GENERAL INFORMATION

PRODUCT RANGE

MISSION

For 50 years the Lafert Group have been committing to continuous growth by being the global leading manufacturer of Customised Engineered Electric Motors and Drives with special focus on Industrial Automation, Energy Saving and Renewables.

The Group have developed an excellent ability to adapt the highest quality standards to any specific market demands providing solutions for several applications and OEM requests.

The Lafert Group's range of products is divided in 5 product sectors:

ENERGY EFFICIENT Motors, three-phase motors high efficiency, IE2 and premium efficiency, IE3

ENERGY EFFICIENT Motors

CUSTOMISED Motors, single-phase, three-phase and brake motors in special execution

CUSTOMISED Motors

HIGH PERFORMANCE Motors, permanent magnet synchronous motors and generators as well as the relevant drives

HIGH PERFORMANCE Motors

SERVO Motors & Drives, brushless servomotors and drives for industrial automation

SERVO Motors & Drives

LIFT Motors, permanent magnet synchronous gearless machines for elevators

LIFT Motors

ENERGY EFFICIENT MOTORS

HIGH EFFICIENCY, ENERGY SAVING

The range of Energy Efficient Motors has been developed to meet the increasing demand for increased energy efficiency and energy saving products in Europe, North America and Australia after the introduction of directives imposing higher minimum efficiency levels.

IE2
IE3

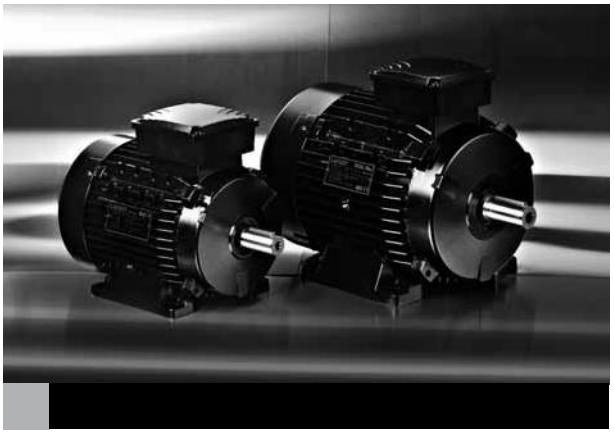
High Efficiency and Premium Efficiency Three-phase Motors up to 200 kW meeting the re□uirements of IE2 and IE3 internationally efficiency levels in accordance with IEC 60034-30;2008 and test method IEC 60034-2-1;2007.

ENERGY
C US

Motors conforming to the higher efficiency standards for the North American market in accordance with EPAct Regulation (Energy Policy Act, 1992) and EISA Directive (Energy Independence and Security Act, 2007).
In addition these motors are verified by UL Underwriters Laboratories Inc..

c UL Energy Verified

The range of Energy Efficient Motors from Lafert is the first complete range of IE2 and IE3 motors available to worldwide Industry.

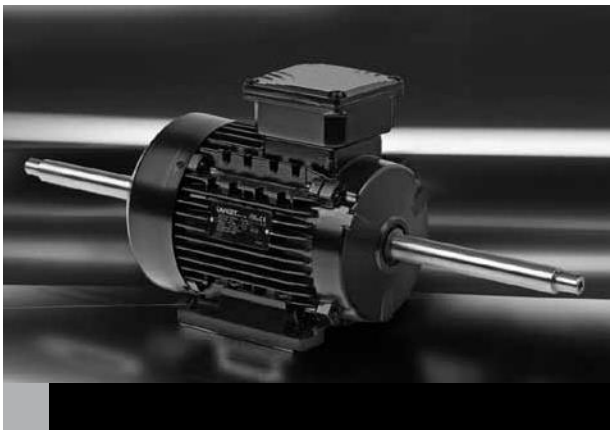


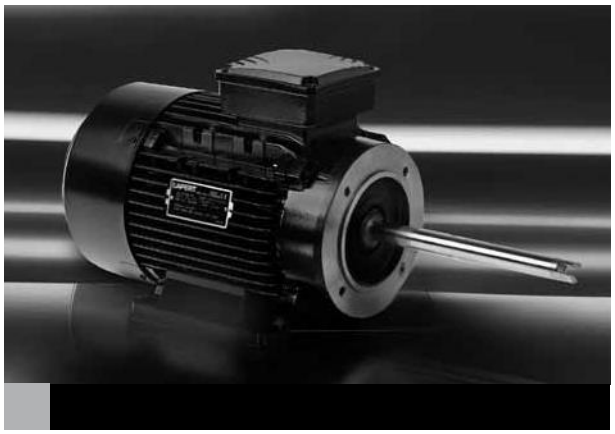
CUSTOMISED MOTORS

CUSTOMISATION, OUR CORE BUSINESS

A wide range of Customised Motors with special execution, in order to optimise electrical and mechanical design for particular markets or specific OEM re□uests.

Single-phase, Three-phase and Brake Motors manufactured ad hoc for non-standard applications according to customer's demands□customised flanges and shafts, special electrical design for each duty re□uest, complete tailor-made design, AC or DC brake coil to fit any applications, solutions to special environmental conditions (Smoke and Heat Exhaust Ventilation, Dust Ignition for Zone 22, Non Sparking Exn).





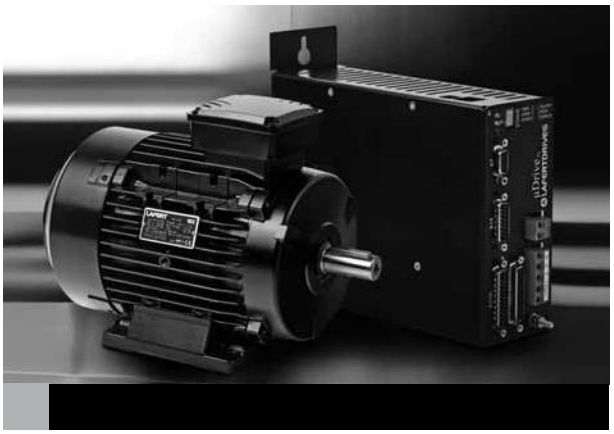
HIGH PERFORMANCE MOTORS

PERMANENT MAGNET SYNCHRONOUS MOTORS SIGNIFICANTLY REDUCE ENERGY COSTS

High Performance is a range of PM synchronous motors 0.37 kW to 22 kW, with variable speed and equipped with sensorless drives. By combining the technology of both brushless servo motors and AC motors, this range achieves the highest efficiency level IE4 – Super Premium Efficiency and is specifically designed for its energy saving potential and renewable energy applications.

Permanent magnet technology, very high efficiency, compact design, reduced weight, low operating temperature.

A separate catalogue is available.



SERVO MOTORS DRIVES

A MODERN AND COMPLETE RANGE FOR INDUSTRIAL AUTOMATION

The range of Brushless Servo Motors is one of the most complete available on the market, with nominal tor ues 0.20 Nm to 150 Nm. Direct Drive Motors cover tor ues 10 Nm to 500 Nm.
Thanks to its whole integrated manufacturing process, Lafert is one of the few independent manufacturers of servo motors and can supply a wide range of standard and tailor-made products for Industrial Automation giving excellent flexibility and high level of cost efficiency.

The family of Servo Drives is especially engineering for brushless servo motors and DC motors providing particular versatility and adaptability when designing automated industrial machines.
These products ensure high reliability and are sub ected to strict tests in different loads and climatic conditions.

A separate catalogue is available.

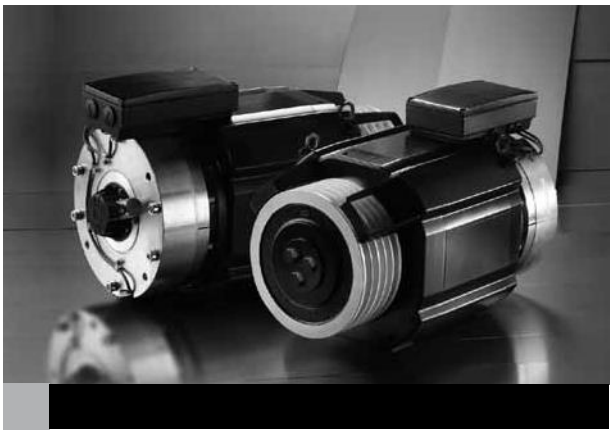
LIFT MOTORS

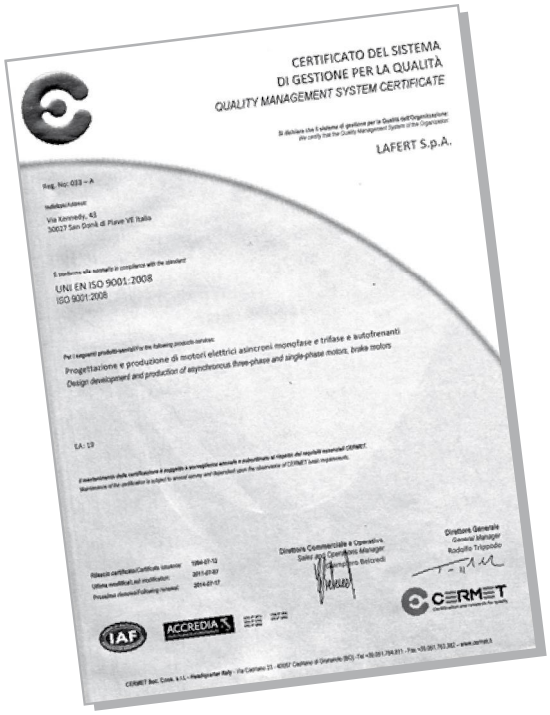
GEARLESS MACHINES FOR ELEVATORS

The Lift range allows the manufacturing of systems where the traction machine is inside the elevator shaft, so there is no need for a machine room, with obvious space and cost savings and a more rational layout of the all components.

Permanent Magnet Gearless Synchronous Machines with compact design, reduced energy consumption, low noise level, high comfort and re□uiring less maintenance. Motors with tor□ue up to 660 Nm for systems with a capacity load up to 1,275 kg, machines with T□V S□D Certifications, in compliance with the Specifications EN 81-1 and Lifts Directive 95/16/EC.

A separate catalogue is available.




CERTIFICATO DEL SISTEMA
DI GESTIONE PER LA QUALITÀ
QUALITY MANAGEMENT SYSTEM CERTIFICATE

LAFERT S.p.A.

UNI EN ISO 9001:2008
ISO 9001:2008

Progettazione e produzione di motori elettrici asincroni monofase e trifase e autofrenanti
Design development and production of asynchronous three-phase and single-phase motors, brake motors

EA: 19

CERMET

IAF ACCREDIA

QUALITY SYSTEM CERTIFICATE

The strictness of our quality control assures the flawless operation and reliability of our products. Our quality is confirmed by the Certificate ISO 9001 awarded by CERMET, a certification body authorized by ACCREDIA.

SAFETY STANDARDS

Our motors comply with the requirements of the International Standard IEC 60034 for rotating electrical machines as well as with the following European Directives: Low Voltage Directive (LV) 2006/95/EC, Electromagnetic Compatibility Directive (EMC) 2004/108/EC and RoHS Directive 2002/95/EC on the restriction of hazardous substances in electrical and electronic equipment.

All products comply with the requirements of the Directive Machines (MD) 2006/42/EC. In accordance with this Directive, induction motors are components and intended solely for integration into other machines. Commissioning is forbidden until conformity of the end-product with this Directive is proved.

CE The CE marking was applied for the first time in 1995.

When operating the motor, the observance of the Regulation EN 60204-1 and safety instructions indicated in our Operating Instructions must be complied with.

Motors complied with many other international standards are available on request.

c UL us Motors approved by UL Underwriters Laboratories Inc.

Motors approved by CSA

Motors approved by CQC (small motors up to 1.1 kW – AM, AMBY, AMF series)

EFFICIENCY STANDARDS

IE1 IE2 IE3 Efficiencies are harmonized to the International Standard IEC 60034-30;2008 that states new efficiency levels: Standard Efficiency IE1, High Efficiency IE2 and Premium Efficiency IE3. The efficiency levels are in accordance with the testing method IEC 60034-2-1;2007.

ENERGY c UL us High Efficiency motors according to EPAct legislation.
Verified by UL Underwriters Laboratories Inc.

c UL Energy Verified Premium Efficiency motors according to EISA Directive.
Verified by UL Environment.

NEW INTERNATIONAL EFFICIENCY LEVELS FOR MOTORS IE CODES

The International standard IEC 60034-30;2008 states the new efficiency levels IE1, IE2 and IE3 for electric motors, ensuring an international common base for motor designing and classification, as well as for national legislative activities.

The efficiency measurement method for motors has also been reviewed.
The new standard IEC 60034-2-1;2007 provides for test conditions and efficiency measurement methods which are more accurate and replaces the previous standard EN 60034-2;1996.

The efficiency levels provided for by the standard for single speed, three-phase – brake motors included -50 Hz or 50/60 Hz, motors with rated output between 0,75 kW and 375 kW, 2, 4 or 6 poles, on the basis of continuous duty operation S1 or intermittent periodic duty operation S3 are the following

- IE1 Standard Efficiency
- IE2 High Efficiency
- IE3 Premium Efficiency

However, IEC 60034-30 states only the re uirements for the efficiency levels, thus creating shared measures worldwide. It does not state the motors to be supplied or the minimum efficiency level. This depends on any regional laws that are applicable.

EUROPE – ECODESIGN EUP DIRECTIVE (2005/32/EC)

The EcoDesign EuP directive (2005/32/CE) states the ecodesign re uirements for energy-using products.
It is the Commission Regulation (EC) 640/2009 that specifies the efficiency re uirements for electric motors and that introduces in all countries of the European Community the obligation of the IE2 minimum efficiency level as from 16th June 2011.
At further dates, progressively higher minimum efficiency re uirements will be established. The IE3 level will come in from 2015-2017.

The scope of the Commission Regulation includes single speed, three-phase 50 Hz or 50/60 Hz, s uirrel cage asynchronous motors with rated output between 0.75 kW and 375 kW, 2, 4 or 6 poles, on the basis of continuous duty operation S1.

Motors to be exclusively exported out of the EU (machine distributors or manufacturers) may be produced and distributed with IE1 efficiency level even after 16th June 2011.
To that end, a statement will have to be made to the manufacturer.

UNITED STATES, CANADA – EISA ENERGY INDEPENDENCE AND SECURITY ACT, 2007

The Energy Independence and Security Act, 2007 (EISA) imposes in the USA and Canada Nema Premium Efficiency (IE3) as minimum level of efficiency as from 19th December 2010.

EISA, which replaces the current 1992 Energy Policy Act (EPAct) legislation, sets out new efficiency restrictive limits for a wide range of three-phase motors, including brake motors with power ratings from 1 to 500 HP.

EFFICIENCY VALUES FOR 50 HZ ACCORDING TO IEC 60034-30;2008
Efficiency standard calculation IEC 60034-2-1;2007

Output	Standard Efficiency - IE1			High Efficiency - IE2			Premium Efficiency - IE3		
kW	2 poles	4 poles	6 poles	2 poles	4 poles	6 poles	2 poles	4 poles	6 poles
0.75	72.1	72.1	70.0	77.4	79.6	75.9	80.7	82.5	78.9
1.1	75.0	75.0	72.9	79.6	81.4	78.1	82.7	84.1	81.0
1.5	77.2	77.2	75.2	81.3	82.8	79.8	84.2	85.3	82.5
2.2	79.7	79.7	77.7	83.2	84.3	81.8	85.9	86.7	84.3
3	81.5	81.5	79.7	84.6	85.5	83.3	87.1	87.7	85.6
4	83.1	83.1	81.4	85.8	86.6	84.6	88.1	88.6	86.8
5.5	84.7	84.7	83.1	87.0	87.7	86.0	89.2	89.6	88.0
7.5	86.0	86.0	84.7	88.1	88.7	87.2	90.1	90.4	89.1
11	87.6	87.6	86.4	89.4	89.8	88.7	91.2	91.4	90.3
15	88.7	88.7	87.7	90.3	90.6	89.7	91.9	92.1	91.2
18.5	89.3	89.3	88.6	90.9	91.2	90.4	92.4	92.6	91.7
22	89.9	89.9	89.2	91.3	91.6	90.9	92.7	93.0	92.2
30	90.7	90.7	90.2	92.0	92.3	91.7	93.3	93.6	92.9
37	91.2	91.2	90.8	92.5	92.7	92.2	93.7	93.9	93.3
45	91.7	91.7	91.4	92.9	93.1	92.7	94.0	94.2	93.7
55	92.1	92.1	91.9	93.2	93.5	93.1	94.3	94.6	94.1
75	92.7	92.7	92.6	93.8	94.0	93.7	94.7	95.0	94.6
90	93.0	93.0	92.9	94.1	94.2	94.0	95.0	95.2	94.9
110	93.3	93.3	93.3	94.3	94.5	94.3	95.2	95.4	95.1
132	93.5	93.5	93.5	94.6	94.7	94.6	95.4	95.6	95.4
160	93.7	93.8	93.8	94.8	94.9	94.8	95.6	95.8	95.6
200-375	94.0	94.0	94.0	95.0	95.1	95.0	95.8	96.0	95.8

EFFICIENCY VALUES FOR 60 HZ ACCORDING TO IEC 60034-30;2008
Efficiency standard calculation IEC 60034-2-1;2007

Output	Standard Efficiency - IE1			High Efficiency - IE2			Premium Efficiency - IE3		
kW	2 poles	4 poles	6 poles	2 poles	4 poles	6 poles	2 poles	4 poles	6 poles
0.75	77.0	78.0	73.0	75.5	82.5	80.0	77.0	85.5	82.5
1.1	78.5	79.0	75.0	82.5	84.0	85.5	84.0	86.5	87.5
1.5	81.0	81.5	77.8	84.0	84.0	86.5	85.5	86.5	88.5
2.2	81.5	83.0	78.5	85.5	87.5	87.5	86.5	89.5	89.5
3.7	84.5	85.0	83.5	87.5	87.5	87.5	88.5	89.5	89.5
5.5	86.0	87.0	85.0	88.5	89.5	89.5	89.5	91.7	91.0
7.5	87.5	87.5	86.0	89.5	89.5	89.5	90.2	91.7	91.0
11	87.5	88.5	89.0	90.2	91.0	90.2	91.0	92.4	91.7
15	88.5	89.5	89.5	90.2	91.0	90.2	91.0	93.0	91.7
18.5	89.5	90.5	90.2	91.0	92.4	91.7	91.7	93.6	93.0
22	89.5	91.0	91.0	91.0	92.4	91.7	91.7	93.6	93.0
30	90.2	91.7	91.7	91.7	93.0	93.0	92.4	94.1	94.1
37	91.5	92.4	91.7	92.4	93.0	93.0	93.0	94.5	94.1
45	91.7	93.0	91.7	93.0	93.6	93.6	93.6	95.0	94.5
55	92.4	93.0	92.1	93.0	94.1	93.6	93.6	95.4	94.5
75	93.0	93.2	93.0	93.6	94.5	94.1	94.1	95.4	95.0
90	93.0	93.2	93.0	94.5	94.5	94.1	95.0	95.4	95.0
110	93.0	93.5	94.1	94.5	95.0	95.0	95.0	95.8	95.8
150	94.1	94.5	94.1	95.0	95.0	95.0	95.4	96.2	95.8
185-375	94.1	94.5	94.1	95.4	95.4	95.0	95.8	96.2	95.8

GLOBALLY MINIMUM EFFICIENCY STANDARDS

Country	Product range	Law / Regulation	Minimum efficiency level	Next steps
EUROPE	400 V ± 10% ; 50 Hz 0.75 - 375 kW - 2-6 poles	EC 640/2009	IE2 compulsory 16.06.2011	01.01.2015 - IE3 from 7.5 to 375 kW or IE2 motor with fre□uency converter 01.01.2017 - IE3 from 0.75 to 375 kW or IE2 motor with fre□uency converter
RUSSIA	up to 690 V ± 10% ; 50 Hz 1 - 400 kW - All poles	GOST R 51677-2000	-	
SWITZERLAND	400 V ± 10% ; 50 Hz 0.75 - 375 kW - 2-6 poles	EnV	IE2 compulsory 01.07.2011	For extension of regulations in 2015 and 2017, Swiss Energy Act will be revised in time
TURKEY	400 V ± 10% ; 50 Hz 0.75 - 375 kW - 2-6 poles	EC 640/2009	IE1	No decision yet. Will follow probably the EU timeline state initiative and customer awareness for IE2
USA	460 V ± 10% ; 60 Hz 1 - 200 HP - 2-6 poles	Nema EPAct EISA 2007	IE3 compulsory 19.12.2010	
CANADA	460 V/575 V ± 10% ; 60 Hz 1 - 200 HP - 2-6 poles	CSA C390	IE3 compulsory 01.01.2011	
MEXICO	460 V ± 10% ; 60 Hz 1 - 200 HP - 2-6 poles	Nema EPAct EISA 2007	IE3 compulsory 01.01.2011	Will follow USA model
BRAZIL	220/380/440/460/480 V ± 10% ; 60 Hz 0.75 - 250 kW - 2-8 poles	NBR 17094-1 Regulation 553	IE2 compulsory 08.12.2009	
CHILE	380/400/420/440/460/690 V ± 10% ; 50 Hz 0.75 Kw - 7.5 kW - 2-6 poles	NCH 3086	IE2 compulsory 04.01.2011	
CHINA	380 V ± 10% ; 50 Hz 0.55 - 315 kW - 2-6 poles	GB 18613-2006	IE2 is planned	
HONG KONG	380 V ± 10% ; 50 Hz 0.75 - 375 kW - 2-6 poles	Mandatary Buildings Energy Efficiency Bill	IE2 introduction stage since Dec 2009	01.01.2015 - IE3 from 7.5 to 375 kW or IE2 motor with fre□uency converter 01.01.2017 - IE3 from 0.75 to 375 kW or IE2 motor with fre□uency converter
INDIA	415 V/690 V ± 10% ; 50 Hz 0.37 - 315 kW - 2-8 poles	IS□ 2615	IE2 compulsory 01.06.2011	IE3 from 01.01.2014
ISRAEL	400 V ± 10% ; 50 Hz 0.75 - 185 kW - 2-8 poles	IS□5289	IE2 compulsory 01.02.2008	
JAPAN	200/220/400/440 V ± 10% ; 50/60 Hz 0.2 - 160 kW - 2-6 poles	JIS C 4210 JIS C 4212	IE2 expected	No law, efficiency per JIS standards. IEC 60034-30 will be integrated into JIS in 2012
KOREA	up to 600 V ± 10% ; 60 Hz 0.75 - 200 kW - 2-6 poles	KS C 4202	IE2 compulsory 01.01.2010	
SINGAPORE	415 V ± 10% ; 50 Hz 1.1 - 90 kW - 2-4 poles	SS530□2006	IE2	Only government pro□ects compulsory IE2
TAIWAN	□ 600 V ± 10% ; 60 Hz 0.37 - 200 kW - 2-8 poles	CNS14400	IE2	No plan to adapt IEC 60034-30. IE2 motors can be certified acc. to CNS 14400 as high efficiency motors
SAUDI ARABIA	380 V/ 460 V ± 5% ; 60 Hz all kW - all poles	No regulation	-	
UNITED ARAB EMIRATES	400 V ± 10% ; 50 Hz 0.75 - 375 kW - 2-6 poles	No regulation	IE1	No regional standards regarding a minimun efficiency
SOUTH AFRICA	400 V/525 V ± 10% ;50 Hz 0.75 - 375 kW - 2-6 poles	IEC 60034-30	IE1	
AUSTRALIA NEW ZELAND	415 V/690 V ± 10% ; 50 Hz 0.75 - 186 kW - 2-8 poles	AS/NZS 1359.5-2004	IE2 compulsory 01.04.2006	IE3 expected for near future

CONDITIONS OF INSTALLATION

The motors comply with the relevant standards and regulations, especially:

ELECTRICAL	Rating and performance	IEC 60034-1
	Methods for determining losses and efficiency using tests	IEC 60034-2
	Standard method for determing losses and efficiency from tests	IEC 60034-2-1
	Efficiency classes of single speed, three-phase, cage-induction motors (IE-code)	IEC 60034-30
	Terminal markings and direction of rotation	IEC 60034-8
	Starting performance	IEC 60034-12
	Standard voltages	IEC 60038
	Insulating materials	IEC 60085
MECHANICAL	Dimensions and output ratings	IEC 60072
	Mounting dimensions and relationship frame sizes-output ratings, IM B3, IM B5, IM B14	IEC 60072
	Cylindrical shaft ends for electric motors	IEC 60072
	Degrees of protection	IEC 60034-5
	Methods of cooling	IEC 60034-6
	Mounting arrangements	IEC 60034-7
	Noise limits	IEC 60034-9
	Mechanical vibration	IEC 60034-14
	Mounting flanges	DIN 42948
	Tolerances of mounting and shaft extensions	DIN 42955
	Classification of environmental conditions	IEC 60721-2-1
	Mechanical vibration; balancing	ISO 8821

The motors are designed for operation at **altitudes ≤ 1000 m** above sea-level and at ambient temperatures of up to 40°C. Exceptions are indicated on the rating plate. The motors conform to degree of protection IP 55 to IEC 60034-5[1]. Higher protection on request.

The standard design for horizontal mounting is suitable for indoor and protected outdoor installation, climate group moderate (see page 18) (temperature of coolant -20° to +40°C). For unprotected outdoor installation or severe climatic conditions (moisture category wet, climate group worldwide, extremely dusty site conditions, aggressive industrial atmosphere, danger of storm rain and coastal climate, danger of attack by termites, etc.), as well as vertical mounting, special protective measures are recommended, such as:

- Protective cowl (for vertical shaft-down motors)
- For vertical shaft-up motors additional bearing seal and flange drainage
- Special paint finish
- Treatment of winding with protective moisture-proof varnish
- Anti-condensation heating (possibly winding heating)
- Condensation drain holes

The special measures to be applied have to be agreed with the factory once the conditions of installation have been settled.

The corresponding conditions of installation have to be clearly indicated in the order.

1) IP54 for brake motors AMS and for AMBZ, AMBY from size 63 to 132

TOLERANCES

ELECTRICAL TOLERANCES

For industrial motors to EN 60034-1, certain tolerances must be allowed on guaranteed values, taking into consideration the necessary tolerances for the manufacture of such motors and the materials used. The standard includes the following remarks:

1- It is not intended that guarantees necessarily have to be given for all or any of the items involved. Quotations including guaranteed values subject to tolerances should say so, and the tolerances should be in accordance with the table.
2- Attention is drawn to the different interpretation of the term guarantee. In some countries a distinction is made between guaranteed values and typical or declared values.
3- Where a tolerance is stated in only one direction, the value is not limited in the other direction.

Values for	Tolerance
Efficiency (η) (by indirect determination)	- 0.15 (1 - η) at $P_N \leq 150$ kW - 0.1 (1 - η) at $P_N > 150$ kW
Power factor ($\cos \varphi$)	$\frac{1 - \cos \varphi}{6}$, minimum 0.02, maximum 0.07
Slip (s) (at rated load and at working temperature)	± 20 % of the guaranteed slip at $P_N \geq 1$ kW ± 30 % of the guaranteed slip at $P_N < 1$ kW
Breakaway starting current (I_A) (in the starting circuit envisaged)	+ 20 % of the guaranteed starting current (no lower limit)
Breakaway torque (M_A)	- 15 % and + 25 % of the guaranteed breakaway torque (+ 25 % may be exceeded by agreement)
Pull-up torque (M_S)	- 15 % of the guaranteed value
Pull-out torque (M_K)	- 10 % of the guaranteed value (after allowing for this tolerance, M_K/M_N not less than 1.6)
Moment of inertia (J)	± 10 % of the guaranteed value

MECHANICAL TOLERANCES

According to IEC 60072-1, the following tolerances on mechanical dimensions of electric motors are permitted:

Parameter	Code	Tolerance	
Shaft height	H	- up to 250 - over 250	-0.5 mm -1 mm
Diameter of shaft end[1)]	D-DA	- from 11 to 28 mm - from 38 to 48 mm - from 55 to 100 mm	j6 k6 m6
Hub key width	F-FA		h9
Flange spigot	N	- up to 132 - over size 132	j6 h6

1) Centerings holes in shaft extension to DIN 332 part 2

DEGREES OF PROTECTION

Degrees of mechanical protection for machines are designated in accordance with IEC 60034-5 by the letters IP and two characteristic numerals.

First numeral Protection against contact and ingress of foreign bodies

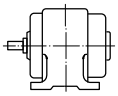
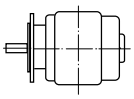
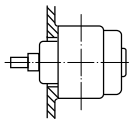
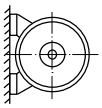
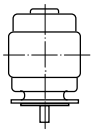
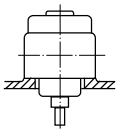
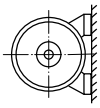
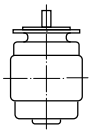
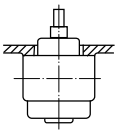
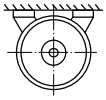
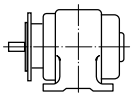
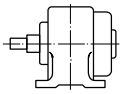
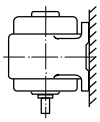
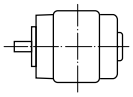
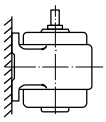
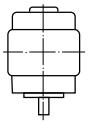
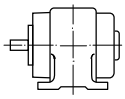
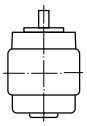
IP	Description
0	No special protection
1	Protection against solid foreign bodies larger than 50 mm (Example inadvertent contact with the hand)
2	Protection against solid foreign bodies larger than 12 mm (Example inadvertent contact with the fingers)
3	Protection against solid foreign bodies larger than 2.5 mm (Example Wires, tools)
4	Protection against solid foreign bodies larger than 1 mm (Example Wires, bands)
5	Protection against dust (harmful deposits of dust)
6	Complete protection against dust

Second numeral Protection against ingress of water

IP	Description
0	No special protection
1	Protection against vertically falling water drops (condensation)
2	Protection against dropping water when inclined by up to 15
3	Protection against waterspray at up to 60 from vertical
4	Protection against water splashed from any direction
5	Protection against water projected by a nozzle from any direction
6	Protection against heavy seas or water projected in powerful jets
7	Protection when submerged between 0.15 and 1 m.
8	Protection when continuously submerged in water at conditions agreed between the manufacturer and the user

MOUNTING ARRANGEMENTS

Mounting arrangements for rotating electrical machines are designated according to IEC 60034-7, Code I (in brackets Code II).

Foot mounting	Flange mounting	Motors without endshield
IM B3 (IM 1001) 	IM B5 (IM 3001) Flange type A to DIN 42 948 at drive end 	IM B9 (IM 9101) without endshield and without ball bearings on drive end 
IM B6 (IM 1051) 	IM V1 (IM 3011) Flange type A to DIN 42 948 at drive end 	IM V8 (IM 9111) without endshield and without ball bearings on drive end 
IM B7 (IM 1061) 	IM V3 (IM 3031) Flange type A to DIN 42 948 at drive end 	IM V9 (IM 9131) without endshield and without ball bearings on drive end 
IM B8 (IM 1071) 	IM B35 (IM 2001) Flange type A to DIN 42 948 at drive end 	IM B15 (IM 1201) without endshield and without ball bearings on drive end 
IM V5 (IM 1011) 	IM B14 (IM 3601) Flange type C to DIN 42 948 at drive end 	
IM V6 (IM 1031) 	IM V18 (IM 3611) Flange type C to DIN 42 948 at drive end 	
IM B34 (IM 2101) Flange type C to DIN 42 948 at drive end 	IM V19 (IM 3631) Flange type C to DIN 42 948 at drive end 	

All standard motors can be installed according to the following mounting arrangements

Frame Size	B3	B5	B35	Based on B5		Based on B3					Based on B35	
				V1	V3	V5	V6	B6	B7	B8	V15	V36
56-160	√	√	√	√	√	√	√	√	√	√	√	√
180-225	√	√	√	√	*	*	*	*	*	*	*	*
250-315	√	*	√	*	*	*	*	*	*	*	*	*

* for high loads refer to us

It is essential to state the desired mounting arrangement when ordering, as the constructive design depends partly on the mounting arrangement.

MATERIALS

Motor parts	Frame size	Material
Motor housing	56 - 160 180 - 315	Aluminium alloy Cast iron
Endshield	56 - 160 180 - 315	Aluminium alloy* Cast iron
Flanged endshield	56 - 160 180 - 315	Aluminium alloy* Cast iron
Fan cover	56 - 112 56 - 112 132 - 315	Plastics Sheet steel (optional) [1)] Sheet steel
Fan	56 - 315 56 - 160	Plastics Aluminium alloy (optional)
Terminal box	56 - 112 56 - 112 132 - 160 180 - 315	Plastics Aluminium alloy (optional) [2)] Aluminium alloy Cast iron

1) Standard for brake motors type AMBY and AMBZ and for AMS 112
2) For three-phase motors only

* Cast iron option for 112-132

PAINT FINISH

NORMAL FINISH

Suitable for climate group Moderate to IEC 60721-2-1, e.g. indoor and outdoor installation.
For short periods up to 100% rel. humidity at temperatures up to +30 C.
Continuously up to 85% rel. humidity at temperatures up to +25 C.
Standard paint color RAL 9005.

SPECIAL FINISH K1

Suitable for climate group Worldwide to IEC 60721-2-1, e.g. outdoor installation in corrosive chemical and marine atmospheres.
For short periods up to 100% rel. humidity at temperatures up to +35 C.
Continuously up to 98% rel. humidity at temperatures up to +30 C.

BEARINGS

CLASSIFICATION OF BEARINGS (STANDARD DESIGN) [1)]

Bearings for standard design have permanent lubrication. Ball bearings to ISO15 (DIN 625).

Frame size	Poles	DE - NDE	Dimension
56	2 + 4	6201-2Z	12x32x10
63	2 + 4	6202-2Z	15x35x11
71	2 - 8	6203-2Z	17x40x12
80	2 - 8	6204-2Z C3	20x47x14
90	2 - 8	6205-2Z C3	25x52x15
100	2 - 8	6206-2Z C3	30x62x16
112	2 - 8	6306-2Z C3	30x72x19
132	2 - 8	6208-2Z C3	40x80x18
160	2 - 8	6309-2Z C3	45x100x25
180	2 - 8	6311 C3	55x120x29
200	2 - 8	6312 C3	60x130x31
225	2 - 8	6313 C3	65x140x33
250	2 - 8	6314 C3	70x150x35
280	2 - 8	6316 C3	80x170x39
315	2	6317 C3	85x180x41
315	4 - 8	NU319 C3 - 6319 C3	95x200x45

1) With regard on bearings for special design, consult us

LUBRICATION

Permanent lubrication up to 160 frame
180 frame up with regreasing facility lubrication nipple is a flat M10x1 to DIN 3404

ROLLER BEARINGS

Roller bearings available as an option. Please consult us.

BEARING ARRANGEMENT

Frame size	Bearing DE	Bearing NDE	Spring-loaded
56 - 160 Standard motors	Non-locating bearing	Non-locating bearing	Non-drive end
63 - 160 Brake motors	Non-locating bearing	Locating bearing	Drive end
180 - 315 Standard motors	Locating bearing	Non-locating bearing	Non-drive end

RELUBRICATION INTERVALS

Relubrication intervals for operating temperatures up to 70□C for 1000HRS

	3000 RPM		1500 RPM		1000 RPM		Quantity
Frame Size	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical	gr
180	4.00	2.00	9.00	4.50	13.00	7.50	15
200	3.50	1.75	8.00	4.00	12.00	6.00	20
225	3.00	1.50	7.50	3.75	11.00	5.50	23
250	2.00	1.00	7.00	3.50	10.00	5.00	26
280	1.50	0.75	6.50	3.25	9.00	4.50	40
315	1.00	0.50	4.00	2.00	8.00	4.00	55

BELT DRIVE

The data apply only to the normal drive end shaft extension of IM B3 motors with one speed.
Calculation of belt drive

$$F_R = \frac{19120 \cdot P \cdot k}{D_1 \cdot n}$$

F_R = Radial shaft load in N
P = Output in kW
n = Speed in min^{-1}
D_1 = Pulley diameter in m
k = Belt tension factor, varying with the type of belt, assumed to be approximately

- 3-4 for normal flat belt without idler pulley
- 2-2.5 for normal flat belt with idler pulley
- 2.2-2.5 for V-belt

For exact data apply to the belt manufacturer.

PERMISSIBLE AXIAL FORCES

Maximum permissible axial forces without additional radial forces*

Frame size	Horizontal shaft				Vertical shaft - force upwards				Vertical shaft - force downwards			
	3000 min^{-1} kN	1500 min^{-1} kN	1000 min^{-1} kN	750 min^{-1} kN	3000 min^{-1} kN	1500 min^{-1} kN	1000 min^{-1} kN	750 min^{-1} kN	3000 min^{-1} kN	1500 min^{-1} kN	1000 min^{-1} kN	750 min^{-1} kN
56	0.16	0.21	-	-	0.18	0.22	-	-	0.15	0.19	-	-
63	0.19	0.26	-	-	0.21	0.28	-	-	0.17	0.24	-	-
71	0.23	0.33	0.33	0.37	0.26	0.35	0.36	0.39	0.21	0.30	0.31	0.34
80	0.32	0.44	0.46	0.50	0.34	0.47	0.48	0.53	0.29	0.41	0.43	0.47
90	0.34	0.48	0.49	0.54	0.38	0.47	0.53	0.58	0.31	0.44	0.46	0.51
100	0.48	0.68	0.70	0.77	0.54	0.74	0.76	0.83	0.43	0.62	0.64	0.71
112	0.48	0.68	0.70	0.77	0.56	0.75	0.77	0.84	0.40	0.60	0.62	0.69
132 S	0.80	1.13	1.16	1.28	1.00	1.32	1.36	1.47	0.61	0.93	0.97	1.08
132 M	0.78	1.09	1.13	1.24	0.99	1.30	1.33	1.45	0.58	0.89	0.92	1.03
160 M	0.84	1.18	1.21	1.33	1.18	1.52	1.56	1.68	0.50	0.83	0.87	0.99
160 L	0.82	1.15	1.18	1.30	1.18	1.51	1.55	1.67	0.46	0.79	0.82	0.94
180	0.82	1.15	1.18	1.30	1.18	1.51	1.55	1.67	0.46	0.79	0.82	0.94
200	0.82	1.15	1.18	1.30	1.18	1.51	1.55	1.67	0.46	0.79	0.82	0.94
225	1.10	1.60	1.90	2.40	2.10	2.60	2.90	3.40	0.30	0.70	1.00	1.50
250	1.00	1.60	2.00	2.50	2.30	2.70	3.20	3.70	0.20	0.60	1.10	1.50
280	1.70	1.90	2.40	2.90	2.90	3.10	3.60	3.70	0.15	0.30	0.80	1.00
315	2.00	14.00	14.00	14.00	3.60	8.00	9.20	7.40	1.00	1.90	2.40	2.90

Values for 50 Hz. For service on 60 Hz, reduce values by 10%

* Consult according to direction of force

PERMISSIBLE RADIAL FORCES

Without additional axial force (Ball bearings)

Nominal life ≥ 20.000 h (Lh10)

F_R = permissible radial force in kN in load point corresponding to half shaft extension

Frame size	3000 min^{-1} kN	1500 min^{-1} kN	1000 min^{-1} kN	750 min^{-1} kN
56	0.34	0.42	-	-
63	0.38	0.48	-	-
71	0.46	0.58	0.67	0.73
80	0.59	0.83	0.86	0.94
90	0.67	0.94	0.97	1.07
100	0.92	1.29	1.33	1.47
112	0.93	1.30	1.34	1.48
132 S	1.35	1.90	1.96	2.15
132 M	1.40	1.97	2.03	2.23
160 M	1.55	2.17	2.23	2.46
160 L	1.58	2.22	2.29	2.52
180 M	3.00	4.44	4.55	4.76
180 L	3.02	4.47	4.58	4.79
200 L	5.24	6.85	8.01	8.94
225 M	6.11	7.80	9.09	10.12
250 M	6.79	8.82	10.31	11.45
280 S	7.76	11.90	13.87	15.44
280 M	7.79	11.99	13.97	15.55
315 S/M	7.02	11.35	13.40	15.13
315 L	7.03	11.37	13.35	15.09

SPECIAL ENDSHIELDS AND FLANGES

Full range of smaller sized and over sized flanges

Frame size	Smaller sized Flange		Over sized Flange	
	IM B5 [1]	IM B14	IM B5	IM B14
56	NA	NA	NA	63
63	56	56	71 [3]	71-80
71	56-63	63	80-90	80-90
80	63-71	63-71	NA	90-100
90 S-L	63-71	71-80	100 [3]	100-112
100 L	71-80	90	NA	132
112 M	80 [2] -90 [2]	90	132 [7]	132
132 S	112 [2]	112	NA	160 [1] [4]
132 M	112	112	160 [4]	160
160 M	NA	132	NA	NA
160 L	NA	132	NA	NA

Possibility to fit over sized bearings

Frame size	IM B3	IM B5	IM B14
56	NA	NA	NA
63	6203-6205	6203	6203-6205
71	6204-6205	6204-6205	6204-6205
80	6205-6206	6205-6206	6205-6206
90 S-L	6206	6206-6308	6206
100 L	6306	6306-6208	6306
112 M	6208	6208	6208
132 S	6308-6309	6308	6308 [4]
132 M	6308-6309	6308-6309	6309
160 M	NA	6310	6310
160 L	NA	6310	6310

For higher output (progressive motor) please consult us

Aluminium endshields and flanges with steel insert

Frame size	Endshield DE	Endshield NDE	IM B5	IM B14
71	A	A	A	NA
80	A	A	A	A
90 S-L	A	A	NA	NA
100 L	A	A	A	NA
112 M	A	A	A	NA
132 S	NA	NA	NA	NA
132 M	NA	NA	A [5]	NA
160 M	NA	NA	NA	NA
160 L	NA	NA	NA	NA

Cast iron endshields and flanges

Frame size	Endshield DE	Endshield NDE	IM B5	IM B14	Regreasing device DE	Regreasing device NDE	Regreasing device IM B5	Regreasing device IM B14
71	NA	NA	NA	NA	NA	NA	NA	NA
80	A [6]	A [6]	NA	NA	NA	NA	NA	NA
90 S-L	A [6]	A [6]	NA	NA	NA	NA	NA	NA
100 L	A [6]	A [6]	NA	NA	NA	NA	NA	NA
112 M	A [6]	A [6]	NA	NA	NA	NA	NA	NA
132 S	A	A	A	A	NA	NA	A	A
132 M	A	A	A	A	A	A	A	A
160 M	A	A	A	A	A	A	A	A
160 L	A	A	A	A	A	A	A	A

A Available NA Not available

1) Not available for all motor ratings; consult us
2) Cast iron endshield with radial slotted holes
3) Not interchangeable with standard execution
4) Cast iron endshield
5) Only with oversized bearing (6308)
6) Special mechanical design
7) Only with oversized bearing (6208)

COOLING

Surface cooling, independent of the direction of rotation.
Motors type AM available without internal fan as type AG, e.g. for installation in a directed air stream (outputs on re□uest).

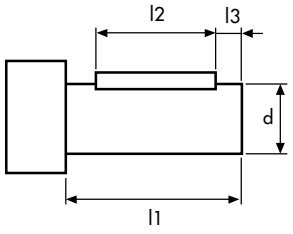
VIBRATION

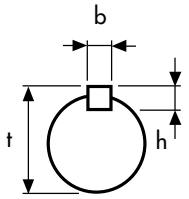
The amplitude of vibration in electric motors is governed by EN 60034-14 Mechanical vibration of rotating electrical machines with shaft heights 56 and larger - methods of measurement and limits.
Standard motors are designed to vibration grade A (normal). Vibration grade B is available at extra cost.

Rotors are at present dynamically balanced with half key fitted as per DIN ISO 8821. Other balancing only on re□uest.
The motors are identified as follows□

□H□ or □blank□ means balanced with half key
□F□ means balanced with full key
□N□ means no key

POSITION AND DIMENSIONS OF KEY





Frame size	Poles	d x l1	b x h	l2	l3	t
56		9 x 20	3 x 3	15	2.5	10.2
63		11 x 23	4 x 4	15	4	12.5
71		14 x 30	5 x 5	20	6	16
80		19 x 40	6 x 6	30	6	21.5
90		24 x 50	8 x 7	40	6	27
100		28 x 60	8 x 7	50	6	31
112		28 x 60	8 x 7	50	6	31
132		38 x 80	10 x 8	70	6	41
160		42 x 110	12 x 8	100	6	45
180		48 x 110	14 x 9	90	5	51.5
200		55 x 110	16 x 10	90	5	59
225	2	55 x 110	16 x 10	90	5	59
225	4	60 x 140	18 x 11	110	5	64
250	2	60 x 140	18 x 11	110	5	64
250	4	65 x 140	20 x 11	110	5	74.5
280	2	65 x 140	18 x 11	110	5	69
280	4	75 x 140	20 x 12	140	5	85
315	2	65 x 140	18 x 11	125	5	69
315	4	80 x 170	22 x 14	160	5	85

Dimensions in mm.
For larger shafts in special design the dimensions l2 and l3 are maintained.

ANTI-CONDENSATION HEATER

On re□uest, motors which due to strong temperature fluctuations are exposed to condensation during standstill, can be fitted against surcharge with an anti-condensation heater (space heater).
For supply voltage and heater rating please refer to the following table□

Frame size	Supply voltage (V)	Heater rating per motor (W)
112 - 160	110 or 230	25
180 - 225	110 or 230	50
250 - 280	110 or 230	50
315	110 or 230	75

During operation of the motor, the heating must be switched off.

NOISE

The noise level of an electrical machine is determined by measuring the sound pressure level in accordance with curve A of the sound level meter to EN 60651 and is indicated in dB (A).
The permitted noise levels of electrical machines are fixed in EN 60034-9 (IEC 34-9). The noise level of our motors is well below these limit values.
Air-borne sound measurements are carried out in an anechoic testing chamber to EN 21680-ISO 1680.
Speed corresponding to a mains fre□uency of 50 Hz and the number of poles.

NOISE LEVELS

The noise values listed below refer to 50 Hz at rated voltage with a tolerance of up to + 3 dB(A). Values for pole-changing motors on re□uest. For 60 Hz supply values are 3-5 dB(A) higher.
Sound pressure level L_{pA} and sound power level L_{WA} for three-phase single-speed motors with dimensions and output ratings to IEC 60072

Frame size	2 poles		4 poles		6 poles		8 poles	
	LWA	LpA	LWA	LpA	LWA	LpA	LWA	LpA
56	57	48	47	38				
63	58	49	47	38				
71	61	52	51	42	49	40		
80	72	60	60	48	52	40	47	35
90	74	62	61	49	58	46	54	42
100	78	66	62	50	62	51	58	46
112	80	68	65	53	65	53	58	46
132	81	72	71	59	69	57	64	52
160	87	74	75	62	71	58	69	56
180	90	77	78	66	74	62	72	60
200	91	78	80	68	77	65	74	62
225	92	80	88	76	80	68	75	64
250	93	81	88	76	80	68	75	64
280	93	82	89	79	83	71	81	70
315	93	82	89	79	83	71	81	70

RATED VOLTAGE

For the rated voltage of the motors, EN 60034-1 allows a tolerance of ± 5 %. According to IEC 60038, the mains voltages may have a tolerance of ± 10 %.

Therefore the three-phase motors are designed for the following rated voltage ranges (exceptions are shown in the data tables)

Mains voltage to IEC 60038	Rated voltage range of motor
230 V ± 10%	218-242 V ± 5%
400 V ± 10%	380-420 V ± 5%
690 V ± 10%	655-725 V ± 5%

Within the rated motor voltage range, the permissible maximum temperature is not exceeded. When the motors are operated at the limits of the voltage tolerance, the permissible overtemperature of the stator winding may be exceeded by 10 K.

Nameplates are marked with the maximum rated currents within the stated voltage ranges.

For brake motors, for motors in 500 V, 50 Hz design, and all not standard voltages, no voltage range is marked. The voltage tolerances to EN 60034-1 apply.

RATED FREQUENCY

Three-phase 50 Hz motors can also be operated on 60 Hz mains, provided the mains voltage increases proportionally to the frequency. The relative values for starting and breakaway torque remain nearly unchanged and slightly increase for the starting current. The rated speed increases by the factor 1.2 and output by factor 1.15. Should a motor designed for 50 Hz be operated at 60 Hz without the voltage being increased, the rated output of the motor cannot be increased. Under these operating conditions, rated speed increases by factor 1.2. The relative values for starting and breakaway torque are reduced by factor 0.82 and for starting current by factor 0.9.

Additionally to the voltage range for 50 Hz operation, three-phase single-speed motors (not brake motors) are also marked with the voltage range for 60 Hz operation.

Nameplates examples

RATED CURRENT

For three-phase motors the rated currents listed in the data tables apply to an operating voltage of 400 V. The conversion to other operating voltages, with output and frequency remaining unchanged, is to be made as follows:

Nominal voltage (V)	230	380	400	440	500	660	690
Conversion factor x I_N	1.74	1.05	1.0	0.91	0.80	0.61	0.58

RATED TORQUE

$$\text{Rated torque in Nm} = 9550 \times \frac{\text{Rated power in kW}}{\text{Rated speed in min}^{-1}}$$

OUTPUT

The outputs stated in this catalogue are for constant load in continuous running duty S1 according to EN 60034-1, based on an ambient temperature of 40°C and installation at altitudes up to 1000 m above sea level.

For severe operating conditions, e.g. high switching rate, long run-up time or electric braking, a thermal reserve is necessary, which could call for higher thermal class or the use of a motor with a higher rating. In these cases we recommend to enquire with detailed information on the operating conditions.

OVERLOAD

At operating temperature three-phase motors are capable of withstanding an overload for 15 seconds at 1.5 times the rated torque at rated voltage. This overload is according to EN 60034-1 and will not result in excessive heating.
Utilizing thermal class F, motors can be operated continuously with an overload of 12%. Nevertheless this is not valid for motors which to catalogue are utilized to thermal class F.

CONNECTION

Motor output at 50 Hz	230 V Δ 400 V Y	400 V Δ 690 V Y	500 V Y	500 VΔ	690 VΔ
under 3 kW	standard	on request	on request	on request	-
4 to 5.5 kW	standard	standard	on request	on request	on request
≥ 7.5 kW	on request	standard	on request	on request	on request

INSULATION AND TEMPERATURE RISE

Class F insulation to EN 60034-1 is used throughout.
In standard design motors are intended for operation at 40°C ambient temperature with class B temperature rise only, with an overtemperature limit of 80 K. This also applies for the rated voltage range to IEC 60038. Exceptions are shown on the data tables.

Temperature rise (ΔT*) and maximum temperatures at the hottest points of the winding (T_{max}) according to the temperature classes of EN 60034-1.

	ΔT*	T_{max}
Class B	80 K	125°C
Class F	105 K	155°C
Class H	125 K	180°C

*Measurement by resistance method

Output reduction at ambient temperatures over 40°C

Ambient temperature	45°C	50°C	55°C	60°C
Class B Reduction of nominal output to approx.	95 %	90 %	85 %	80 %

When a winding is utilized to temperature class F (105K), no output reduction is required up to an ambient temperature of 55°C. This does not apply to motors which in their standard design are already utilized to thermal class F.

Installation at altitudes of more than 1000 m above sea level (see also EN 60034-1)

Altitude of installation	2000 m	3000 m	4000 m
At 40°C ambient temperature and thermal class B Rated output reduced to approx.	92 %	84 %	76 %
At 40°C ambient temperature and thermal class F Rated output reduced to approx.	89 %	79 %	68 %
Full nominal output to data tables with thermal class B and ambient temperature of	32°C	24°C	16°C
Full nominal output to data tables with thermal class F and ambient temperature of	30°C	19°C	9°C

STARTING RATE

The permissible number of starts per hour can be taken as given in the table below, provided the following conditions are met.
Additional moment of inertia ≤ moment of inertia of the rotor: load torque rising with the square of the speed up to nominal torque; starts at even intervals.

Shaft height	Permissible no. of starts per hour for		
	2 poles	4 poles	≥ 6 poles
56 - 71	100	250	350
80 - 100	60	140	160
112 - 132	30	60	80
160 - 180	15	30	50
200 - 225	8	15	30
250 - 315	4	8	12

For permissible number of starts for pole-changing motors and brake motors please consult us, indicating the complete operating conditions.

For the motors AMME and AMDE series, time between stop and restart of the motor must be higher than 15 s.

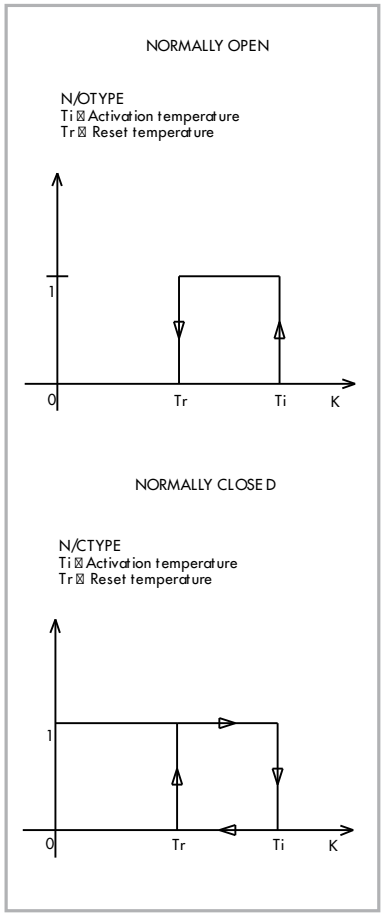
THERMAL PROTECTION

The decision on a particular type of thermal protection should be taken according to the actual operating conditions. Motors may be protected by means of current-dependent thermal protection switches, overcurrent relays and temperature detectors.

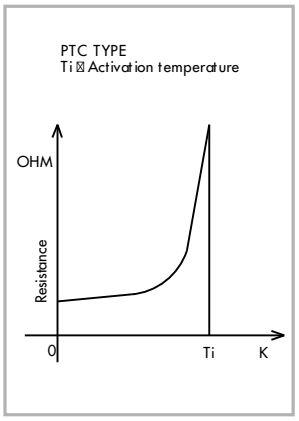
Thermal protection is possible as follows:
- Thermal protection switch with bimetal release
- Thermistor protection with semiconductor temperature detectors (PTC) in the stator winding in connection with release (if required, with additional motor protection switch).
- Bimetal temperature detector as N/C or N/O in the stator winding (if required, with additional motor protection switch).
- Resistance thermometer for monitoring winding and bearing temperature.

Should protection of the motor be required, we install protection switch with bimetal release (semiconductor temperature detectors on request).

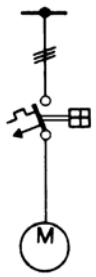
Operating specifications
Thermal cut-out



Operating specifications
of the thermistors

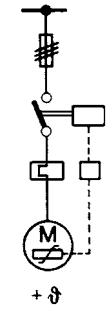


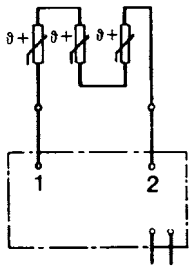
EXAMPLES OF CONNECTION



Protection method

Motor protection switch with thermal and electromagnetic overcurrent release	Protection against • Overload in continuous service • Locked rotor
Contactor with overcurrent relay Thermistor protection and fuse	In service against • Overload in continous service • Long starting and braking periods • High switching rate In case of fault against • Obstruction of cooling • Increased ambient temperature • Single-phase operation • Fre uency fluctuations • Switching against locked rotor
Semiconductor temperature detector with release	In service against • Overload in continous service • Long starting and braking periods • High switching rate In case of fault against • Obstruction of cooling • Increased ambient temperature • Single-phase operation • Fre uency fluctuations • Switching against locked rotor





AUXILIARIES

Encoder (standard design)

Pulses per revolution	200-2048
Max outputs fre uency	100 kHz
Power supply	$5V_{dc}$
Electronics	line driver
Current consumption without load	100 mA
Outputs	2 signals with rectangular pulses $\overline{A}$, $\overline{B}$ 2 signals with inverted rectangular pulses A, B zero pulse and inverted zero pulse
Pulse displacement between outputs	90
Protection	IP 54
Max speed	3000 (6000) min^{-1}
Operating temperature	-10 C 85 C

ORDER DATA

MOTORS FOR NORMAL CONTINUOUS DUTY (S1) AND NORMAL OPERATING CONDITIONS

Quotation (if submitted) No./Date
Quantity Units
Designation Type
Output (for pole-changing motors, outputs referred to speeds) kW
Speed (for pole-changing motors, outputs referred to speeds) min-1
Direction of rotation (viewed on drive end)
Mounting arrangement (to IEC 60034-7)
Degree of protection, motor/terminal box (to IEC 60034-5)
Mains voltage V
Mains frequency Hz
Method of starting (direct-on-line or Y-Δ)
Location of terminal box
Machine to be driven

Dimensions of cables, if these differ from those allocated by VDE 0100, referred to an ambient temperature of 40 C, or when aluminium conductors are used. It should be stated when parallel connected conductors are used.

ADDITIONAL INFORMATION FOR SPECIAL DESIGNS

Second or non-standard shaft extension
Radial sealing ring
Paint coating
Corrosive protection
Vibration level
Anti-condensation heating
Temperature detectors
Noise requirements
Mechanical or electrical brake
Special stipulations

ADDITIONAL INFORMATION FOR SPECIAL DUTIES

S 2 ... min (short-time duty)
S 3 ... % - ... min (intermittent duty)
S 4 ... % - J_M ... kgm² - J_{ext} ... kgm² (intermittent duty with starting)
S 5 ... % - J_M ... kgm² - J_{ext} ... kgm² (intermittent duty with electric braking)
S 6 ... % - min (continuous-operation periodic duty with intermittent load)
S 7 J_M ... kgm² - J_{ext} ... kgm² (continuous-operation periodic duty with electric braking)
S 8 J_M ... kgm² - J_{ext} ... kgm² (continuous-operation periodic duty with speed changes)
S 9 ... kW (continuous duty with non-periodic load and speed variations).
For this duty type suitable full load values should be taken as the overload concept.
S10 p/Δt .... r .... TL (Duty with discrete constant loads).

ADDITIONAL INFORMATION FOR SPECIAL OPERATING CONDITIONS

Starting conditions (no-load or loaded starting)
Shock loads
Load torque curve during run-up (characteristic)
Moment of inertia (J_{ext}) referred to the motor shaft kgm²
Description of the type of drive (direct coupling, flat or V-belt, straight or helical gears, sprocket, crank, eccentric cam, etc.)
Radial force (or diameter of drive element) N
Direction of force and point of application (distance from shaft shoulder or width of drive element) mm
Axial force and direction of application (pull/thrust) N
Ambient conditions (e.g. increased humidity, dust accumulation, corrosive gases or vapours, increased or extremely low ambient temperature, outdoor installation, installation at altitudes over 1000 m above sea level, external vibration, etc.)