

Efficiency of motors

New efficiency classes for the low-voltage three-phase motors (IE = International Efficiency).

Along with the international discussion on energy efficiency a worldwide harmonized energy efficiency standard classification system has been established for low-voltage three-phase asynchronous motors. For many years low-voltage three-phase motors in the European Union have been sold in three efficiency classes EFF3, EFF2 and EFF1 (CEMEP classification). Aside from this, many different efficiency classification systems have been introduced and well-proven in many countries all over the world.

This was the reason for the International Electrotechnical Commission IEC to develop and publish an energy efficiency standard which replaces all previous national issues. In parallel IEC developed and issued a new standard for determining motor efficiency. The new standard IEC 60034-30-1 defines and harmonizes worldwide the efficiency classes IE1, IE2, IE3 and IE4 for low-voltage three-phase motors in the power range from 0,12 kW to 1000 kW (2p=2, 4, 6, 8).

IE1 = Standard Efficiency

IE2 = High Efficiency

IE3 = Premium Efficiency

IE4 = Super Premium Efficiency

Complying with IEC 60034-30-1 standard the efficiency has to be determined in accordance with the new requirements given in the IEC 60034-2-1 standard.

New EU Commission Regulation 2019/1781 & 2021/341 regarding minimum efficiency of electric motors.

Motors covered by new Regulation

Type	general purpose, geared, with brake, Ex
Voltage	>50V ÷ 1000V
Frequency	50 Hz, 60 Hz or 50/60 Hz
Number of poles	2, 4, 6, 8
Rated power	0,12kW ÷ 1000kW
Duty	continuous (S1, S3≥80 % or S6≥80%)

Motors excluded from new Regulation

Type	<ul style="list-style-type: none"> • multi-speed, slip-ring and with mechanical commutators • motors completely integrated into a product whose efficiency cannot be tested independently from the product • motors with an integrated variable speed drive (compact drives) whose efficiency cannot be tested independently from the variable speed drive • motors with an integrated brake which forms an integral part of the inner motor construction and can neither be removed nor powered by a separate power source during the testing of the motor efficiency • motors specifically designed and specified to operate wholly immersed in a liquid • motors specifically qualified for the safety of nuclear installations, as defined in Article 3 of Council Directive 2009/71/EURATOM • explosion-protected motors specifically designed and certified for mining, as defined in Annex I, point 1 of Directive 2014/34/EU • motors in cordless or battery-operated equipment and motors in hand-held equipment whose weight is supported by hand during operation • motors in hand-guided mobile equipment moved while in operation • Totally Enclosed Non-Ventilated (TENV) motors • motors placed on the market before 1 July 2029 as substitutes for identical motors integrated in products placed on the market before 1 July 2021 (Annex I.1 (a)) and before 1 July 2023 (Annex I.1 (b)), and specifically marketed as such • motors designed specifically for the traction of electric vehicles
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Designed for altitudes > 4000 m a.s.l.

Designed for ambient temperatures < -30°C or > 60°C

With maximum operating temperatures > 400°C

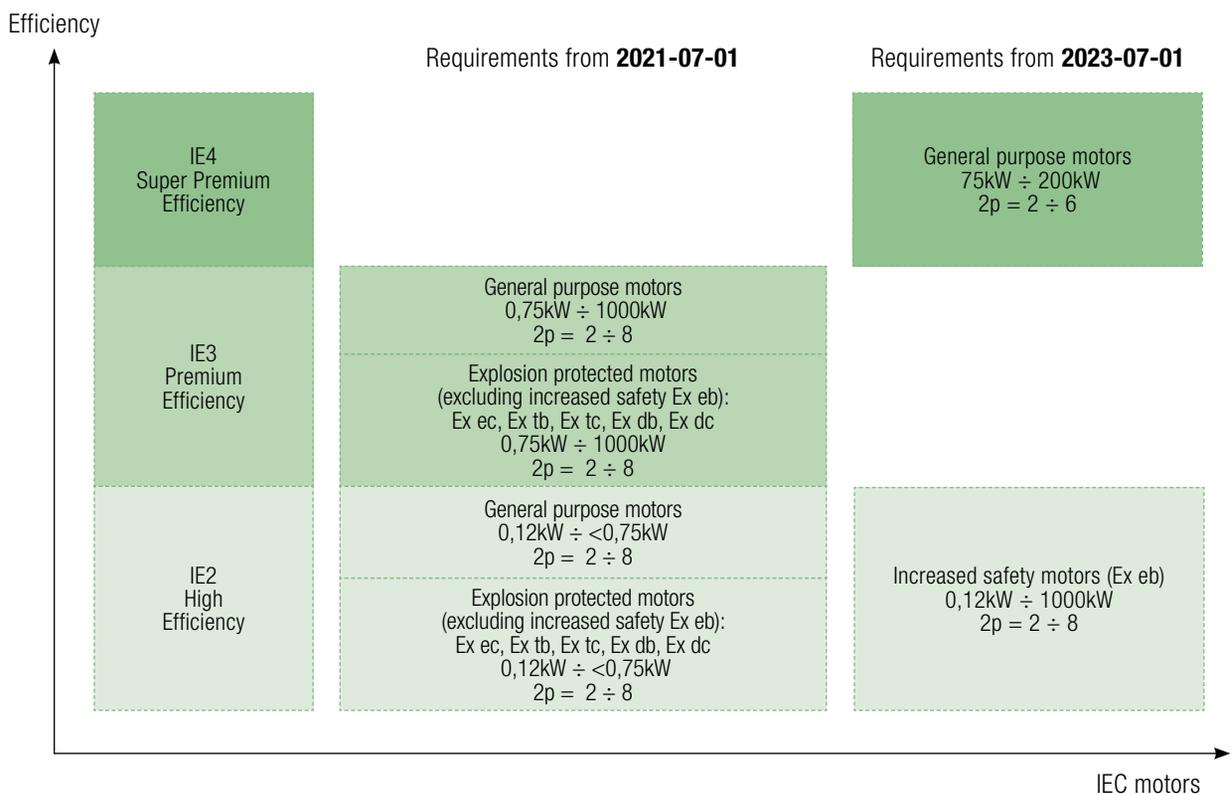
The Commission Regulation (EC) No 2019/1781 & 2021/341 describes efficiency requirements which have been implemented on **2021-07-01** and which will come into force on **2023-07-01**. The required efficiency class of three phase induction motors has to be as follows:

Required efficiency class of three phase induction motors	General purpose motors	Explosion protected motors except motors dedicated for underground mining	
		Increased safety (Ex eb)	Others (Ex ec, Ex tb, Ex tc, Ex db, Ex dc)
IE2	0,12kW ÷ <0,75kW 2p = 2 ÷ 8 from 2021-07-01	0,12kW ÷ 1000kW 2p = 2 ÷ 8 from 2023-07-01	0,12kW ÷ <0,75kW 2p = 2 ÷ 8 from 2021-07-01
IE3	0,75kW ÷ 1000kW 2p = 2 ÷ 8 from 2021-07-01	–	0,75kW ÷ 1000kW 2p = 2 ÷ 8 from 2021-07-01
IE4	75kW ÷ 200kW 2p = 2 ÷ 6 from 2023-07-01	–	–

Cantoni Group pursuing a policy of continuous development of its products, back in the past already took actions to extend offer of high efficiency motors including also explosion-proof motors – we are ready for the new requirements.

Moreover, at this point, **we can deliver to our Customers motors with higher efficiencies or in wider range than defined in Regulation 2019/1781 & 2021/341.**

A graph representation of the above table:



Ratings – Tolerances

Tolerances of motor parameters

Permissible deviations between catalogue values and real values are according to the IEC 60034-1:

Power factor $\cos \varphi$	$\Delta \cos \varphi = -1/6 (1 - \cos \varphi_N)$
Efficiency η	$\Delta \eta = -15\% (100 - \eta_N)$ for $P_N \leq 150 \text{ kW}$ $\Delta \eta = -10\% (100 - \eta_N)$ for $P_N > 150 \text{ kW}$
Speed n	$\Delta n = \pm 20\% (n_s - n_N)$ for $P_N > 1 \text{ kW}$ $\Delta n = \pm 30\% (n_s - n_N)$ for $P_N \leq 1 \text{ kW}$
Locked rotor current ratio I_L/I_N	$\Delta(I_L/I_N) = +20\% (I_L/I_N)$
Locked rotor torque ratio T_L/T_N	$\min (T_L/T_N) = -15\% (T_L/T_N)$ $\max (T_L/T_N) = +25\% (T_L/T_N)$
Breakdown torque ratio T_B/T_N	$\Delta(T_B/T_N) = -10\% (T_B/T_N)$
Moment of inertia J [kgm^2]	$\Delta J = \pm 10\% J$
Sound pressure level L_{pA} [dB]	$\Delta L_{pA} = +3 \text{ dB /A}$

Tolerances of supply voltage value and frequency

Motors comply in standard with voltage value and voltage frequency variations within zone A according to the IEC 60034-1:

Voltage value U	$\Delta U = \pm 5\%$
Voltage frequency f	$\Delta f = \pm 2\%$

Other extended tolerances of supply voltage and their frequency are available on request.

Standards

The electric motors are manufactured according to the international standards:

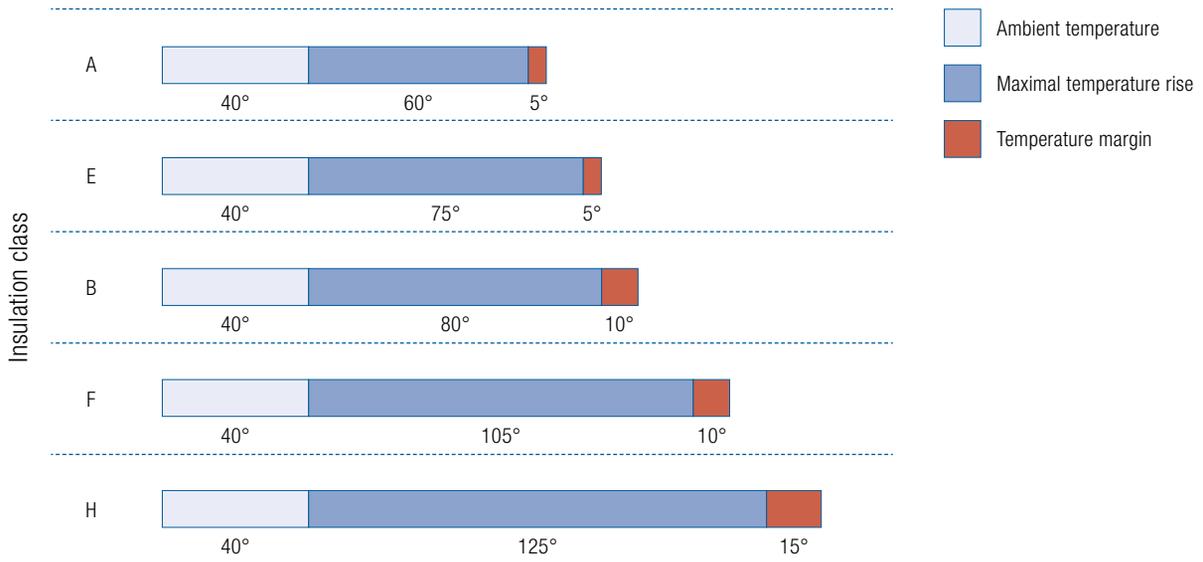
Rating and performance	IEC 60034-1
Methods for determining losses and efficiency	IEC 60034-2-1
Classification of degrees of protection	IEC 60034-5
Methods of cooling	IEC 60034-6
Symbols of construction and mounting arrangements	IEC 60034-7
Terminal markings and direction of rotation	IEC 60034-8
Noise limits	IEC 60034-9
Dimensions and output of electric machines	IEC 60072-1
Vibration limits	IEC 60034-14
Explosive atmospheres – Part 0: Equipment – General requirements	IEC 60079-0
Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures "d"	IEC 60079-1
Explosive atmospheres – Part 7: Equipment protection by increased safety "e"	IEC 60079-7

Insulation classification

The insulation system of an electric motor is determined by a given insulation class on the basis of its thermal resistance. This thermal resistance should be guaranteed by the entire set of electric insulating materials used in the motor insulating system.

Thermal resistance classification is related to the temperature of the hotspot in the insulation occurring during rated operating conditions of the electric motor, allowing for the highest permissible rise in average temperature.

This rise should be selected so that at the highest permissible ambient temperature, the temperature of the hotspot in insulation will not exceed the value assigned to a given thermal resistance class.



Insulation class F in an electric motor means that at ambient temperature of 40°C the temperature rise of the winding may be max. 105°C with the additional temperature margin of 10°C (under specified measuring conditions in accordance with the IEC 60034-1 standard).

Symbols of thermal resistance classes (permissible insulation temperatures at 40°C ambient temperature)

Symbol	Temperature [°C]
A	105
E	120
B	130
F	155
H	180

Class F/B

The standard motors made by Cantoni Motor in their basic version have the insulation class F while the temperature rise is for class B. This means longer life for motors.

For special request we can deliver motors equipped with insulation class H.

Strengthened insulation system gives possibility to safe operation with frequency converters.

Hazardous Area Classification



Hazardous areas include any area in which explosive atmosphere may occur under specific conditions.

An explosive atmosphere is a mixture of dangerous substances with air, under atmospheric conditions, in the form of gases, vapours, mist or dust in which, after ignition has occurred, combustion spreads to the entire unburned mixture.

Potentially explosive atmospheres are classified according to the Zone system (defined in European directive 1999/92/EC) on the basis of the frequency and duration of the occurrence of an explosive atmosphere.

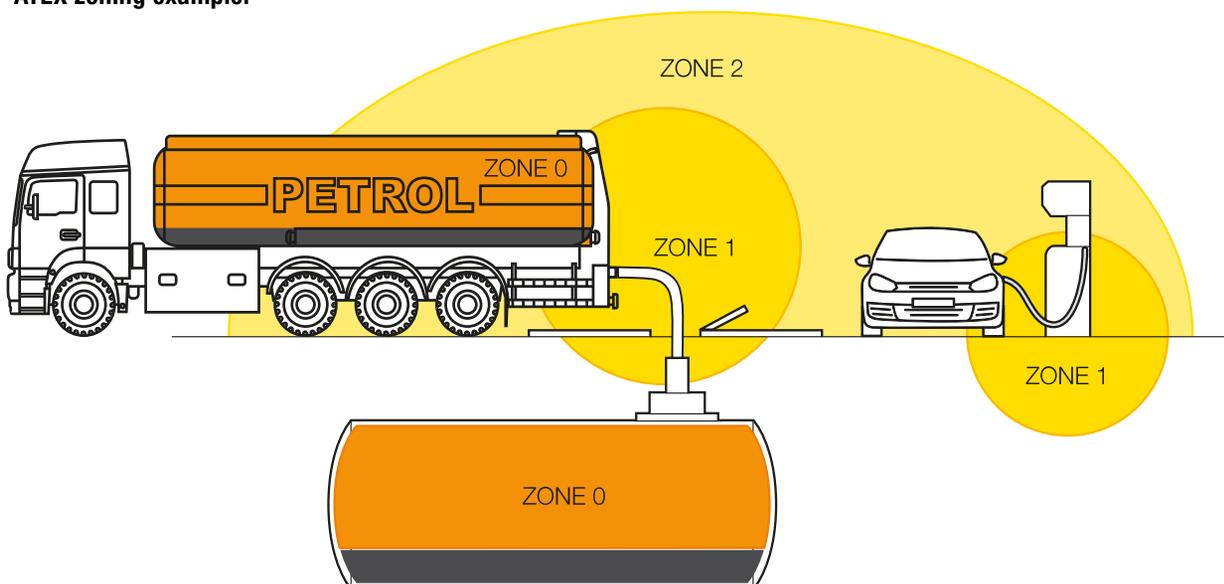
Zone classification

European and IEC Classification		Definition of zone
GAS, VAPOUR, MIST	Zone 0	An area in which an explosive mixture is present continuously or for long periods or frequently
	Zone 1	An area in which an explosive mixture is likely to occur in normal operation occasionally
	Zone 2	An area in which an explosive mixture is unlikely to occur in normal operation but, if it does occur, will persist for a short period only
DUST	Zone 20	An area in which an explosive mixture is present continuously or for long periods or frequently
	Zone 21	An area in which an explosive mixture is likely to occur in normal operation occasionally
	Zone 22	An area in which an explosive mixture is unlikely to occur in normal operation but, if it occurs it will persist for a short period only

'Normal operation' means the situation when installations are used within their design parameters.

Zones are normally determined by the Authorities, but that can also be performed by a third party, a notified body or other experts. It is the owner's responsibility to ensure that the classification of their site is performed before suitable products can be installed at the location.

ATEX zoning example:



REMARK: Electric motors are not used in case of Zone 0 (gases) and Zone 20 (dusts).

Gas and dust subgroups

Different explosive atmospheres (gases, vapours and dusts) have different properties like for example flame temperature, ignition energy, explosive limits, and molecular weight. These properties will determine the likelihood and severity of an explosion. Taking into consideration above, gases and dusts can be grouped in order to select the right equipment for explosive areas.

Subgroup	Environment	Typical substance
IIA	Gases, Vapours and Mists	Propane
IIB		Ethylene
IIC		Hydrogen, Acetylene
IIIA	Combustible Dusts	Combustible flyings
IIIB		Non-conductive
IIIC		Conductive

REMARK: Any equipment which is marked as IIC can be used in atmospheres that contain Group IIA and IIB gases

Any equipment which is marked as IIIC can be used in atmospheres that contain Group IIIA and IIIB dusts

Temperature classes for gases

Temperature classes (T-rating) are defined for equipment based on its maximum surface temperature. When selecting equipment for a potentially explosive atmosphere, the equipment's maximum surface temperature must be lower than the ignition temperature of the possible potential gas mixture.

Temperature class	Maximum surface temperature of electrical equipment [°C]
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

REMARK: Any equipment which is marked as T5 comply with requirements of T1,T2,T3 and T4 classes.

Example of gases with their ignition temperature		
Subgroup of gases	Gas example	Ignition temperature °C
IIA	methane	537
	propane	470
	n-butane	365
	n-hexane	240
	ethyl ether	160
	ethyl nitrate	90
IIB	ethylene	425
	hydrogen sulfide	270
IIC	hydrogen	560
	acetylene	305
	carbon disulphide	102

Equipment groups, safety categories and level of protection

Electrical equipments are divided into two groups according to ATEX Directive 2014/34/EU:

- Group I: products are intended for use in the underground parts of mines and in those parts of surface installations of such mines that are likely to become endangered by firedamp and/or combustible dust
- Group II: products are intended for use in other environments (other than mines) that are likely to become endangered by explosive atmospheres.

Standard EN IEC 60079-0 defines additional subgroup of mentioned above Group II:

- Group III: products intended for use in other environments (other than mines) that are likely to become endangered by explosive dust atmospheres

Equipment Group	Definition	According to
Group I	Electrical equipment intended for use in underground mines susceptible to fire damp and/or combustible dust	ATEX Directive 2014/34/EU
Group II	Electrical equipment intended for use in explosive atmospheres (other than mines)	ATEX Directive 2014/34/EU
Group III	Electrical equipment intended for use in explosive dust atmospheres (other than mines)	Standard EN IEC 60079-0

Equipment groups are divided into equipment safety categories according to ATEX Directive 2014/34/EU with different level of protection EPL according to EN IEC 60079-0:

- category 1 / protection level a: with very high level of protection and thus a very high degree of safety
- category 2 / protection level b: with high level of protection and therefore a high degree of safety
- category 3 / protection level c: with normal level of protection and therefore a conventional degree of safety

Safety Category	Protection level	Degree of safety
Category 1	very high	very high
Category 2	high	high
Category 3	normal	normal

The table below presents the safety level of the equipment according to EN IEC 60079-0 and ATEX Directive 2014/34/EU.

EN IEC 60079-0		Flammable substances		Zone	ATEX Directive 2014/34/EU	
EPL	Group				Protection level	Group
Ma	I (mine)	methan, coal dust	N/A		very high	M1
Mb					high	M2
Ga	II (others)	G	gas, vapour, mist	0	very high	1G
Gb				1	high	2G
Gc				2	normal	3G
Da				20	very high	1D
Db	III (others)	D	dust	21	high	2D
Dc				22	normal	3D

REMARK: Equipment from higher category (higher protection level) can also be installed instead of equipment from lower category (with lower protection level)

The table below lists the typical protection methods and basic concepts of protection used in electric motors according to ATEX Directive and EN / IEC standards.

Symbol	Type of protection	Basic concept of protection	Suitable for Zones						Equipment protection level (EPL)					EN / IEC Standard	
			0	1	2	20	21	22	Ga (very high)	Gb (high)	Gc (normal)	Da (very high)	Db (high)		Dc (normal)
e	Increased safety	No arcs, sparks or hot surfaces, enclosure IP54 or better	•	•					•						60079-7
n	Type 'n' (non-sparking)				•					•					60079-15
d	Flameproof	Containment of the explosion	•	•					•						60079-1
px	Pressurised enclosure	Keep the flammable substances out	•	•					•						60079-2
py			•	•					•						
pz			•							•					
tb	Dust ignition protection by enclosure	Dust-tight enclosure				•	•						•	60079-31	
tc						•									•

Cooling

Flameproof motors from Cantoni Group are equipped with standard IC411 cooling according to IEC 60034-6. Other cooling methods (for example motors with external/separate cooling) are available on request.

IC code according to IEC 60034-6	Description	Drawing
IC410	<ul style="list-style-type: none"> – Enclosed machine – Surface cooled by natural convection and radiation – Without internal or external fan 	
IC411	<ul style="list-style-type: none"> – Enclosed machine – Smooth or finned casing – External shaft-mounted fan – Often called TEFC motor 	
IC416A	<ul style="list-style-type: none"> – Enclosed machine – Smooth or finned casing – External motorized axial fan integrated with the motor 	
IC416R	<ul style="list-style-type: none"> – Enclosed machine – Smooth or finned casing – External motorized radial fan integrated with the motor 	

Standard terminal box equipment

Motor frame size	Number of terminals	Number of cable glands	Optional rotation of terminal box	Temperature sensors in the winding	Thermal protection of bearings
80	3	1	4x90°	on request	on request
90	3	1	4x90°	on request	on request
100	3	1	4x90°	on request	on request
112	3	1	4x90°	on request	on request
132	3	1	4x90°	on request	on request
160	3	1	4x90°	on request	on request
180	3	1	4x90°	on request	on request
200	3	1	4x90°	on request	on request
225	3	1	4x90°	on request	on request
250	3	1	4x90°	on request	on request
280	3	1	4x90°	on request	on request
315	3	1	4x90°	on request	on request

Vibration level

The rotor balancing method guarantees that a standard vibration level A is maintained in accordance with the IEC 60034-14. On customer's demand the motors can be produced with reduced vibration level (B).

Limits of maximum vibration velocity (r.m.s.) for shaft height H according to IEC 60034-14

Vibration level	Shaft height	56 ≤ H ≤ 132	H > 132
	Fitting type	mm/s	mm/s
A	Free suspension	2.8	2.8
	Rigid setting	–	2.3
B	Free suspension	1.1	1.8
	Rigid setting	–	1.5

Remark:

Limits stated in the table mentioned above are applicable for uncoupled (disconnected from the driven machine) and operating at no load motors.

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Noise level

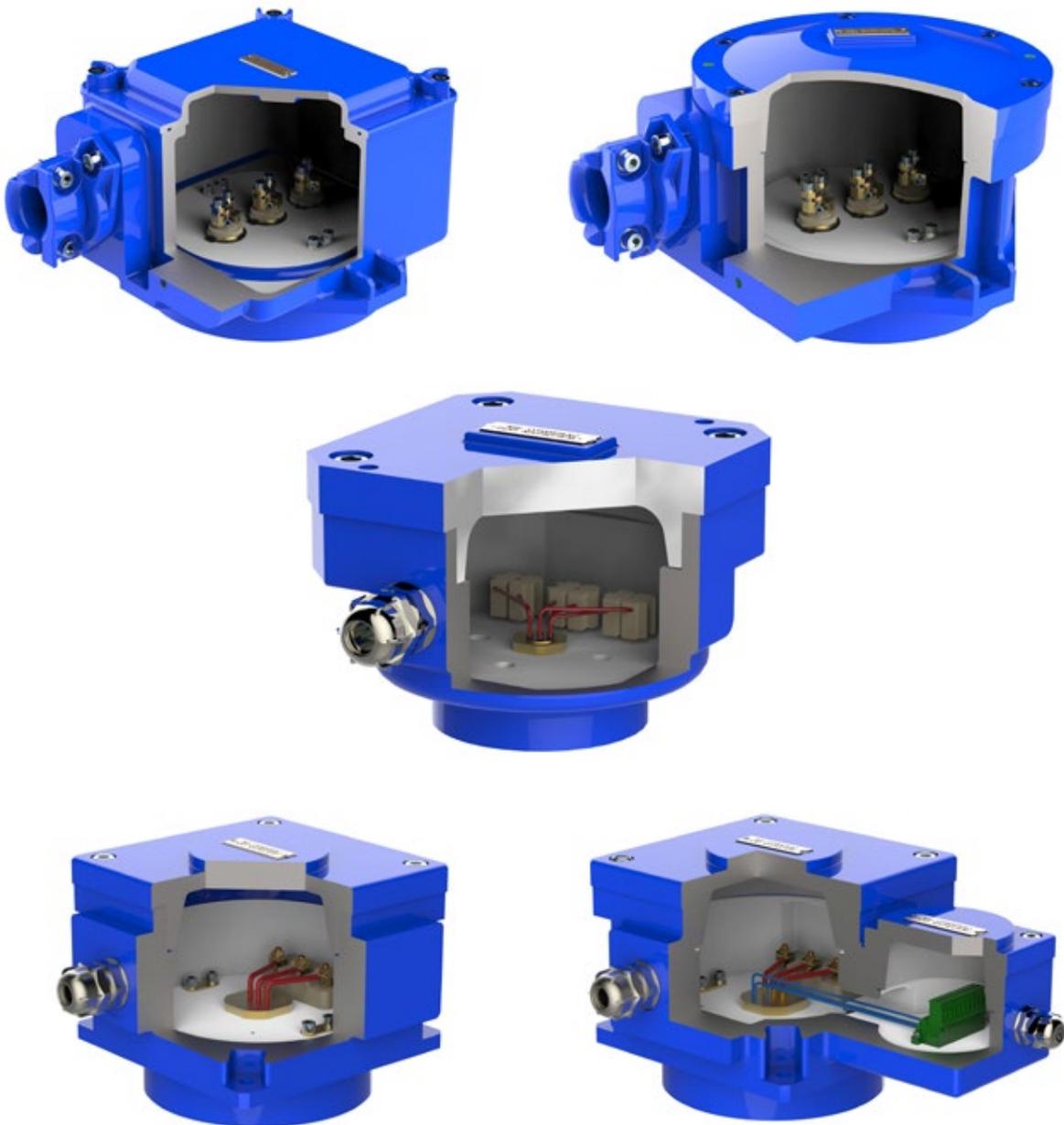
Motors in standard comply with a permissible sound power level according to IEC 60034-9.

On customer's demand the motors can be delivered with reduced noise level by using special cooling systems or additional external sound-absorbing covers.

Terminal box

In standard execution main terminal box is in increased safety design (Ex eb) equipped with 3 supply terminals for DOL or VSD ("-f" execution) supply and one cable gland. On request motors can be equipped with fully flameproof main terminal box (Ex db).

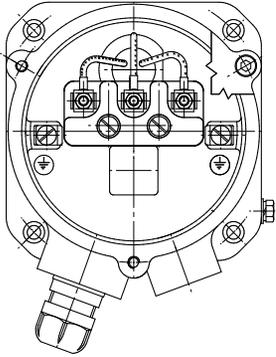
If the motor is equipped with temperature sensors or winding heaters, they can be lead out to the main terminal box or to separate auxiliary terminal box.



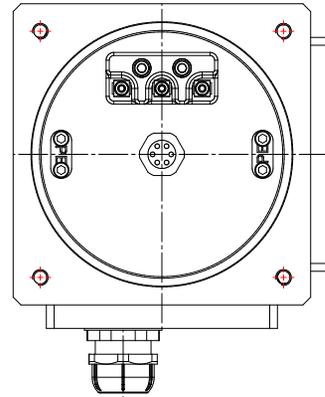
In standard all motors are equipped with terminal box mounted on top. On request motors size 200...315 can be equipped with terminal box installed on right or left side.

Standard terminal box view:

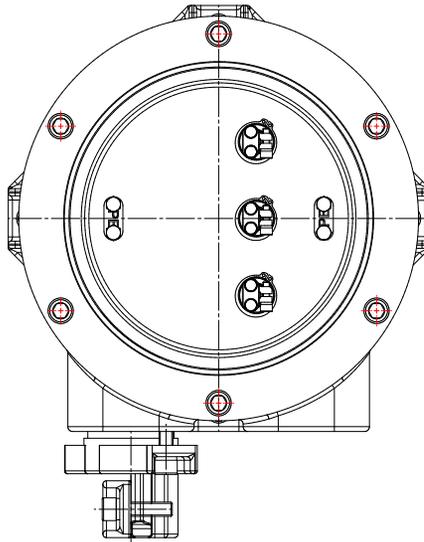
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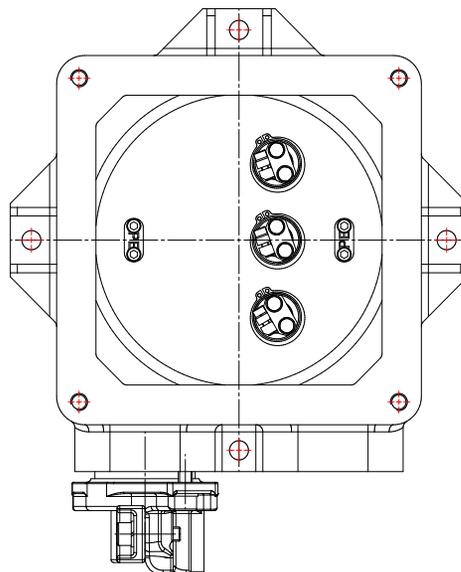
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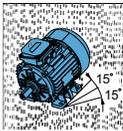
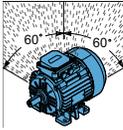
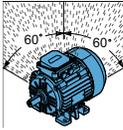
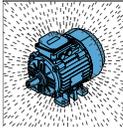
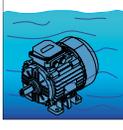
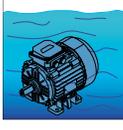
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Degree of protection IP

IP 55

Motors in standard execution comply with IP55 requirements according to IEC 60034-5

Protection against penetration of solid matter			Protection against penetration of fluids		
1st digit	Description		2nd digit	Description	
0	 Not protected		0	 Not protected	
1	 Protected against solid bodies larger than 50 mm		1	 Protected against vertically falling drops of water	
2	 Protected against solid bodies larger than 12 mm		2	 Protected against vertically falling drops of water up to 15°	
3	 Protected against solid bodies larger than 2,5 mm		3	 Protected against rain up to 60°	
4	 Protected against solid bodies larger than 1 mm		4	 Protected against rain falling from any direction	
5	 Protected against deposition of dust		5	 Protected against sprayed water from any direction	
6	 Totally protected against deposition of dust		6	 Protected against temporary immersion	
			7	 Protected against immersion between 0,15 and 1 m	
			8	 Protected against immersion at preset pressure and time	

Each size 80 to 132 motor is equipped with V-ring on drive side and on non drive side. Labyrinth seals protect the motors from size 160 and above.

Higher degree of protection is available on request.

Painting and corrosivity classes

Standard painting system with RAL5010 color used in all our motors comply with C3 corrosion class according to ISO 12944.

For special request motors can be painted with other colors and with alternative painting systems (up to C5M corrosion class).

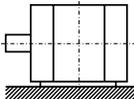
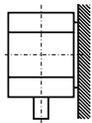
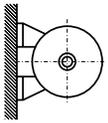
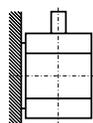
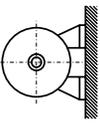
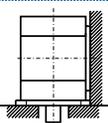
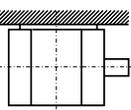
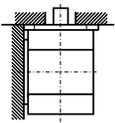
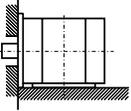
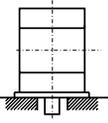
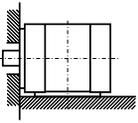
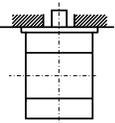
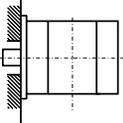
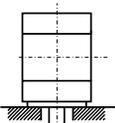
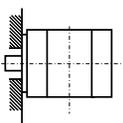
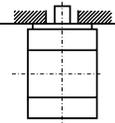
RAL 5010/C3



Corrosion class	Environment	
	Interior	Exterior
C1 (very low)	Heated buildings with a clean atmosphere such as hotels, offices, shops, schools.	N/A
C2 (low)	Unheated buildings, where condensation may occur e.g. storehouses, sports halls.	Atmosphere contaminated to a small extent, mostly rural regions.
C3 (medium)	Production space of high humidity and certain air contamination e.g. foodstuff plants, laundries, breweries, dairies.	Industrial and urban atmosphere with an average Sulphur oxide (IV) contamination level. Inshore areas of low salinity.
C4 (high)	Chemical plants, swimming pools, ship repair yards.	Industrial areas and inshore areas of medium salinity.
C5I (very high – industrial)	Buildings and areas of almost constant condensation and high contamination.	Industrial areas of high humidity and aggressive atmosphere.
C5M (very high – marine)	Buildings and areas of almost constant condensation and high contamination.	Coast and offshore areas with high salt content.

Mounting arrangements

According to the IEC 60034-7 standard

Horizontal shaft				Vertical shaft			
Designation				Designation			
Code II	Code I	Frame size		Code II	Code I	Frame size	
	IM 1001	IM B3	80 ÷ 315		IM 1011	IM V5	80 ÷ 315
	IM 1051	IM B6	80 ÷ 280		IM 1031	IM V6	80 ÷ 315
	IM 1061	IM B7	80 ÷ 280		IM 2011 or IM 2111	IM V15	80 ÷ 315
	IM 1071	IM B8	80 ÷ 280		IM 2031 or IM 2131	IM V36	80 ÷ 315
	IM 2001	IM B35	80 ÷ 315		IM 3011	IM V1	80 ÷ 315
	IM 2101	IM B34	80 ÷ 132		IM 3031	IM V3	80 ÷ 280
	IM 3001	IM B5	80 ÷ 315		IM 3611	IM V18	80 ÷ 132
	IM 3601	IM B14	80 ÷ 132		IM 3631	IM V19	80 ÷ 132

*Other mounting arrangements available on special request

Definitions

Relation between rated output power and rated torque on motor shaft:

$$T = \frac{9,55 \times P}{n}$$

where:

- T [Nm] is rated output torque on motor shaft
- P [W] is rated output power on motor shaft
- n [rpm] is rated speed of motor shaft

Relation between rated output power on shaft and rated consumed power from mains:

$$P_1 = \frac{P}{\eta} \times 100$$

where:

- P_1 [kW] is rated consumed power from mains by motor
- P [kW] is rated output power on motor shaft
- η [%] is rated efficiency of motor

Relation between rated consumed power from mains and rated voltage, current, power factor:

$$P_1 = \sqrt{3} \times U \times I \times \cos\varphi$$

where:

- P_1 [W] is rated consumed power from mains by motor
- U [V] is rated supply voltage of motor
- I [A] is rated current consumed from mains by motor
- $\cos\varphi$ is rated power factor of motor

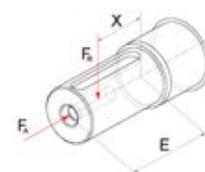
Units of measurement

Parameter name	Symbol	Unit name	Symbol
Frequency	f	Hertz	Hz
Active power	P	Watt	W
Voltage	U	Volt	V
Electric Current	I	Amper	A
Power factor	cosφ	N/A	N/A
Resistance	R	Ohm	Ω
Sound power level	L _w	decibel	dB
Sound pressure level	L _p	decibel	dB

Permissible shaft end loads

Size	Max radial force		Max axial force			Weight of rotor [kg]
	x=0	x=E	Horizontal [N]	Vertical		
	[N]	[N]		Down [N]	Up [N]	
80-2A	500	410	420	390	450	3
80-2B	490	420	410	380	460	4
80-4A	630	530	530	500	560	3
80-4B	630	540	530	490	570	4
90S2	590	520	420	380	480	5
90S4	740	650	590	540	660	6
90S6	880	770	680	630	750	6
90S8	1010	890	770	720	820	5
90L2	570	500	410	360	480	6
90L2A	550	480	410	360	480	6
90L4	700	610	570	520	660	7
90L4A	650	570	560	480	660	9
90L6	850	740	670	610	750	7
90L6A	790	700	650	590	750	8
90L8	970	850	750	700	820	6
100L2	820	710	580	520	660	7
100L2A	780	680	570	500	660	8
100L4A	1010	870	800	720	920	10
100L4B	970	830	790	700	920	11
100L4C	890	770	760	640	920	14
100L6	1210	1050	940	850	1050	10
100L6A	1170	1010	920	830	1050	11
100L8A	1390	1200	1050	980	1160	9
100L8B	1310	1140	1030	930	1150	11
112M2	1210	1050	850	780	960	9
112M2A	1190	1040	850	770	950	9
112M2B	1130	980	830	730	950	11
112M4	1490	1290	1180	1080	1320	12
112M4A	1390	1200	1150	1020	1320	15
112M6	1770	1540	1370	1270	1510	12
112M6A	1740	1510	1360	1250	1510	13
112M8	1980	1720	1520	1420	1660	12
132S2A	1750	1470	1210	1100	1300	13
132S2B	1680	1420	1190	1060	1380	16
132S4	2130	1800	1670	1490	1910	21
132S6	2540	2140	1950	1770	2190	21
132S8	2900	2440	2180	2040	2380	17
132M2	1640	1390	1180	1030	1370	17
132M2A	1620	1370	1170	1020	1380	18
132M4	2100	1770	1660	1470	1910	22
132M4A	2060	1740	1650	1440	1920	24
132M4B	2030	1710	1640	1420	1920	25
132M6A	2450	2070	1920	1720	2200	24
132M6B	2420	2040	1910	1700	2200	25
132M6C	2380	2010	1890	1660	2200	27
132M8	2820	2380	2160	1980	2400	21
160M2A	2090	1760	1500	1290	1770	24
160M2B	2030	1710	1490	1260	1780	26
160M4	2540	2140	2070	1780	2460	34
160M6	2960	2490	2390	2070	2810	37
160M8A	3530	2970	2710	2490	3010	26

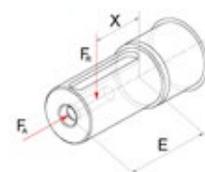
1. Permissible load as a function of X is linear in the range from X=0 to X=E.
2. L_n – calculated lifetime of bearings 30000h
3. For calculated lifetime $L_n = 40000h$ above permissible load decrease by 20%



Permissible shaft end loads

Size	Max radial force		Max axial force			Weight of rotor [kg]
	x=0	x=E	Horizontal [N]	Vertical		
	[N]	[N]		Down [N]	Up [N]	
160M8B	3440	2890	2690	2420	3040	31
160L2	1990	1670	1470	1230	1790	28
160L4	2410	2030	2030	1690	2490	40
160L6	2850	2400	2360	1990	2830	42
160L8	3310	2780	2650	2330	3070	37
180M2	2630	2220	1980	1610	2450	42
180M4	3350	2830	2780	2330	3370	52
180L4	3240	2740	2750	2260	3400	57
180L6	3770	3180	3160	2590	3930	67
180L8	4360	3670	3550	3010	4250	62
200L2A	3010	2590	2270	1750	2950	60
200L2B	2940	2530	2250	1700	2960	63
200L2C	2910	2500	2240	1680	2980	65
200L2D	2780	2390	2210	1590	3010	71
200L4	3720	3200	2840	2140	3740	80
200L4C	3720	3200	2840	2140	3740	80
200L4D	3440	2960	2760	1930	3850	96
200L6A	4440	3820	3670	2950	4630	84
200L6B	4180	3600	3580	2730	4710	99
200L8	5080	4370	4090	3400	5020	81
225S4	4240	3530	3200	2430	4210	89
225S8	5570	4630	4550	3780	5580	90
225M2	3360	2900	2540	1940	3320	69
225M2C	3150	2720	2480	1780	3380	80
225M4	4020	3350	3140	2260	4280	101
225M4C	3900	3240	3110	2160	4320	108
225M6	4630	3860	4000	2960	5380	121
225M6C	4330	3600	3910	2680	5520	142
225M8	5500	4580	4530	3640	5720	104
250M2	4140	3500	3120	2270	4210	97
250M2C	4140	3500	3120	2270	4210	97
250M4	5070	4280	3820	2610	5430	141
250M4C	4770	4030	3800	2460	5540	154
250M6	6030	5090	4990	3770	6630	143
250M6C	5690	4800	4880	3450	6790	167
250M8	6750	5700	5530	4240	7260	151
280S2	4120	3470	5410	4370	6870	125
280S4	6510	5480	5000	3610	6750	157
280S6	7670	6450	6440	5010	8270	163
280S8	8730	7340	7180	5820	8900	154
280M2	4020	3380	5310	4220	6900	134
280M2C	3860	3250	5130	3920	6960	152
280M4	6190	5210	4770	3080	6980	195
280M6	7530	6330	6360	4800	8360	178
280M6C	7230	6080	6100	4250	8590	217
280M8	8480	7130	7050	5490	9050	178
315S2	4510	3880	3570	2150	5410	163
315S4	7600	6330	6020	3890	8750	243
315S6	9510	7920	7020	5010	9650	232
315S8	10630	8850	8630	6570	11390	241
315M2A	3970	3410	3480	1790	5650	193

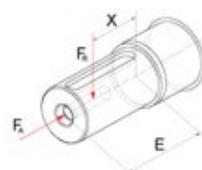
1. Permissible load as a function of X is linear in the range from X=0 to X=E.
2. L_n – calculated lifetime of bearings 30000h
3. For calculated lifetime $L_n = 40000h$ above permissible load decrease by 20%



Permissible shaft end loads

Size	Max radial force		Max axial force			Weight of rotor [kg]
	x=0	x=E	Horizontal [N]	Vertical		
	[N]	[N]		Down [N]	Up [N]	
315M2B	3720	3240	3340	1470	5790	216
315M2C	3460	3020	3040	1070	5570	225
315M4A	7480	6350	5900	3650	8830	259
315M4B	7210	6120	5820	3380	9000	281
315M4C	6420	5520	5670	2740	9460	336
315M6A	9030	7520	6880	4540	9940	270
315M6B	8550	7250	6740	4010	10310	315
315M6C	7750	6670	6620	3420	10760	367
315M6D	7590	6530	6580	3250	10870	381
315M8A	10470	8720	8580	6390	11510	256
315M8B	9870	8370	7560	4860	11080	311
315M8C	8930	7690	7390	4120	11620	375
315M8D	8780	7560	7360	3990	11710	386

1. Permissible load as a function of X is linear in the range from X=0 to X=E.
2. L_n – calculated lifetime of bearings 30000h
3. For calculated lifetime $L_n = 40000h$ above permissible load decrease by 20%



Value of radial force F_R acting on the shaft end for a given belt pulley diameter is calculated according to the following formula:

$$F_R = \frac{19\,600 \times P \times k}{D_k \times n} \text{ [N]}$$

where: P – motor output [kW]
 D_k – belt pulley diameter [m]
 n – speed [rpm]
 k – belt tension factor:
 for V-belts $k=2,2$
 for flat belts $k=3$

Value of force F_R acting on any point of the shaft end (between points $X=\max$ and $X=0$) may be calculated according to the following formula:

$$F_R = F_{x0} - \frac{X}{E} \times (F_{x0} - F_{xMAX}) \text{ [N]}$$

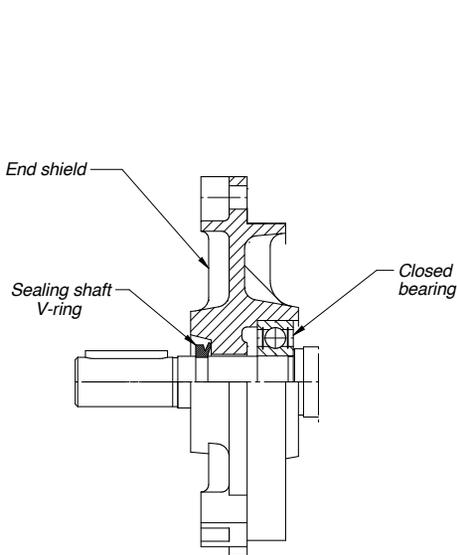
where: F_{x0} – value of F_R force acting on the beginning of the shaft end
 F_{xMAX} – value of F_R force acting on the end of the shaft end
 E – length of the shaft end

Bearing types and bearing nodes

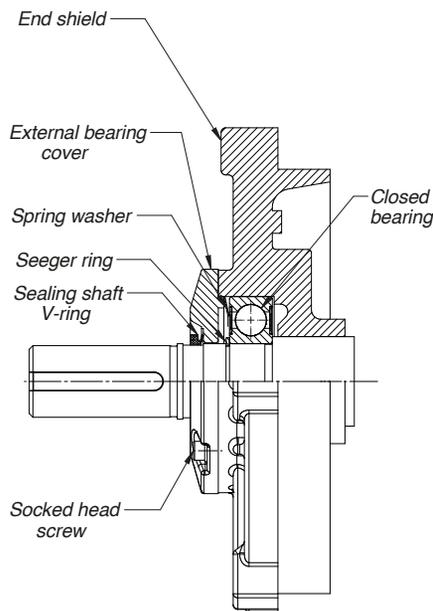
Frame size	Number of poles	Bearings	
		DE	NDE
80	2÷8	6204 2Z C3	6204 2Z C3
90	2÷8	6205 2Z C3	6205 2Z C3
100	2÷8	6206 2Z C3	6206 2Z C3
112	2÷8	6306 2Z C3	6306 2Z C3
132	2÷8	6308 2Z C3	6308 2Z C3
160	2÷8	6309 2Z C3	6309 2Z C3
180	2÷8	6311 2Z C3	6311 2Z C3
200	2÷8	6312C3	6312C3
225	2÷8	6313C3	6313C3
250	2÷8	6315C3	6315C3
280	2	6315C3	6315C3
280	4÷8	6317C3	6317C3
315	2	6317C3	6317C3
315	4÷8	6320C3	6320C3

Bearing types and bearing nodes

Frame size
(E)cSTe80

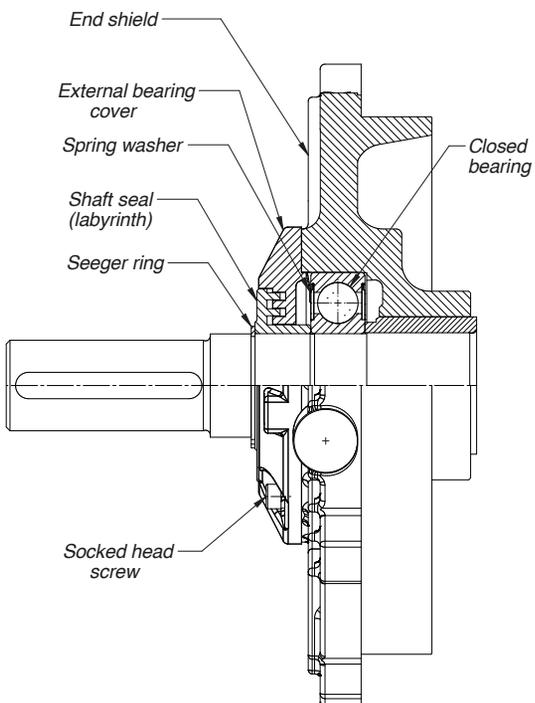


Frame size
(E)cSTe90-132

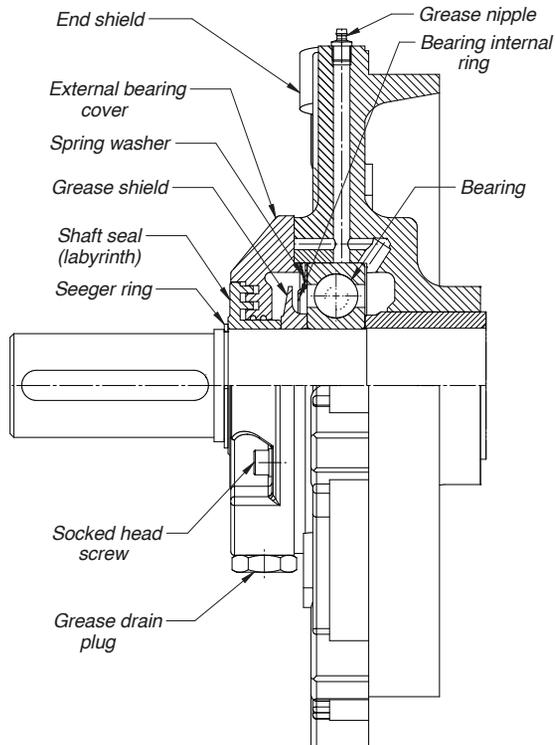


Motor frame size	Bearings lubrication on the run
80	no
90	no
100	no
112	no
132	no
160	on request
180	on request
200	yes
225	yes
250	yes
280	yes
315	yes

Frame size
(E)cSTe160-180



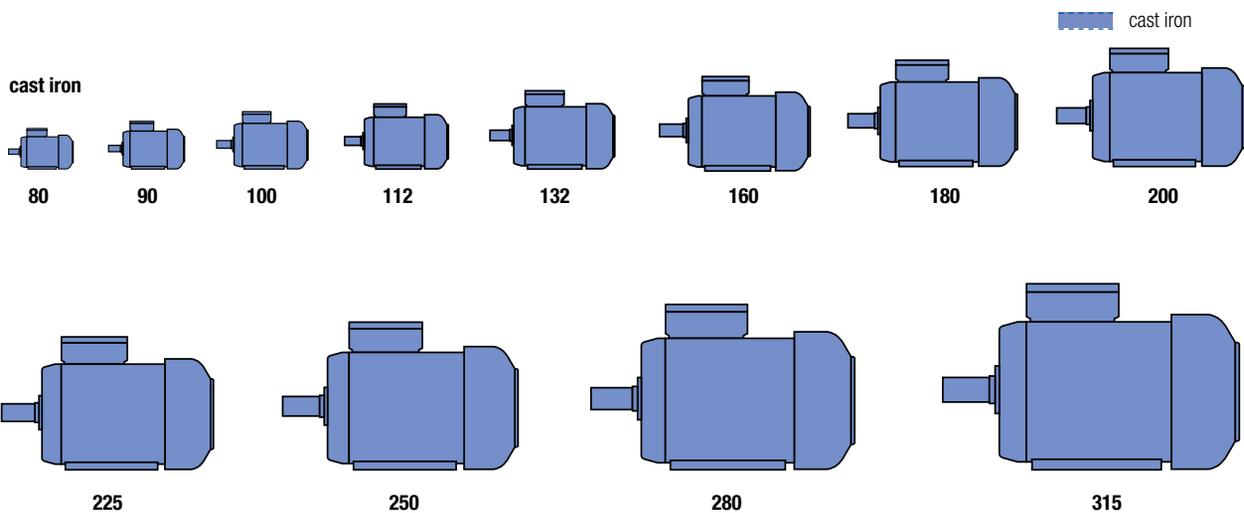
Frame size
(E)cSTe200-315



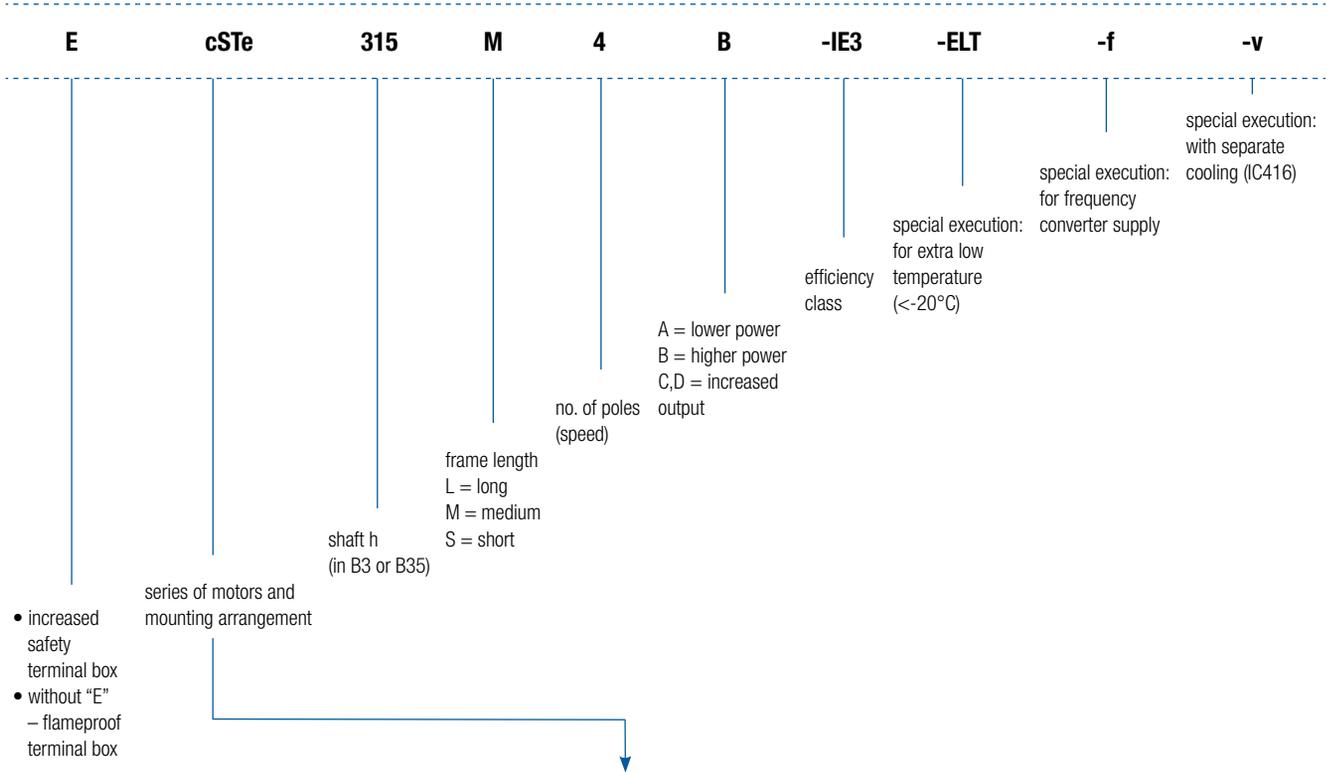
Flameproof paths/joints on shaft in motors size 90...315 are placed inside of motor housing (assures very high lifetime of flameproof path/joint).

Material of housing, end shields and feet

Frame size [mm]	Motor housing	End shields	Feet
(E)cSTe80	Cast iron	Cast iron	Cast iron – screwed
(E)cSTe90	Cast iron	Cast iron	Cast iron – screwed
(E)cSTe100	Cast iron	Cast iron	Cast iron – screwed
(E)cSTe112	Cast iron	Cast iron	Cast iron – screwed
(E)cSTe132	Cast iron	Cast iron	Cast iron – screwed
(E)cSTe160	Cast iron	Cast iron	Cast iron – screwed
(E)cSTe180	Cast iron	Cast iron	Cast iron – screwed
(E)cSTe200	Cast iron	Cast iron	Cast iron – screwed
(E)cSTe225	Cast iron	Cast iron	Cast iron – screwed
(E)cSTe250	Cast iron	Cast iron	Cast iron – screwed
(E)cSTe280	Cast iron	Cast iron	Cast iron – screwed
(E)cSTe315	Cast iron	Cast iron	Cast iron – screwed



Nomenclature



(E)cSTe



(E)cSTKe



(E)cSTLe



Ex marking

Type of motor	Frame size 80	Frame size 90 ÷ 315
EcST(K,L)e...	Motor with flame-proof enclosure and with increased safety terminal box	
	II 2G Ex db eb IIC T5 Gb (-20°C ÷ +40°C)	
cST(K,L)e...	Motor and terminal box with flame-proof enclosure	
	II 2G Ex db IIB+H ₂ T5 Gb (-20°C ÷ +40°C)	II 2G Ex db IIC T5 Gb (-20°C ÷ +40°C)

Frequency converter operation (VSD)

Electronic speed control is carried out using a frequency converter (VSD) that adjusts the speed of the motor – and therefore the torque produced – based on the energy needed.

Our flameproof motors can be ordered in special execution designed for the frequency converter supply ("-f"). Permissible output parameters of frequency converter and speed control range have to be established individually.

Flameproof motors with electromagnetic brake

Cantoni Group has a vast experience in the production of explosion proof motors. In 1950s, it was one of Cantoni Group's manufacturing companies which produced the first explosion proof and flameproof motors in Poland. Such long experience resulted in Cantoni's outstanding knowledge in this field.

Cantoni motors are recognized globally as safe, reliable and durable, operating in the harshest conditions.



Premium efficiency IE3 flameproof motor (Ex db eb) with built in electromagnetic brake HEX160 (1600Nm) type EcSte315M4B-IE3-H

Apart from the wide range of standard flameproof motors, our offer includes also many different special executions of motors.

One of them are motors equipped with **flameproof electromagnetic (DC) brakes** which are installed on the ND side of motor. This compact execution enables to reduce complexity of the drive system.

The whole variety of electromagnetic brakes (including flameproof brakes) is produced within Cantoni Group, therefore, we can guarantee the highest quality of the whole set.

HEX DC electromagnetic brakes are switchable spring loaded and electromagnetically released brakes which can be used also separately (as stand alone components) in different drive systems to brake the rotating parts of machines (safety) and their exact positioning.

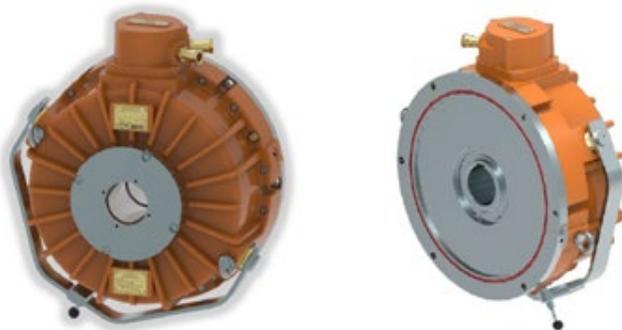
They feature high repeatability, also at high operating rates and can be powered from alternating current sources through a built-in rectifier. Brakes are optionally equipped with manual release levers to allow their emergency releasing.

An additional feature is their stable operation, which is particularly important if a machine is powered by several drives, working at high on-off rates. Brake design guarantees simple and trouble-free installation.

Various versions are available with different equipment, brake power supply types, allowing users to select the right option for their needs.

HEX brakes provide protection:

- against methane and coal dust explosion for the I group of devices, category M2 (I M2 Ex db [ja] I Mb)
- against explosion of gases for the II group of devices, category 2G (I 2G Ex db [ja] IIB T4 Gb)
- against dust explosion for the II group of devices, category 2D (II 2D Ex tb [ja] IIIC T125°C Db)



Application areas:

- Underground mining and open-cast mining
- Chemical industry
- Petrochemical and refinery industry
- Motor with brake – explosion proof self-braking motor
- Brake reducer - explosion proof kit
- Lifts, cranes and winches working in explosive areas...



For other types of brakes or for more information on brake motors please contact us directly or visit www.cantonigroup.com.