	Y	N	M
	Shaft extension dimensions	7.4	Y	Y	N	M
	Principal dimensions, machines with defined shape and with mounting flange, with spigot	7.5	Y	Y	N	M
	Principal dimensions, machines with defined shape and with mounting flange, without spigot	7.6	Y	Y	N	M
60072-3	<b>Small built-in motors – Flange numbers BF10 to BF50</b>					
	Scope	1	Y	N	Y	O
	Dimensions	2	Y	N	Y	M

## **Annex B**

(informative)

### **Bibliography**

SANS 60079-0/IEC 60079-0, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements.*

SANS 60079-1/IEC 60079-1, *Electrical apparatus for explosive gas atmospheres – Part 1: Flameproof enclosures "d".*

SANS 60079-15, *Electrical apparatus for explosive gas atmospheres – Part 15: Construction, test and marking of type of protection "n" electrical apparatus.*

SANS 61241-0/IEC 61241-0, *Electrical apparatus for use in the presence of combustible dust – Part 0: General requirements.*

SANS 61241-1/IEC 61241-1, *Electrical apparatus for use in the presence of combustible dust – Part 1: Protection by enclosures "tD".*

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