

# **SOUTH AFRICAN NATIONAL STANDARD**

## **Induction motors**

### **Part 2: Low-voltage three phase standard motors**

Committee draft

Committee draft

**SANS 1804-2:2007**  
Edition 1.4

**Table of changes**

<b>Change No.</b>	<b>Date</b>	<b>Scope</b>
Amdt 1	2001	Amended to update and clarify definitions, to incorporate a wider voltage variation and to update a referenced standard.
Amdt 2	2004	Amended to change the units for tolerance given in column 5 of table 3, and to update referenced standards.
Amdt 3	2006	Amended to add requirements for motor performance and to update referenced standards.
Amdt 4	2007	Amended to add requirements for concentricity and perpendicularity of flange-mounted motors.

**Foreword**

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

This document was published in xxxxx 2007.

This document supersedes SANS 1804-2:2004 (edition 1.2).

A vertical line in the margin indicates where the text has been technically modified by amendment No. 4.

SANS 1804 consists of the following parts, under the general title *Induction motors*:

*Part 1: IEC requirements.*

*Part 2: Low-voltage three-phase fan-lar motors.*

*Part 3: Low-voltage three-phase, intermittently-rated wound-rotor motors.*

*Part 4: Single-phase induction motors.*

Annex A forms an integral part of this part of SANS 1804. Annexes B to G are for information only.

Committee draft

## Introduction

The scope of IEC 60034, *Rotating electrical machines*, is extremely wide and refers to rotating machines and not to induction motors specifically. There is also a wide range of power and voltage requirements, from a few watts to megawatts and from less than 100 V to many kilovolts. Because most induction motors already comply dimensionally with SANS 60072, relevant requirements from SANS 60072 have also been included.

Some three-phase induction motors have been considered standard in South Africa for nearly 20 years due to the output/frame size/shaft/flange relationships having been standardized and produced by all the local manufacturers.

This part of SANS 1804 is intended to maintain the established relationships in order to provide for replacement standard motors within South Africa.

Only the requirements previously considered necessary for South African conditions and that are not covered in SANS 1804-1, *IEC requirements*, have been included in this part of the standard.

The working groups charged with the revision of existing induction motor standards have agreed that, in order to assist local manufacturers to compete on the same level with international manufacturers, it is necessary to produce an induction motor standard that will encompass all the relevant requirements specified in IEC 60034 that pertain to induction motors.

Motors that comply with this part of SANS 1804 are intended for the local market. SANS 1804-1 should be consulted for motors for the export market.

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.

Induction motors for use in hazardous areas should comply with the requirements of relevant standards such as SANS 60079-1, SANS 60079-15 and SANS 61241-1. **Amdt 2; amdt 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.

The relevant optional requirements of SANS 1804-1 that have to be specified by the purchaser and those that have to be agreed upon between the manufacturer and the purchaser are listed in annex A.

On 26 January 1997, some regulations of the Electricity Act, 1987 (Act No.41 of 1987), were amended by the Minister of Minerals and Energy Affairs to permit a variation of  $\pm 10\%$  of the standard voltage in a distribution system with a nominal system voltage lower than 500 V. These regulations are defined in SANS 101 (and its subsequent amendment). **Amdt 1**

This has serious repercussions for existing induction motors and for future production.

In the past, motors have been designed to operate with a  $\pm 5\%$  voltage variation, with occasional short periods at  $\pm 10\%$ .

The standard voltage is now 400/230 V, so some induction motors may be required to run continuously at 440/253 V or 360/207 V, depending on their position within the system.

This means that, in future, motors will have to be designed for the  $\pm 10\%$  voltage variation. The active material will have to be increased in most cases but occasionally it might result in an increase in frame size.

Existing motors might not be able to cope with this variation and might have to be rewound or replaced.

**Contents**

	Page
Foreword	
Introduction .....	1
<b>1</b> Scope .....	<b>3</b>
<b>2</b> Normative references .....	<b>3</b>
<b>3</b> Definitions .....	<b>3</b>
<b>4</b> General requirements .....	
<b>4.1</b> Mandatory requirements .....	
<b>4.2</b> Lifting facilities .....	
<b>4.3</b> Terminal boxes .....	
<b>4.4</b> Terminal bases .....	
<b>4.5</b> Dimensions of frames, shafts and flanges .....	
<b>4.6</b> Clearances and creepage distances .....	
<b>5</b> Electrical and physical requirements .....	
<b>5.1</b> Allocation of rated output, shaft number and flange number .....	
<b>5.2</b> Cooling of airstream-rated motors .....	
<b>5.3</b> Flame-retardant and self-extinguishing attributes .....	
<b>5.4</b> Absorption resistance .....	
<b>5.5</b> Standard site conditions .....	
<b>5.6</b> Motor performance .....	<b>Amdt 1</b>
	<b>Amdt 3</b>
<b>6</b> Tests .....	
<b>6.1</b> Test for flame retardance and self-extinguishing .....	
<b>6.2</b> Absorption resistance test .....	
<b>Annex A</b> (normative) Notes to purchasers .....	
<b>Annex B</b> (informative) Detailed information that should be provided in tender invitations .....	
<b>Annex C</b> (informative) Quality verification of low-voltage three-phase standard motors .....	
<b>Annex D</b> (informative) Type tests and routine tests .....	
<b>Annex E</b> (informative) Recommended open-circuit rotor voltages .....	
<b>Annex F</b> (informative) Recommendations for the size of supply cable and cable inlet .....	
<b>Annex G</b> (informative) Bibliography .....	

## Induction motors

### Part 2:

### Low-voltage three-phase standard motors

## 1 Scope

This part of SANS 1804 specifies requirements for low-voltage three-phase alternating-current standard induction motors of the cage and wound-rotor (slip-ring) types, in frame sizes up to and including 315, for voltages up to and including 1 100 V between lines and at a frequency of 50 Hz.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of SANS 1804. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, 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 standards indicated below. Information on currently valid national and international standards can be obtained from Standards South Africa.

SANS 1700-3-3/ISO 273, *Fasteners – Part 3: Forms, dimensions and designations – Section 3: Clearance holes for bolts and screws.* Amdt 3

SANS 1804-1 (SABS 1804-1), *Induction motors – Part 1: IEC requirements.*

SANS 6003-1/IEC 60034-1, *Rotating electrical machines – Part 1: Rating and performance.*

SANS 6003-2/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).* Amdt 3

## 3 Definitions

For the purposes of this part of SANS 1804, the definitions given in SANS 1804-1 (that are applicable to low-voltage standard motors) and the following definitions apply:

### 3.1

#### **acceptable**

acceptable to the authority administering this part of SANS 1804 or to the parties concluding the purchase contract, as relevant Amdt 1

**3.2**

**airstream-rated motor (pad-mounted motor rod-mounted motor)**

motor that drives an axial-flow fan, and that is cooled only by the fan airstream, the method of mounting the motor being by supports attached to pads or brackets or by rods screwed into pads or brackets

**3.3**

**duty cycle**

variation of load in which the cycle time is too short for thermal equilibrium to be attained in the first cycle

**3.4**

**guaranteed efficiency**

efficiency (as certified by the manufacturer) under normal operating conditions at rated output or at a specified percentage of rated output

**3.5**

**momentary excess torque**

dynamic mechanical shaft load, expressed as a percentage of full-load torque of 160% for 15 s when rated voltage and frequency are applied to the motor

**Amdt 1**

**3.6**

**standard direction of rotation**

clockwise direction when the driving end of the motor is viewed

**3.7**

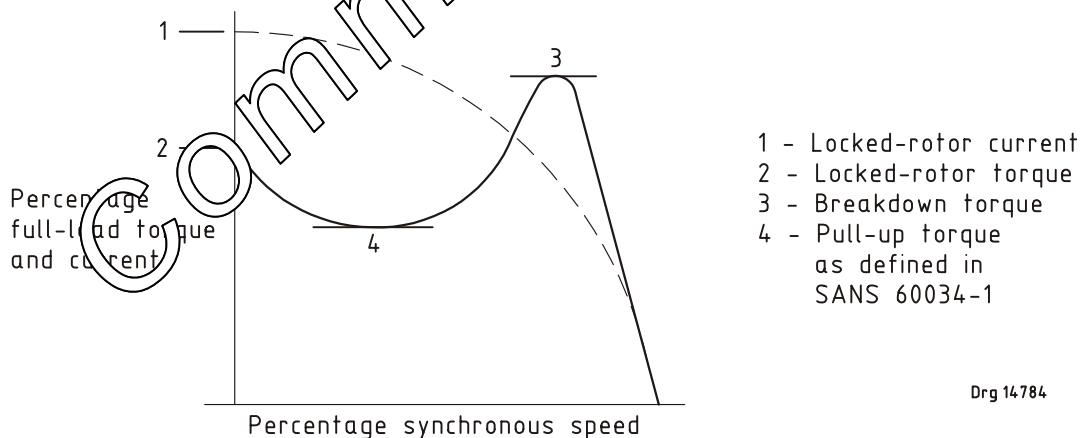
**standard motor**

motor in which the dimensions are in accordance with the appropriate table of this part of SANS 1804

**3.8**

**starting performance**

change in the percentage full-load torque and current as a function of the percentage synchronous speed during start-up of the motor (see figure 1)



Drg 14784

**Figure 1 — Starting performance**

**4 General requirements**

**4.1 Mandatory requirements**

Low-voltage three-phase standard motors shall comply with the relevant mandatory requirements of SANS 1804-1, except where modified in this part of SANS 1804.

**Amdt 1**

## 4.2 Lifting facilities

A motor of frame size 100 and larger shall have acceptable motor lifting facilities that are strong enough to carry the full mass of the motor.

Amdt 1

## 4.3 Terminal boxes

**4.3.1** Terminal boxes shall be of a material that is flame retardant, self-extinguishing and absorption resistant.

**4.3.2** The edges of openings for the passage of conductors from the motor winding into the terminal box shall be so rounded as to prevent abrasion of the conductor insulation or, alternatively, an acceptable bushing or an acceptable insulating compound shall prevent the conductors from coming into contact with the metal surrounding the opening.

## 4.4 Terminal bases

Terminal bases (if fitted) on which live parts are mounted shall be of flame-retardant, self-extinguishing, absorption-resistant material.

## 4.5 Dimensions of frames, shafts and flanges

### 4.5.1 Frames

The fixing dimensions of the frame of a foot-mounted and large-mounted motor and of an airstream-rated cage motor shall conform to the values given in the relevant columns of tables 2, 3 and 4, appropriate to the required frame size (see annex A).

NOTE The frame sizes given in tables 2 and 3 are numerically equal to the shaft height, in millimetres, and the letters, when relevant, indicate the frame length as follows:

S: a short motor;

M: a medium length motor; and

L: a long motor.

(These designations are based on the ratio of length  $B$  to height  $H$ . Motors for which the ratio of  $B$  to  $H$  is approximately the same, have the same designation.)

### 4.5.2 Shafts

Each motor shall be fitted with a single cylindrical shaft extension of the number (i.e. nominal diameter, in millimetres) given in columns 4, 5, 6 and 7 of table 2, column 12 of table 3 or column 2 of table 4, as applicable.

### 4.5.3 Flanges

**4.5.3.1** The dimensions of the flange fitted to a motor shall conform to the values given in table 3, appropriate to the required flange number (see annex A).

**4.5.3.2** When the shaft and flange are tested in accordance with 6.3, the spigot and shaft shall be concentric and the flange and shaft shall be mutually perpendicular, in each case to within the value for the normal tolerance class given in column 2 of table 11 or, if so required by the purchaser, the precision tolerance class given in column 3, appropriate to the flange number given in column 1 of table 11.

Amdt 4

# SANS 1804-2:2007

Edition 1.4

NOTE The flange numbers given in column 1 of tables 3 and 11 are numerically equal to the pitch circle diameter in millimetres and the letter F = flange. **Amdt 4**

## 4.5.4 Shaft run-out (flange-mounted motors)

The shaft run-out, measured in accordance with 7.5, shall not exceed the appropriate value for the normal tolerance class given in column 2 of table 12 or, if so required by the purchaser, the precision tolerance class given in column 3. **Amdt 4**

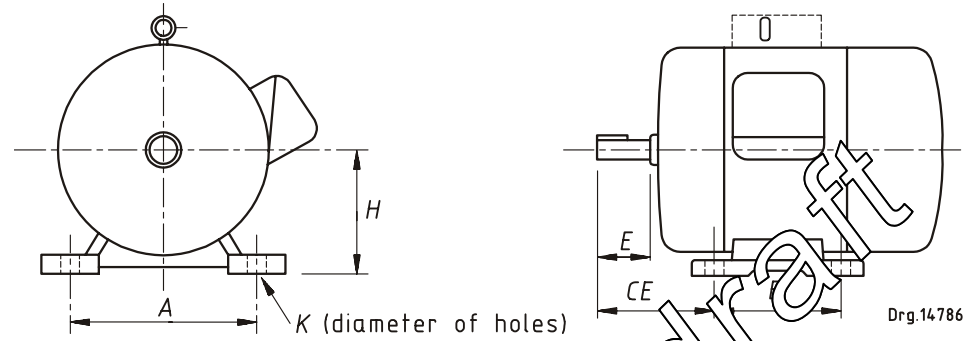
## 4.6 Clearances and creepage distances

When terminals are fitted with cable lugs of the size recommended by the motor manufacturer, the distances between terminal assemblies, and between a terminal assembly and an adjacent metal part, shall be such that the clearances (measured in a straight air path) and the creepage distances (measured by the shortest path along the surface of any non-displaceable insulating barrier) are as given in table 1.

Table 1 — Clearances and creepage distances

1	2	3	4	5
Supply voltage $E$	Minimum clearance mm		Minimum creepage distance mm	
V	Terminal assembly to metal parts	Between terminal assemblies	Terminal assembly to metal parts	Between terminal assemblies
$E \leq 250$	2,5	2,5	3,0	3,0
$250 < E \leq 660$	10,0	10,0	12,5	12,5
$660 < E \leq 1\ 100$	14,0	16,0	18,0	20,0

Table 2 — Fixing dimensions for foot-mounted frames (all enclosures)



1 Frame size	2 Nominal shaft height $H$ mm	3 Tolerance mm	4 Shaft number				8 $E^{(1)}$ Nominal mm	9 $A$		12 $B$		13 $CE$		15 $K^{(2)}$ , min. mm
			5 IP 44 – IP 55		6 IP 20 – IP 25			Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	
			7 3 000 r/min	$\leq 1\ 500$ r/min	3 000 r/min	$\leq 1\ 500$ r/min								
56	56	+0 -0,5	9	9	-	-	90	$\pm 1$	71	$\pm 1$	56	+0 -1	6	
63	63	+0 -0,5	11	11	-	-	83	$\pm 1$	80	$\pm 1$	63	+0 -1	7	
71	71	+0 -0,5	14	14	-	-	30	$\pm 1$	90	$\pm 1$	75	+0 -1	7	
80	80	+0 -0,5	19	19	-	-	40	$\pm 1,5$	100	$\pm 1,5$	90	+0 -1,5	9	
90 S	90	+0 -0,5	24	24	-	-	50	$\pm 1,5$	100	$\pm 1,5$	106	+0 -1,5	9	
90 L	90	+0 -0,5	24	24	-	-	50	$\pm 1,5$	125	$\pm 1,5$	106	+0 -1,5	9	
100 L	100	+0 -0,5	28	28	-	-	60	$\pm 1,5$	140	$\pm 1,5$	123	+0 -1,5	12	
112 M	112	+0 -0,5	28	28	-	-	60	$\pm 1,5$	140	$\pm 1,5$	130	+0 -2	12	
132 S	132	+0 -0,5	38	38	-	-	80	$\pm 2$	140	$\pm 1,5$	169	+0 -2	12	

Table 2 (continued)

1	2	3	4				8	9		10		11		12		15			
			Frame size	Nominal shaft height <i>H</i> mm	Tolerance mm	Shaft number				<i>E</i> <sup>(1)</sup>			<i>B</i>		<i>CE</i>		<i>K</i> <sup>(2)</sup> , min. mm		
						IP 44 – IP 55		IP 20 – IP 25		Nominal mm	Nominal mm	Tolerance mm	Nominal mm	Tolerance mm	Nominal mm			Tolerance mm	
						3 000 r/min		≤ 1 500 r/min	3 000 r/min										≤ 1 500 r/min
132 M	132	+0 -0,5	38	38	–	–	80	216	± 2	178	± 2	169	+0 -2	12					
160 M	160	+0 -0,5	42	42	48	48	110	254	± 2,5	218	± 2,5	218	+0 -3	14					
160 L	160	+0 -0,5	42	42	48	48	110	254	± 2,5	254	± 2,5	218	+0 -3	14					
180 M	180	+0 -0,5	48	48	55	55	110	279	± 2,5	241	± 2,5	231	+0 -3	14					
180 L	180	+0 -0,5	48	48	55	55	110	279	± 2,5	279	± 2,5	231	+0 -3	14					
200 M	200	+0 -0,5	–	–	60	60	140	279	± 2,5	267	± 2,5	273	+0 -3	18					
200 L	200	+0 -0,5	55	55	–	–	140	318	± 2,5	305	± 2,5	243	+0 -3	18					
200 L	200	+0 -0,5	–	–	60	60	140	318	± 2,5	305	± 2,5	273	+0 -3	18					
225 S	225	+0 -0,5	–	60	–	–	140	356	± 3	286	± 3	289	+0 -4	18					
225 M	225	+0 -0,5	55	–	–	–	110	356	± 3	311	± 3	259	+0 -4	18					
225 M	225	+0 -0,5	–	60	60	65	140	356	± 3	311	± 3	289	+0 -4	18					
250 S	250	+0 -0,5	60	60	65	75	140	406	± 3	311	± 3	308	+0 -4	22					
250 M	250	+0 -0,5	60	60	65	75	140	406	± 3	349	± 3	308	+0 -4	22					
280 S	280	+0 -0,5	65	75	65	–	140	457	± 3	368	± 3	330	+0 -4	22					

Table 2 (concluded)

1	2	3	Shaft number				8	9		10		11		12		13	14	15
			IP 44 – IP 55		IP 20 – IP 25			E <sup>1)</sup>		A		B		CE				
			3 000	≤ 1 500	3 000	≤ 1 500		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance			
Frame size	Nominal shaft height H	Tolerance	r/min	r/min	r/min	r/min	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
280 S	280	+0 -0,5	–	80	–	80/85	170	457	± 3	368	± 3	360	+0 4	22				
280 M	280	+0 -0,5	65	75	65	–	140	457	± 3	470	± 3	330	+0 4	22				
280 M	280	+0 -0,5	–	80	–	80/85	170	457	± 3	419	± 3	360	+0 -4	22				
315 S	315	+0 -1	65	–	70	–	140	508	± 3	406	± 3	356	+0 -4	27				
315 S	315	+0 -1	–	80/85	–	90	170	508	± 3	406	± 3	386	+0 -4	27				
315 M	315	+0 -1	65	–	70	–	140	457	± 3	457	± 3	356	+0 -4	27				
315 M	315	+0 -1	–	80/85	–	90	170	508	± 3	457	± 3	386	+0 -4	27				

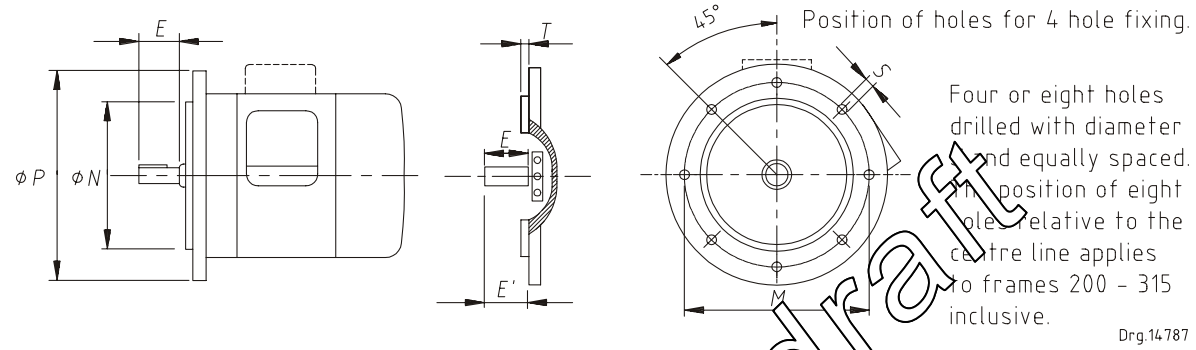
1) Dimension from shaft end to shaft shoulder or outer face of bearing C, whichever is the shorter.

2) Dimensions are selected from the coarse series in SANS 1700-3. H14 tolerances are applicable.

Amdt 3

Committee draft

**Table 3 — Fixing dimensions for flange-mounted frames**



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Flange number	$M$		$N$		$P^{(1)}$ max.	$T$		Holes <sup>(2)</sup>			Shaft number	$E^{(3)}$		$E^{(4)}$	
	Nominal	Tolerance	Nominal	Tolerance		Nominal	Tolerance	Number	Drilled holes, min.	Tapped holes		Nominal	Tolerance	Nominal	Tolerance
	mm	mm	mm	$\mu\text{m}$	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
F65	65	$\pm 0,25$	50	+0 -39	80	2,5	+0 -0,5	4	-	M5	9	20	+0 -1	20	+2 -0
F75	75	$\pm 0,25$	60	+0 -46	90	2,5	+0 -0,5	4	-	M5	11	23	+0 -1	23	+2 -0
F85	85	$\pm 0,3$	70	+0 -46	105	2,5	+0 -0,5	4	-	M6	9 14	20 30	+0 +0 -1	20 30	+2 +2,5 -0
F100	100	$\pm 0,3$	80	+0 -46	120	3	+0 -0,5	4	-	M6	11 19	23 40	+0 +0 -1 -1,5	23 40	+2 +2,5 -0

Amdt 2

Table 3 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Flange number	M		N		P <sup>1)</sup> max.	T		Number	Holes <sup>2)</sup>		Shaft number	E <sup>3)</sup>		E <sup>4)</sup>	
	Nominal	Tolerance	Nominal	Tolerance		Nominal	Tolerance		S			Nominal	Tolerance	Nominal	Tolerance
									Drilled holes, min.	Tapped holes					
mm	mm	mm	µm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
F115	115	± 0,5	95	+0 -54	140	3	+0 -0,5	4	-	M8	11	23	+0 -1	23	+2 -0
											14	30	+0 -1	30	+2,5 -0
											24	50	+0 -1,5	50	+3 -0
F130	130	± 0,5	110	+0 -54	160	3,5	+0 -0,5	4	10	M8	14	30	+0 -1	30	+2,5 -0
											19	40	+0 -1,5	40	+2,5 -0
											24	50	+0 -1,5	50	+3 -0
											28	60	+0 -1,5	60	+3 -0
F165	165	± 0,5	130	+0 -63	200	3,5	+0 -0,5	4	12	M10	19	40	+0 -1,5	40	+2,5 -0
											24	50	+0 -1,5	50	+3 -0
											28	60	+0 -1,5	60	+3 -0
											38	80	+0 -2	60	+4 -0
F215	215	± 0,5	180	+0 -63	250	4	+0 -0,5	4	15	M12	28	60	+0 -1,5	60	+3 -0
											38	80	+0 -2	80	+4 -0
											42	110	+0 -3	110	+4 -0

Amdt 2

Table 3 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Flange number	<i>M</i>		<i>N</i>		<i>P</i> <sup>1)</sup> max.	<i>T</i>		Number	Holes <sup>2)</sup>		Shaft number	<i>E</i> <sup>3)</sup>		<i>E</i> <sup>4)</sup>	
	Nominal	Tolerance	Nominal	Tolerance		Nominal	Tolerance		<i>S</i>						
									Drilled holes, min.	Tapped holes		Nominal	Tolerance	Nominal	Tolerance
mm	mm	mm	μm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
F265	265	± 1	230	+0 -72	300	4	+0 -0,5	4	15	15	8	80	+0 -2	80	+4 -0
F300	300	± 1	250	+0 -72	350	5	+0 -1	4	19	19	42 48	110 110	+0 +0 -3 -3	110 110	+4 +4 -0 -0
F350	350	± 1	300	+0 -81	400	5	+0 -1	4	19	—	48 55	110 110	+0 +0 -3 -3	110 110	+4 +4 -0 -0
F400	400	± 1	350	+0 -89	450	5	+0 -1	8	19	—	55 60 65	110 140 140	+0 +0 +0 -4 -4	110 140 140	+4 +5 -0 -0 +5 -0
F500	500	± 1	450	+0 -97	550	5	+0 -1	8	19	—	60 65 75	140 140 140	+0 +0 +0 -4 -4	140 140 140	+5 -0 -0 +5 -0 +5 -0

Amdt 2

Table 3 (concluded)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Flange number	<i>M</i>		<i>N</i>		<i>P</i> <sup>1)</sup> max.	<i>T</i>		Number	Holes <sup>2)</sup>		Shaft number	<i>E</i> <sup>3)</sup>		<i>E'</i> <sup>4)</sup>	
	Nominal	Tolerance	Nominal	Tolerance		Nominal	Tolerance		<i>S</i>						
									Drilled holes, min.	Tapped holes		Nominal	Tolerance	Nominal	Tolerance
mm	mm	mm	μm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
F600	600	± 1,5	550	+0 -110	660	6	+0 -1,5	8	24	-	75	140	+0 -4	140	+5 -0
											75	140	+0 -4	140	+5 -0
											80	170	+0 -4	170	+5 -0
F740	740	± 1,5	680	+0 -125	800	6	+0 -1,5	8	24	-	70	140	+0 -4	140	+5 -0
											90	170	+0 -4	170	+5 -0

1) The external outline of mounting flanges up to and including F300 may be other than circular. Dimension *P* may deviate from that given in the table only on the minus side.

2) When the flange has clearance holes, screws with the thread specified should be used. When the flange has tapped holes, the thread size shall be as shown. The form of thread and diameters and associated pitches of bolts used should be in accordance with ISO recommendations.

3) *E* distance from shaft end to shaft shoulder or outer face of bearing cap whichever is the shorter.

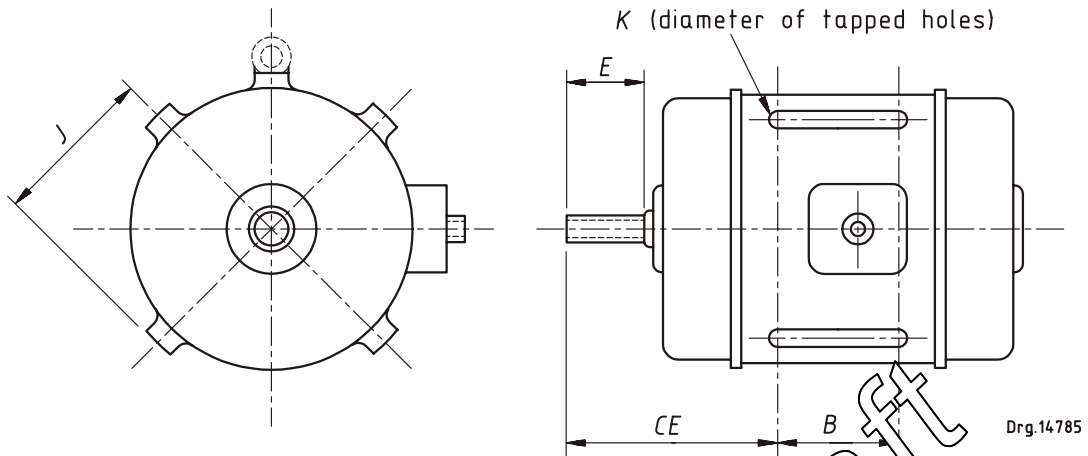
4) *E'* distance from shaft end to flange face.

Amdt 2

Committee

draft

**Table 4 — Fixing dimensions for pad-mounted or rod-mounted frames of airstream-rated cage motors**



1 Frame size	2 Shaft number	3 $J$ , max. mm	4 $B$		6 $CE$		9 $E^{1)}$		10 $K^{2)}$
			Nominal mm	Tolerance mm	Nominal mm	Tolerance mm	Nominal mm	Tolerance mm	
80	19	95	90	$\pm 1$	95,0	+0 -1,5	40	+2,5 -0	M12
90	24	105	90	$\pm 1$	125,0	+0 -1,5	50	+3 -0	M12
100 L	28	117	100	$\pm 1,5$	130,0	+0 -2	60	+3 -0	M12
112 M	28	130	100	$\pm 1,5$	150,0	+0 -2	60	+3 -0	M12
132 M	38	155	140	$\pm 2$	188,0	+0 -2	80	+4 -0	M16
160 L	42	185	200	$\pm 2,5$	245,0	+0 -3	110	+4 -0	M20
180 L	48	200	200	$\pm 2,5$	270,5	+0 -3	110	+4 -0	M20
200 L	55	219	224	$\pm 2,5$	283,5	+0 -4	110	+4 -0	M24
225 M	55	255	224	$\pm 2,5$	302,5	+0 -4	110	+4 -0	M24
225 M	60	255	224	$\pm 2,5$	332,5	+0 -4	140	+5 -0	M24
250 M	60	285	224	$\pm 2,5$	370,5	+0 -4	140	+5 -0	M24
250 M	65	285	224	$\pm 2,5$	370,5	+0 -4	140	+5 -0	M24

1) From shaft end to shaft shoulder or outer facing of bearing cap, whichever is the shorter.

2) The form of thread, diameters, and associated pitches of standard ISO metric bolts are in accordance with ISO recommendations.

## 5 Electrical and physical requirements

NOTE The recommended open-circuit rotor voltages for wound-rotor motors of duty class S1 and rated outputs in the range 5,5 kW to 200 kW (inclusive) are given in annex E.

### 5.1 Allocation of rated output, shaft number and flange number

The shaft number and, when relevant, the flange number and, unless otherwise required (see annex A), the rated output of a motor of duty class S1, shall be of the values given in the appropriate of tables 5 to 9 (inclusive), appropriate to the frame size and, when relevant, to the synchronous speed of the motor.

### 5.2 Cooling of airstream-rated motors

For airstream-rated motors, the average air velocity measured at a distance of 50 mm radially (outwards) from the mounting pads or faces shall be at least the appropriate of the values specified in table 10.

### 5.3 Flame-retardant and self-extinguishing abilities

When tested in accordance with 6.1, materials required to have flame-retardant and self-extinguishing properties shall be incapable of burning, or, if ignition takes place, shall be self-extinguishing within 2 s after removal of the heat source.

### 5.4 Absorption resistance

When tested in accordance with 6.2, materials that are required to be absorption resistant shall not absorb the saline solution in sufficient quantities to cause such swelling, laminating, warping or changing of the material as will impair the ability of the motor to comply with the other requirements of this part of SANS 1804. In addition, after the test the material shall withstand, for 1 min, without arcing or tracking, the application between its terminals of the highest value of dielectric test voltage the material is expected to encounter in service.

### 5.5 Standard site conditions

**5.5.1** For a.c. motors operating below 500 V an additional zone C is introduced to 6.3 of SANS 60034-1.

**5.5.2** Zone C is a restriction of zone B and is classified for a voltage variation of  $\pm 10\%$  and a frequency variation which is negligibly small. This zone consists of the Y-axis between the limit values of 0,90 and 1,10 in figure 12 in SANS 60034-1:2006. (See clause 2.)

**5.5.3** An a.c. motor shall be capable of performing its primary function, as specified in table 2 of SANS 60034-1:2006 (see clause 2), within zone C but may exhibit greater deviations from its performance at rated voltage and frequency than zone A.

**5.5.4** Temperature rises may not exceed the limits for the thermal classification of the motor specified in section 7 of SANS 60034-1:2006. (See clause 2.) For conditions at the extreme boundary of zone C, the temperature rises and temperatures obtained typically exceed the values obtained at the nominal rated supply values by approximately 20 K.

Amdt 1

# SANS 1804-2:2007

Edition 1.4

## 5.6 Motor performance

Motor performance information published by the manufacturer in its catalogue shall be guaranteed by the manufacturer. In addition to the marking requirements of SANS 1804-1, the 100 %, 75 % and 50 % load efficiency as determined in SANS 60034-2 and within the tolerances given in SANS 60034-1 shall be marked on the rating plate or plates. If more than one rating plate is used, the serial number of the motor shall appear on each plate.

NOTE For motors manufactured to this part of SANS 1804, the efficiency calculation is done in accordance with SANS 60034-2, with the following amendment: the copper losses are calculated at operating temperature.

Amdt 3

**Table 5 — Standard rated outputs, shaft numbers and flange numbers  
Single speed, IP 44 — IP 55 enclosure, IC 411 cooling method, cage motors, duty class S1**

1	2	3	4	5	6	7	8	9
Output kW				Frame size	Shaft number		Flange number	
Synchronous speed r/min					3 000	500 or less	Drilled holes	Tapped holes
3 000	1 500	1 000	750					
0,09 and 0,12 0,18 and 0,25 0,37 and 0,55	0,6 and 0,09 0,12 and 0,18 0,25 and 0,37	— — 0,25	— — —	86 90 S 90 L	9 11 14	9 11 14	F115 F130	F65 or F85 F75 or F100 F85 or F115
0,75 and 1,1 1,5 2,2	0,55 and 0,75 1,1 1,5	0,37 and 0,55 0,75 1,1	— 0,55	80 90 S 90 L	19 24 24	19 24 24	F165 F165 F165	F100 or F130 F115 or F130 F115 or F130
3,0 4,0 5,5 and 7,5	2,2 or 3,0 4,0 5,5	1,5 2,2 3,0	0,75 and 1,1 1,5 2,2	100 L 112 M 132 S	28 28 38	28 28 28	F215 F215 F265	F130 or F165 F130 or F165 F165 or F215
— 11 and 15 18,5	7,5 11 15	4 and 5,5 7,5 11	3,0 4 and 5,5 7,5	132 M 160 M 160 L	38 42 42	38 42 42	F265 F300 F300	F215
22 — 30 and 37	18,5 22 30	— 15 18,5 and 22	— 11 15	180 M 180 L 200 L	48 48 55	48 48 55	F300 F300 F350	
— 45 55	— 45 55	— 30 37	18,5 22 30	225 S 225 M 250 S	55 55 60	60 60 70	F400 F400 F500	
75 90 110	75 90 110	45 55 75	37 45 55	250 M 280 S 280 M	60 65 65	70 80 80	F500 F500 F500	
132 160	132 160	90 110	75 90	315 S 315 M	65 65	85 85	F600 F600	

**Table 6 — Standard rated outputs, shaft numbers and flange numbers**  
**Single speed, IP 20 — IP 25 enclosure, IC 00 and IC 01 cooling method, cage motors, duty class S1**

1	2	3	4	5	6	7	8
Output kW				Frame size	Shaft number		Flange number
Synchronous speed r/min					Synchronous speed r/min		Drilled holes
3 000	1 500	1 000	750		3 000	1 500 or less	
11 and 15 18,5 and 22 30	11 15 and 8,5 22	7,5 11 15	5,5 7,5 22	160 M 160 L 180 M	48 48 55	48 48 55	F350 F350 F350
37 45 55	30 37 45	18,5 22 30	15 18,5 22	180 L 200 M 200 L	55 60 60	55 60 60	F350 F400 F400
75 90 110	55 75 90	37 45 55	30 37 45	225 M 250 S 250 M	60 65 65	65 75 75	F500 F600 F600
132 and 150 185 220 250	110 132 and 150 185 220	75 90 110 132 and 150	55 75 90 110	280 S 280 M 315 S 315 M	65 75 75 70	85 85 90 90	F600 F600 F740 F740

**Table 7 — Standard rated outputs, shaft numbers and flange numbers**  
**Single speed, IP 44 — IP 55 enclosure, IC 11 cooling method, wound-rotor motors, duty class S1**

1	2	3	4	5	6	7
Output kW			Frame size	Shaft number	Flange number	
Synchronous speed r/min					Drilled holes	Tapped holes
1 500	1 000	750				
7,5 15	5,5 7,5 11	— 5,5 7,5	160 M 160 L 180 L	42 42 48	F300 F300 F300	F215
15 and 22 37 and 45	15 18,5 and 22 30 and 37	11 15 and 18,5 22	200 L 225 M 250 M	55 60 65	F350 F400 F500	
55 75 90 110	45 55 70 90	37 45 60 75	280 S 280 M 315 S 315 M	75 75 80 80	F500 F500 F600 F600	

**Table 8 — Standard rated outputs, shaft numbers and flange numbers  
Single speed, IP 20 — IP 25 enclosure, IC 00 and IC 01 cooling  
method, wound-rotor motors, duty class S1**

1	2	3	4	5	6
Output kW			Frame size	Shaft number	Flange number
Synchronous speed r/min					Drilled holes
1 500	1 000	750			
7,5 11 and 15 18,5	5,5 7,5 11	4 5,5 7,5	160 M 160 L 180 M	48 48 55	F350 F350 F350
22 30 37	15 18,5 22	11 15 18,5	180 L 200 M 200 L	55 60 60	F400 F400 F400
45 and 55 75 90	30 and 37 45 55	22 and 30 37 45	225 M 250 S 250 M	65 75 75	F500 F600 F600
110 132 160 200	75 90 110 132	55 75 90 110	280 S 280 M 315 S 315 M	80 90 90 90	F600 F600 F740 F740

**Table 9 — Standard rated outputs and shaft numbers  
Single speed, IP 44 — IP 55 enclosure, IC 418 cooling  
method, airstream type cast-iron motors, duty class S1**

1	2	3	4	5	6	7
Output kW				Frame size	Shaft number	
Synchronous speed r/min					Synchronous speed r/min	
3 000	1 500	1 000	750		3 000	1 500 or less
1,1 1,5 and 2,2 3	0,75 1,1 and 1,5 2,2 and 3	0,55 0,75 and 1,1 1,5	— 0,37 and 0,55 0,75 and 1,1	80 L 90 L 100 L	19 24 28	19 24 28
4 5,5 and 7,5 11; 15 and 18,5	4 5,5 and 7,5 11 and 15	2,2 3,4 and 5,5 7,5 and 11	1,5 2,2 and 3 4; 5,5 and 7,5	112 M 132 M 160 L	28 38 42	28 38 42
22 30 and 37 45 55	18,5 and 22 30 37 and 45 55	15 18,5 and 22 30 37	11 15 18,5 and 22 30	180 L 200 L 225 M 250 M	48 55 55 60	48 55 60 65

**Table 10 — Cooling of IP 44 — IP 55 enclosure, IC 418 cooling method, airstream-rated cage motors**

1	2	3	4	5
Frame number	Air velocity			
	m/s			
	Synchronous speed			
	r/min			
	3 000	1 500	1 000	750
80	10,0	7,5	6,5	5,0
90	12,5	9,0	7,5	6,0
100	15,0	10,0	8,0	7,0
112	16,5	11,0	9,0	7,5
132	18,0	12,0	9,5	8,0
160	19,0	12,5	10,5	8,5
180	20,0	13,5	11,0	9,0
200	21,0	14,0	11,5	9,5
225	22,0	14,5	12,0	10,0
250	23,0	15,0	12,5	10,0

**Table 11 — Tolerances on concentricity and perpendicularity of flange-mounted motors**

1	2	3
Flange number (see 4.5.3.1)	Concentricity and perpendicularity (permissible change in indicator reading) µm, max.	
	Tolerance class	
	Normal	Precision
F65	80	40
F75	80	40
F85	80	40
F100	80	40
F110	80	40
F130	100	50
F165	100	50
F215	100	50
F265	100	50
F300	125	63
F350	125	63
F400	125	63
F500	125	63
F600	160	80
F740	160	80

Amdt 4

Table 12 — Shaft run-out

1			2	3
Shaft diameter D mm			Shaft run-out µm, max.	
			Tolerance class	
			Normal	Precision
D	≤	10	30	15
10 < D	≤	18	35	18
18 < D	≤	30	40	21
30 < D	≤	50	50	25
50 < D	≤	80	60	30
80 < D	≤	120	70	35

Amdt 4

## 6 Tests

### 6.1 Test for flame retardance and self-extinguishing

#### 6.1.1 Apparatus (see figure 2)

**6.1.1.1 Glow-wire**, that consists of a loop of 80: 20 NiCr wire formed as shown in figure 3. When forming the loop, use such means that fine cracking of the tip will be avoided.

**6.1.1.2 Thermocouple**, comprising a sheathed fine wire thermocouple of NiCr and NiAl wires, and of outside diameter not exceeding 0,5 mm. The welded junction is located inside the sheath. The thermocouple is either arranged in a pocket comprising a hole of diameter 0,6 mm that has been drilled in the tip of the glow-wire loop, as shown in detail in figure 3, or is attached securely to the loop by other means at a position approximately 20 mm from the tip. The cold junction is kept in melting ice or in a temperature compensation box.

**6.1.1.3 Millivoltmeter**, for measuring the thermocouple voltage, and accurate to within 1 %.

**6.1.1.4 Current source**, capable of supplying a current (a.c. or d.c.) of value in the range 120 A to 150 A and having been connected to the glow-wire loop.

#### 6.1.2 Test specimens

Conduct the test on a complete (unbroken) sample of material.

#### 6.1.3 Preparation

**6.1.3.1** Condition the sample for a period of at least 18 h in a controlled atmosphere at a relative humidity of  $(75 \pm 5) \%$  and at a temperature of  $20 \text{ °C} \pm 5 \text{ °C}$ .

**6.1.3.2** Calibrate the thermocouple at a temperature of 960 °C, determined as the millivoltmeter reading at the instant of melting of a 2 mm × 2 mm chip of pure silver foil (99,8 % (by mass)) of thickness 0,66 mm, which is laid flat on the upper surface of the tip of the heated glow-wire.

**6.1.3.3** Position, centrally and 200 mm below the glow-wire, a piece of white pine board of nominal thickness 10 mm and covered with a single layer of wrapping tissue of mass in the range  $12 \text{ g/m}^2$  to  $25 \text{ g/m}^2$ .

### 6.1.4 Procedure

**6.1.4.1** Use a brush to clean the tip of the glow-wire to ensure that it is free from any residue of insulating material.

**6.1.4.2** Place the test apparatus in a draught-free room in subdued light in order that any flame will be visible.

**6.1.4.3** So position the sample under test that the surface to be tested is vertical.

**6.1.4.4** Switch on the current, so adjust it that the temperature of the glow-wire is at least 650 °C and keep the current constant at this value for at least 60 s before proceeding. Using a force not exceeding 1 N, bring the tip of the glow-wire into contact with the surface to be tested and maintain contact for 30 s  $\pm$  1 s before proceeding.

NOTE If possible, apply the tip of the glow-wire to a flat surface and not to grooves, knicks, pits, narrow recesses or sharp edges. Apply the tip where the section is at its thinnest, but not further than 15 mm from the upper edge of the sample.

**6.1.4.5** Maintain the force between the glow-wire and the sample by allowing the masspiece to move the glow-wire towards the surface of the sample, but do not allow the total movement to exceed 7 mm.

**6.1.4.6** Remove the tip of the glow-wire from the sample, avoiding any movement of air that might affect the results of the test.

### 6.1.5 Measurement and observations

Throughout the test, observe the sample, the glow-wire parts, and the layer of tissue paper. If ignition takes place, and the flame is subsequently extinguished, record the time at which each event takes place, and check for compliance with 5.3.

## 6.2 Absorption resistance tests

**6.2.1** Immerse the terminal block, complete with terminals and pieces of any other material required to be absorption resistant, for 16 h in a 5 g/L aqueous solution of sodium chloride.

**6.2.2** Immediately after removal, inspect the specimen for compliance with the requirement of 5.4.

**6.2.3** Rinse the terminal block in clean running water for 30 s, dry the surfaces, and within 3 min of removal from the saline solution, test the dielectric at the highest voltage the material is expected to encounter, either in service or during any other tests required in terms of this part of SANS 1804.

**6.2.4** Start the test at an r.m.s. voltage not exceeding 600 V and increase the voltage to full test voltage as rapidly as the values can be indicated by the measuring instrument.

**6.2.5** Maintain the full test voltage for 1 min and then decrease it to an r.m.s. value not exceeding 600 V before switching off. Check for compliance with 5.4.

### 6.3 Tests for concentricity of spigot and perpendicularity of mounting face (Flange-mounted motors)

#### 6.3.1 Apparatus

The apparatus (see figure 4) consists essentially of two spring-loaded indicators (or other acceptable devices) mounted on rigid arms that are fixed to a hub that forms a close fit with the shaft of the motor under test.

Indicator 2 shows, in micrometres, variations in the perpendicular distance between the arm on which it is mounted and the outer face of the flange.

Indicator 1 indicates, in micrometres, variations in the radial distance between its mounting and the edge of the spigot.

#### 6.3.2 Procedure

- a) So clamp the motor that its shaft is vertical, and so secure the hub of the apparatus to the shaft that the distance between the hub and the flange is  $10 \pm 0,1$  mm.
- b) Slowly rotate the shaft through  $360^\circ$ , note the maximum and minimum readings given on each indicator, and record the differences between these readings as the concentricity and perpendicularity respectively.
- c) Check for compliance with the requirements of 4.5.3

Amdt 4

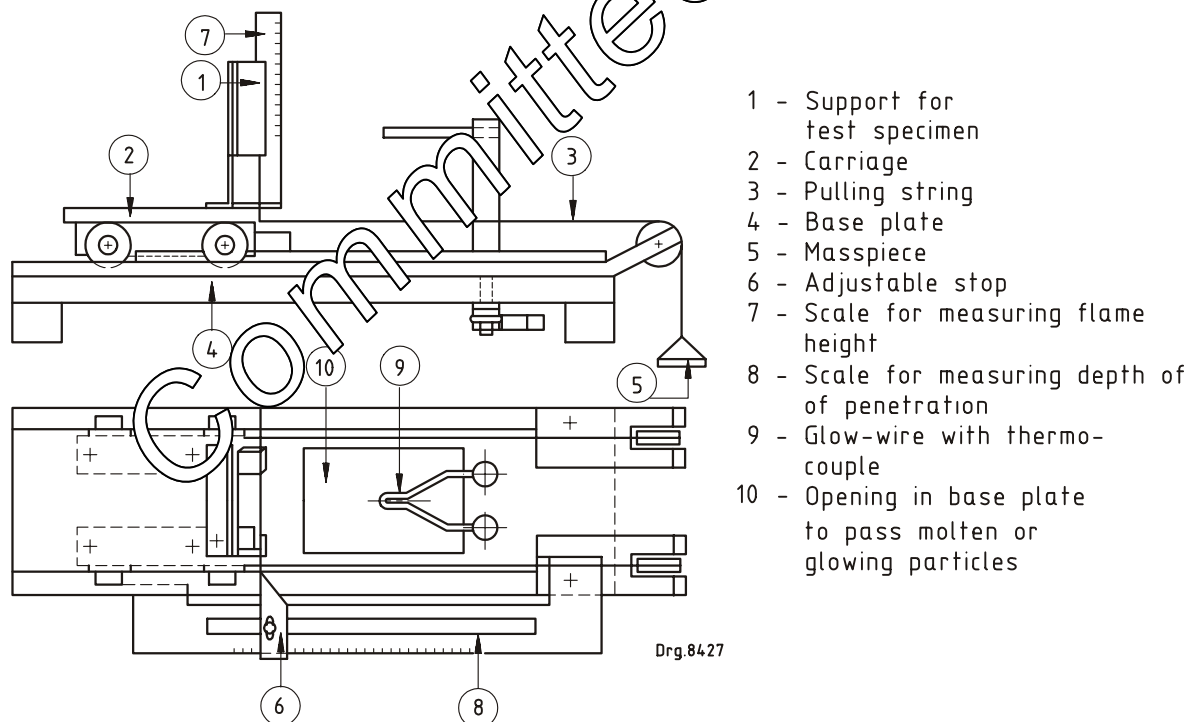


Figure 2 — Glow-wire test apparatus

Dimensions in millimetres

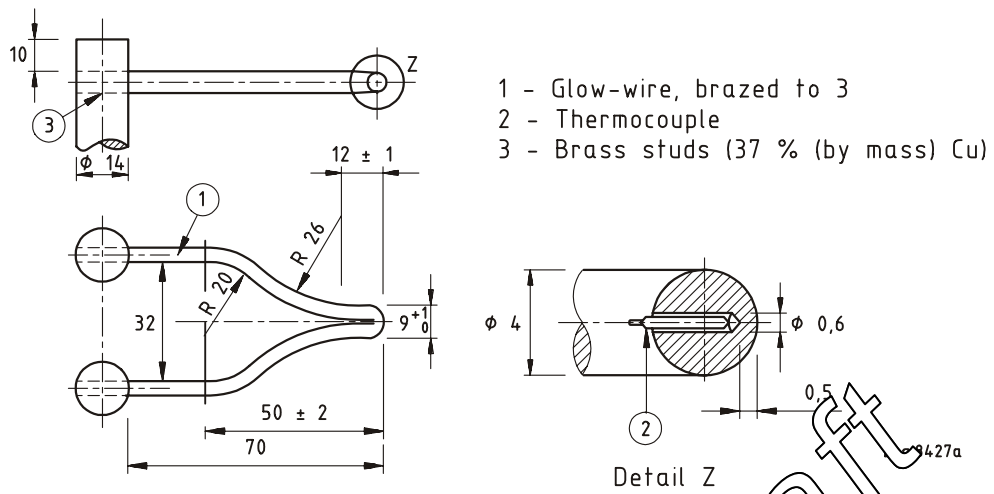


Figure 3 — Glow-wire with thermocouple

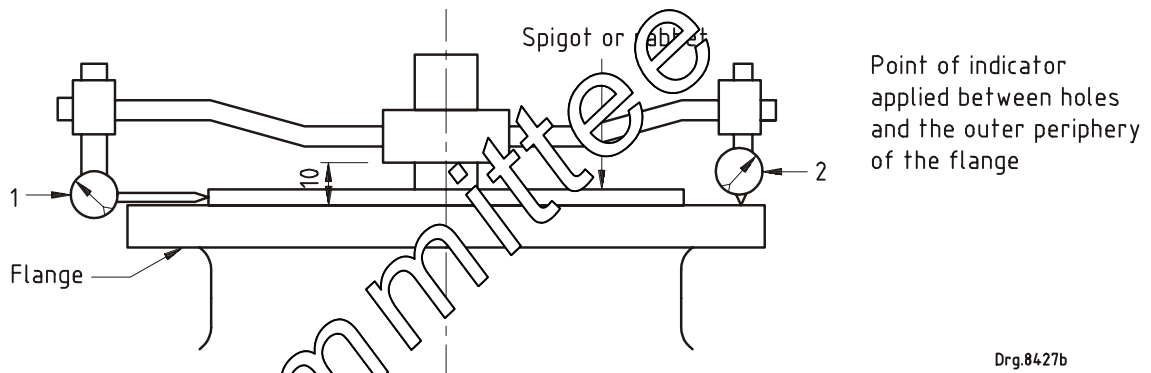


Figure 4 - Apparatus for measuring concentricity and perpendicularity

Amdt 4

**Annex A**

(normative)

**Notes to purchasers**

**A.1** The following requirements shall be specified in tender invitations and in each order or contract (see also annex B):

- a) the type of induction motor (cage or wound rotor);
- b) the type of enclosure;
- c) the method of cooling;
- d) the method of mounting;
- e) the size of the cable inlet, if other than as specified in annex F;
- f) the frame size;
- g) when relevant, the flange number;
- h) when relevant, that the precision tolerance class be applied to concentricity or perpendicularity or both;
- i) when relevant, that the precision tolerance class be applied to shaft run-out;
- j) the rated voltage or, when relevant, rated voltage range;
- k) the rated output;
- l) the duty type of the motor and, when relevant, the cyclic duration factor and the duration of the duty cycle;
- m) the system conditions under which the motor is to operate, if other than as specified in this part of SANS 1804;
- n) the frequency of starting and the load inertia or speed/torque characteristics;
- o) when so required, the efficiency of the motor; and
- p) the voltage to be used for the temperature rise test.

**A.2** The following requirements shall be agreed upon between the manufacturer and the purchaser:

- a) the earthed connections, if other than acceptably protected and accessible for examination without disconnection of other electrical connections;
- b) when relevant, the voltage range;
- c) the starting performance;
- d) whether the vibration test is to be carried out and, when relevant, the limits of vibration amplitude;
- e) whether the noise level test is to be carried out;

- f) the apparatus to be used for the tests on enclosures for ingress of water, if other than as specified in this part of SANS 1804;
- g) whether type tests or routine tests (or both) are to be carried out (see annex D); and
- h) for belt drive applications,
  - 1) the value of the belt pull,
  - 2) the point of application of the belt pull in axial relation to the motor shaft end, and
  - 3) the mass of the pulley.

NOTE If there is a requirement for the motor starting current to be limited, this limit should be stated in the enquiry and should be coordinated with the method of start. For some combinations of motor and driven item types there are practical limits to which the starting current can be reduced. A full engineering assessment might be necessary.

## **Annex B** (informative)

### **Detailed information that should be provided in tender invitations**

The information called for in the form below is covered in part in annex A. Further detailed requirements for purchasers that are not included in annex A, are listed in the form below and should, if possible, be set out in tender invitations.

It is advisable to compare the speed-torque curve of the motor and the speed-torque curve of the drive, to determine the suitability of the motor for the drive.

**Standard requirements**

Supply	Volts		Number of phases		Hz	
Output rating	kW			r/min		
Type of motor	Cage		Slip-ring			
Frame size						
Enclosure	IP 22 (Dripproof)		IP 55 (T.e.f.c)		Other	
Mounting	Foot		Flange		Foot and flange	
Shaft axis	Horizontal		Vertical up		Vertical down	
Insulation	Class			Allowable temperature rise .....K		
Site conditions	Altitude a.s.l.....m			Ambient temperature.....°C		
Duty class	S1 (c.m.r.)		S2 (s.t.r.)		S3 (int.r.)	
Bearings	Ball		Ball and roller		Sleeve	
Cable entry (location)	Top		Bottom		Left	
Cable entry (type and size)	Type			Size		
	Conduit		Gland			
Cable (size and covering)	Size		Covering			
Drive details	Direct		Belt		Gearbox	
Method of starting	Direct on line			Auto transformer		% tap
	Star delta			Rotor resistance		
Load details	Moment of inertia (Mk <sup>2</sup> ).		Reference speed.		r/min	
Direction of rotation looking at shaft end	Clockwise		Anti-clockwise		Bi-directional	

**Special requirements**

Verminproof: Size apertures	Duty cycle	
Weatherproof	Number of starts from cold to operating temperature	
Flameproof	Load kW	
Sparkproof	Duration of load	
Non-standard shaft	Number of stops	
Protection from adverse atmosphere	Method of braking	Mechanical
Protection against excess temperature		Reverse current
Anti-condensation heaters		D.C. injection
Special balance	End thrust	
Flange-mounted, special tolerances	Direction of end thrust	
Power factor correction		

**Performance requirements**

Full-load efficiency	Locked-rotor torque	
Full-load power factor	Locked-rotor starting kVA	
O.C.R.V.	Rotor current	

## Annex C

(informative)

### Quality verification of low-voltage three-phase standard motors

#### C.1 Quality verification

**C.1.1** When a purchaser requires ongoing verification of the quality of low-voltage three-phase standard motors, it is suggested that, instead of concentrating solely on evaluation of the final product, he also direct his attention to the manufacturer's quality system. In this connection it should be noted that SANS 9001 covers the provision of an integrated quality system. **Amdt 1**

**C.1.2** If the motors do not bear the certification mark and no information about the implementation of quality control or testing during manufacture is available to help in assessing the quality of a lot, and a purchaser wishes to establish by inspection and testing of samples of the final product whether a lot (as defined in C.2.1) of motors complies with the requirements of this part of SANS 1804, the sampling procedure given in C.2 and based on the stated AQLs can be applied. (If a different AQL is required, reference should be made to applicable statistical sampling tables.)

It should be noted that

- a) such a sampling procedure applies to fully manufactured products only, and
- b) a lot that in terms of the procedure is deemed to comply with this part of SANS 1804, could contain defective motors to an extent proportional to that permitted by the relevant acceptance numbers given in the sampling table.

#### C.2 Assessment of compliance with this part of SANS 1804

##### C.2.1 Definitions

**C.2.1.1 acceptable quality level (AQL):** The maximum percentage defectives that for the purpose of sampling inspection can be considered satisfactory as a process average.

**C.2.1.2 defective:** A motor for miscellaneous applications that fails in one or more respects to comply with the relevant requirements of this part of SANS 1804.

**C.2.1.3 lot:** Not less than 5 and not more than 1 000 motors of the same type, rating(s) and frame size, and that have the same type of enclosure, method of cooling and method of mounting, from one manufacturer, submitted at any one time for inspection and testing.

##### C.2.2 Sampling

Use the following sampling procedure to determine whether a lot complies with this part of SANS 1804, and deem the samples so taken to represent the lot for the respective properties.

From the lot draw at random the number of motors given in column 2 of table C.1, relative to the appropriate lot size given in column 1.

**Table C.1 — Sample sizes**

1	2	3
Lot size	Sample for inspection and testing (AQL = 2,5)	
	Sample size	Acceptance number
5 – 65	2	0
66 – 180	3	0
181 – 500	5	0
501 – 800	8	0
801 – 1 000	12	1

**C.2.3 Criteria for compliance**

Deem the lot to comply with the relevant requirements of this part of SANS 1804-2 if, on inspection and testing of the samples taken in accordance with C.2.2, the number of defectives found does not exceed the relevant acceptance number given in column 3 of table C.1.

**Annex D**

(informative)

**Type tests and routine tests**

**D.1 General**

The routine tests outlined in this annex are normally carried out by the manufacturer as part of his quality control procedure. In other cases and when the purchaser requires the type tests (see D.2) to be carried out, special agreement should be reached between the manufacturer and purchaser (before the order is placed), and the agreement should include arrangements for the presence of the purchaser or his authorized representative during the tests.

**D.2 Type tests**

Type tests are performed on one completed motor of a new design or whenever major changes have been made in a proven design. These major changes in design include slotting dimensions, insulation system (wire and insulation used), core length, core material(s), air gaps, and major changes in the ventilation system.

Type tests comprise the following:

- a) the temperature rise test;
- b) running at full load (or a stated percentage thereof) with measurements of power factor, efficiency and speed;
- c) the momentary excess torque test;

- d) in the case of cage motors, measurement of the locked-rotor starting kilovolt amperes and the locked-rotor torque at rated voltage (or as close as possible to rated voltage). If the test is done at a reduced voltage, an acceptable method of extrapolating the measured values to the rated voltage should be used; and
- e) all the routine tests as listed in clause D.3.

### D.3 Routine tests

The purpose of the following tests, which should be performed on each completed motor, is to show that the motor has been assembled correctly, is in sound working order (both electrically and mechanically), and that its performance, subject to the manufacturer's tolerances, is approximately equal to that of the type-tested motor.

Routine tests comprise the following:

- a) the measurement of the current and the total input (in watts) while the motor is running at accurately measured rated voltage and frequency under no, or very light, load;
- b) the measurement of the cold resistance of the windings;
- c) the measurement of the voltage and the total input (in watts) while the motor (with the rotor locked) is supplied with at least full-load current (accurately measured);
- d) the dielectric test, i.e. by applying, for 5 s, a voltage of 120 % of the test voltage, or flash testing at a voltage of 200 % of the test voltage (The dielectric test may not be performed more than once on a motor at the full test voltage; site tests on motors should be performed at a voltage of 80 % of the appropriate test voltage.); and

NOTE Where two or more motors are connected in series, base the test voltage on the rated voltage or on 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 greater.

- e) in the case of wound-rotor motors, the measurement of the open-circuit voltage.

### D.4 Tolerances

Unless unacceptable, all values measured in the type tests and routine tests are subject to the tolerances given in SANS 1804-1.

**Annex E**  
(informative)

**Recommended open-circuit rotor voltages**

The values given in this table are the recommended open-circuit rotor voltages for wound-rotor motors of duty class S1 and of rated outputs in the range 5,5 kW to 200 kW (inclusive).

**Table E.1 — Recommended open-circuit rotor voltages for wound-rotor motors of duty class S1**

1	2	3	4	5
Rated output	Open-circuit rotor voltages <sup>1)</sup>			
	V			
kW	4-pole	6-pole	8-pole	10-pole
5,5	—	180	180	180
7,5	180	260	210	210
11	260	230	250	250
15	270	255	225	250
18,5	230	250	270	125
22	275	290	100	150
30	330	140	190	175
37	195	175	200	195
45	235	190	250	225
55	260	235	285	285
75	310	270	360	295
90	315	310	380	370
110	380	400	435	—
132	450	440	—	—
160	550	—	—	—
185	400	—	—	—
200	440	—	—	—

1) Tolerance +15 %

## Annex F

(informative)

### Recommendations for the size of supply cable and cable inlet

**F.1** The conductor sizes in columns 2 and 4 of table F.1 are given as a guide only. In practice, considerations such as type of cable, the permissible voltage drop between starter and motor, and adverse starting conditions dictate the size.

**F.2** The size of cable inlet recommended in columns 3 and 5 of table F.1 are given as a guide only. In practice, considerations such as the type of cable and the type of gland dictate the size. It is common practice for some industries to request a blank gland plate in order that, when the cable and gland details are available, a suitable cable inlet can be drilled on site.

Table F.1 — Conductor

1	2	3	4	5
Full-load rated current ( $I$ ) of the motor  A	7-core cable		1-core cable	
	Size of conductor (nominal cross-sectional area) mm <sup>2</sup>	Recommended diameter of cable inlet mm	Size of conductor (nominal cross-sectional area) mm <sup>2</sup>	Recommended diameter of cable inlet mm
– < $I$ ≤ 8	0,75	20	0,75	20
8 < $I$ ≤ 10	1	20	1	20
10 < $I$ ≤ 12,5	1,5	20	1,5	20
12,5 < $I$ ≤ 16	2,5	–	2,5	20
16 < $I$ ≤ 22,5	4	–	4	20
22,5 < $I$ ≤ 31,5	–	–	6	25
31,5 < $I$ ≤ 40	–	–	10	25
40 < $I$ ≤ 56	–	–	16	32
56 < $I$ ≤ 71	–	–	25	32
71 < $I$ ≤ 90	–	–	35	40
90 < $I$ ≤ 112	–	–	50	40
112 < $I$ ≤ 140	–	–	70	50
140 < $I$ ≤ 170	–	–	95	50
170 < $I$ ≤ 200	–	–	120	50
200 < $I$ ≤ 225	–	–	150	63
225 < $I$ ≤ 260	–	–	185	63
260 < $I$ ≤ 315	–	–	240	
315 < $I$ ≤ 355	–	–	300	
355 < $I$ ≤ 425	–	–	400	To be agreed upon between the manufacturer and purchaser
425 < $I$ ≤ 500	–	–	500	
500 < $I$ ≤ 580	–	–	630	
580 < $I$ ≤ 670	–	–	800	
670 < $I$ ≤ 770	–	–	1 000	

**Annex G**

(informative)

**Bibliography**

~~SANS 314-1~~. Deleted by amendment No. 2.

~~SANS 314-2~~. Deleted by amendment No. 2.

~~SABS 969~~. Deleted by amendment No. 2.

~~SABS 970~~. Deleted by amendment No. 2.

SANS 1019 (SABS 1019), *Standard voltages, currents and insulation levels for electricity supply*.

**Amdt 1**

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

**Amdt 2**

SANS 60079-15/IEC 60079-15 (SABS IEC 60079-15), *Electrical apparatus for explosive gas atmospheres – Part 15: Type of protection "n"*.

**Amdt 2**

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

**Amdt 2; amdt 3**

SANS 9001/ISO 9001, *Quality management systems – Requirements*.

**Amdt 1**