TECHNICAL
MECHANICAL DESIGN

3 MECHANICAL DESIGN

3.1 HOUSING AND EXTERNAL COMPONENTS (ACCORDING TO CEI IEC 71-1))

JM, JMM, JMD SERIES

Die-cast aluminium light alloy housing with excellent thermal conductivity and excellent corrosion resistance.

The feet can be faced, with the possibility of installation on the 3 sides of the motor in order to have the terminal box on the desired side: IM B3, B5, B35, B14, B34. The IMB3 motor is as standard supplied with a top terminal box.

As standard, the IMB3 motor is supplied with top terminal box..

The terminal box can be orientated in 90° steps, also in light aluminium alloy.

Shields and flanges are also made of die-cast aluminium light alloy, the bearing compartments are reinforced with steel size 90. Flange B14 on JM 160 motor also available in cast iron.

The lifting ring or eyebolt, for the motor only, is present starting from size 100 to 450.

GM, GMD SERIES

Housing in cast iron with lifting eyebolt. The cast iron feet are firmly on the housing

The terminal box is adjustable in 90° steps. As standard, the IMB3 motor is supplied with top terminal box. The option of the terminal box is available on request.

Shields and flanges are entirely manufactured in cast iron.

Standard top position and near control side, with standard power supply cables input on the right hand side for JM and GM, and on the side opposite control for JMM motors.

Terminal board to power motor with 6 terminals.

Ground terminal positioned inside the terminal box.
External additional terminal for GM 315...450..

3.2 PAINTING

The JM, JMM and JMD series motors are powder painted, while the GM and GMD series have bicomponent paint suitable to resist normal industrial environments and allow further finishing with monocomponent synthetic paint.

JM 56 ~ 160, JMM 56 ~ 100, JMD 80 ~ 160 SERIES
RAL 9006 - White Aluminium
GM 160 ~ 450, GMD 180 ~ 250 SERIES
RAL 5010 - Blue

3.3 ROTOR

Squirrel cage in die-cast aluminium or (Al-Si) Silumin alloy.

3.4 SHAFTS

They are manufactured in steel C40/C45 (UNI8373-7847), unified according to CEI-IEC72-1 with standardised cylindrical ends, head threaded hole and key. The GM series has an axially locked motor shaft.

3.5 KEYS

In stainless steel C40 with unified size according to CEI IEC 72-1

• 3.7 STRUCTURAL FORMATS AND MOUNTING POSITIONS

The structural formats outlined by legislation **IEC 60034-7** are **IM B3, IM B5, IM B14** and combined formats **IM B35 (B3/B5)** and **IM B34 (B3/B14).**

Motors can also be operated in the corresponding vertical-axis structural formats; when requesting the motor specify its complete IM code to verify any restrictions.

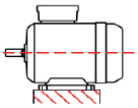
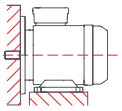
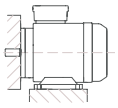
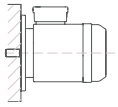
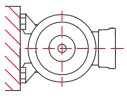
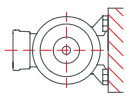
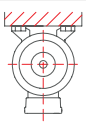
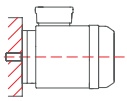
The motor plate indicates the structural format with horizontal axis. The structural formats and mounting positions are shown in the following table

ATTENTION

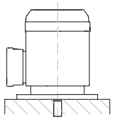
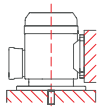
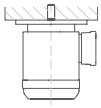
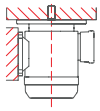
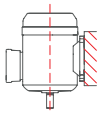
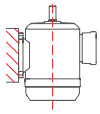
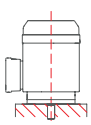
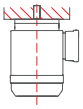
It is important to indicate the type of structural format desired on ordering, since execution of the motor depends in part on its structural format.

Tab. 3.7

■ HORIZONTAL MOUNTING (IM B**)

Designation		SIZE 56—160	180—250	280—315	355—450
IM B3 - IM 1001 Feet		●	●	●	●
IM B35 - IM 2001 Feet and flange with through holes		●	●	●	●
IM B34 - IM 2101 Feet and flange with threaded holes		●			
IM B5 - IM 3001 Flange with threaded holes		●	●	○	○
IM B6 - IM 1051 Feet		●	●	○	
IM B7 - IM 1061 Feet		●	●	○	
IM B8 - IM 1071 Feet		●	●	○	
IM B14 - IM 3601 Flange for threaded holes		●			

■ VERTICAL MOUNTING (IM V**)

Designation		SIZE 56—160	180—250	280—315	355—450
IM V1 - IM 3011 Flange with threaded holes		●	●	●	●
IM V15 - IM 2011 Feet and flange with threaded holes		●	●	●	●
IM V3 - IM 3031 Flange with threaded holes		●	●	○	
IM V36 - IM 2031 Feet and flange with threaded holes		●	●	○	
IM V5 - IM 1011 Feet		●	●	○	
IM V6 - IM 1031 Feet		●	●	○	
IM V18 - IM 3611 Flange for threaded holes		●			
IM V19 - IM 3631 Flange for threaded holes		●			

Legend: ● Possibible; ○ Optional; Some impossible

• 3.8 BEARINGS

TYPE AND DIMENSIONS

Seipee uses bearings selected for specific use on electric motors.

The JM, JMM and JMD series aluminium motors are equipped with rigid radial ball bearings, single-crown, double-shield and lubrication for life.

The cast iron GM and GMD series motors to size 250 are instead equipped with closed bearings ZZ with clearance C3 and lubrication for life. From axle height of 280 upwards, they are equipped with open bearings, also with clearance C3 and they are therefore equipped with a greaser, for the necessary periodic lubrication of the bearings and relevant exhausted grease drainage

The characteristics of the bearings for the standard motors are given in the following table

■ TYPE AND DIMENSIONS OF STANDARD MOTOR BEARINGS

Tab. 3.8

Motor		Horizontal mounting (IM B**)		Vertical mounting (IM V**)		Dimensions Bearings
Size, poles		Drive end	Non drive end	Drive end	Non drive end	[$Ø_i$ x $Ø_e$ x H]
JM, JMM 56		6201 ZZ C3		6201 ZZ C3		12 x 32 x 10
JM, JMM 63		6201 ZZ C3		6201 ZZ C3		12 x 32 x 10
JM, JMM 71		6202 ZZ C3		6202 ZZ C3		15 x 35 x 11
JM, JMM JMD 80		6204 ZZ C3		6204 ZZ C3		20 x 47 x 14
JM, JMM JMD 90		6205 ZZ C3		6205 ZZ C3		25 x 52 x 15
JM, JMM JMD 100		6206 ZZ C3		6206 ZZ C3		30 x 62 x 16
JM, JMD 112		6306 ZZ C3		6306 ZZ C3		30 x 72 x 19
JM, JMD 132		6308 ZZ C3		6308 ZZ C3		40 x 90 x 23
JM, JMD 160		6309 ZZ C3		6309 ZZ C3		45 x 100 x 25
GM 160		6309 ZZ C3		6309 ZZ C3		45 x 100 x 25
GM, GMD 180		6311 ZZ C3		6311 ZZ C3		55 x 120 x 29
GM, GMD 200		6312 ZZ C3		6312 ZZ C3		60 x 130 x 31
GM, GMD 225		6313 ZZ C3		6313 ZZ C3		65 x 140 x 33
GM, GMD 250		6314 ZZ C3		6314 ZZ C3		70 x 150 x 35
GM 280	2	6314 C3		6314 C3		70 x 150 x 35
	4 ~ 8	6317 C3		6317 C3		85 x 180 x 41
GM 315	2	6319 C3		6317 C3		85 x 180 x 41
	4 ~ 8	NU 319 E	6319 C3	6319 C3 [1]	6319 C3 [2]	95 x 200 x 45
GM 355	2	6319 C3		6319 C3	6319 C3 [2]	95 x 200 x 45
	4 ~ 8	NU 322 C3	6322 C3	6322 C3 [1]	6322 C3 [2]	110 x 240 x 50
GM 355X	2	6319 C3	6319 C3	6319 C3	7319 B	95x200x45
	4 ~ 8	NU 324 E	6324 C3	6324 C3	7324 B	120x260x55
GM 400	2	6317 C3	6317 C3	6317 C3	7317 B	85x180x41
	4 ~ 8	NU 326 E	6326 C3	6326 C3	7326 B	130x280x58
GM 450	2	NU 222 e + 6222 C3	NU 222 E	NU 222 E + 6222 C3	7222 B	110x200x38
	4 ~ 8	NU 228 E + 6228 C3	NU 228 E	NU 228 E +6228 C3	7228 B	140x250x42

1) = The cylindrical roller bearing can only be used if the bearing is subject to constant radial load.
Otherwise the motor with the ball bearing is required.

2) For high axial loads, request the motor with the series 7 angular contact ball bearing.

LUBRICATION AND MAINTENANCE

For amounts of grease (g) and re-lubrication interval (h), always refer to the label on the motor fan cover.

For refilling, proceed by means of the two greasers, one on the shield/flange on the control side and one on the shield on the side opposite control.

It is also necessary to unscrew the exhaust plug (located at the bottom of the shield/flange) and top up according to the indicated amounts of grease.
To open the NDE side drain plug, if there is no hole and pipe on the fan cover, it is necessary to remove the fan cover and unscrew the drain plug placed behind the fan on the bearings cover

NOTE

In some models the drainage hole is placed directly on the shield!
Close the hole with the plug and reassemble the fan cover if it has been previously disassembled.
At this point you can continue with the normal procedure.

If the re-lubrication interval is less than six months, all the existing grease must be completely replaced after 2-3 refills at the latest.

If the re-lubrication interval is longer than six months, all the grease must be replaced every six months.

To completely replace the used grease, if the supports are accessible, it is advisable to remove the existing grease and re-lubricate the bearing manually.

The free space inside the bearing should be filled with fresh grease, while the space in the support should be filled 30 - 50%.

The amount of grease in the space around the bearing should not be excessive in order to avoid causing a local rise in temperature which would be harmful to both the grease and the bearing.

Take special care not to introduce impurities into the bearing or support at this stage of maintenance.

Be careful not to put too much grease inside the support, and once the operation is complete, screw the drain plug back on.

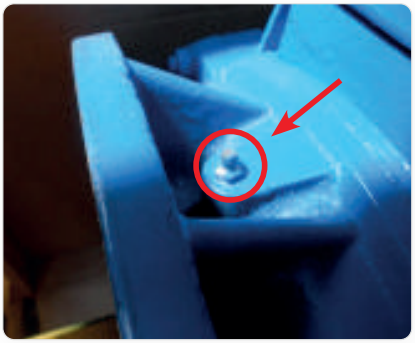
With very frequent lubrication intervals, you are advised to apply automatic greasing systems that simplify the operation

Regular lubrication is necessary for the life of the bearings and therefore for operation of the motor.
It is recommended to use lithium grease with a good quality mineral oil base.

It is recommended to use lithium grease with a good quality mineral oil base.

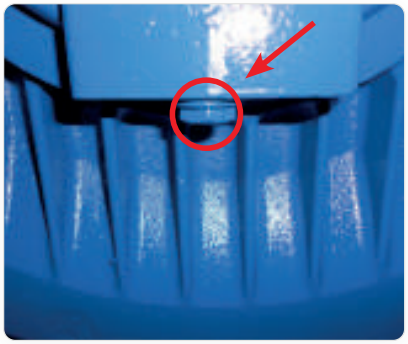
Recommended brands
Shell Gadus S2 V100 2, SKF LGMT 2, Mobil Mobilux EP 2, Esso Beacon EP 2, BP Energrease LS 2 e TOTAL ALTIS SH2.

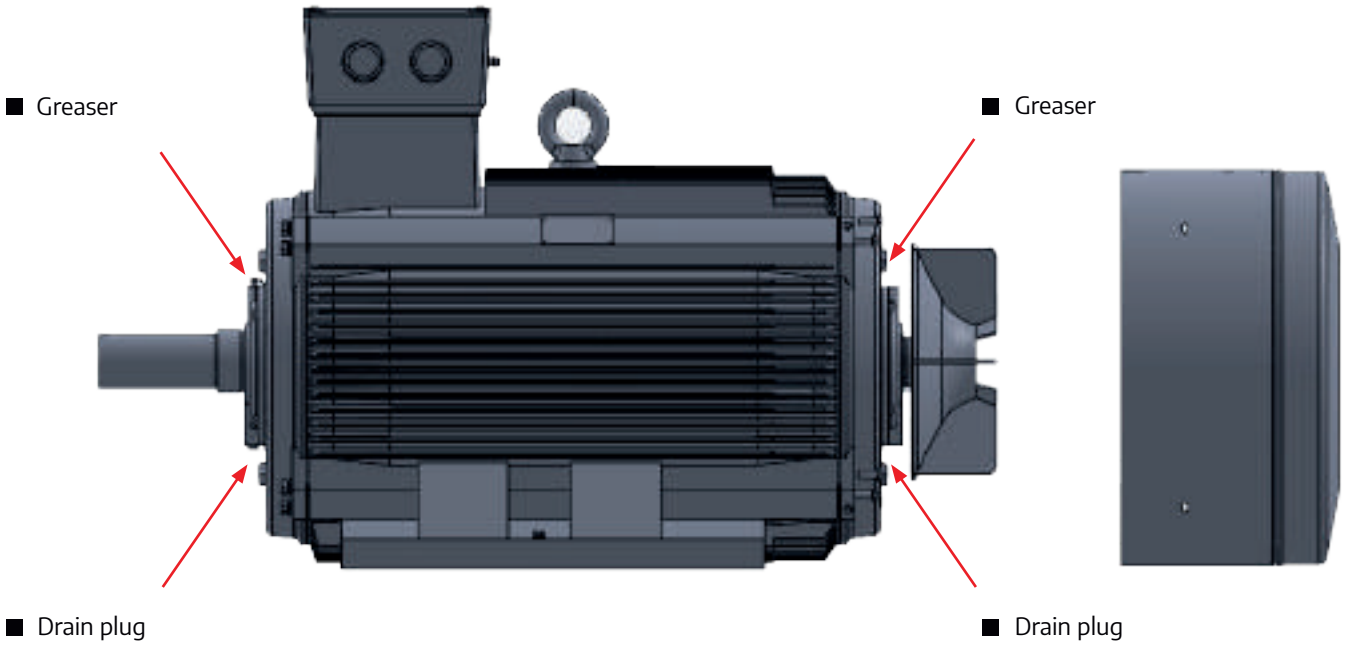
■ Position **greaser on control side**

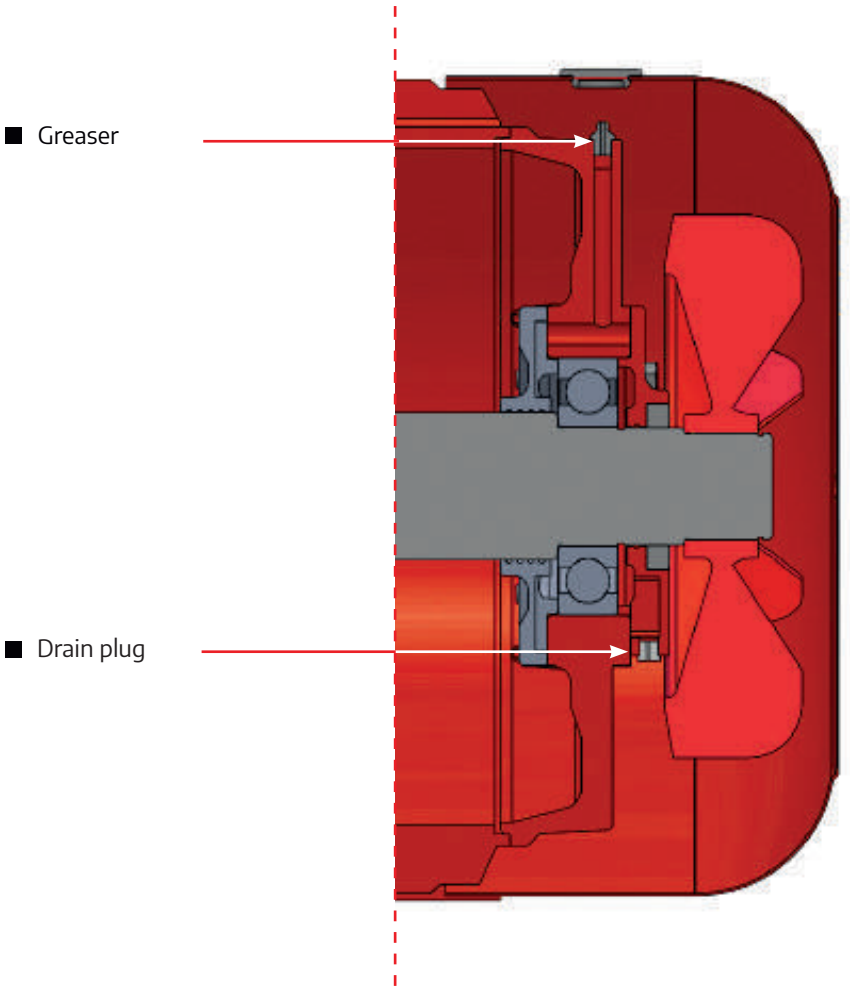


■ Position **greaser on opposite side**

■ Position **drain plug/screw**




Greaser
Greaser
Drain plug
Drain plug


Greaser
Drain plug

BEARINGS LUBRICATION

Motor	Lubrication interval* [h]																Grease [g]	
	Coupling side								Coupling opposite side									
	50 Hz Poles				60 Hz Poles				50 Hz Poles				60 Hz Poles					
	2	4	6	8	2	4	6	8	2	4	6	8	2	4	7	8	2	4~8
160*	3250	5450	7000	8300	2600	5000	6200	7500	3250	5450	7000	8300	2600	5000	6200	7500	13	
180*	2750	5250	6750	8000	2100	4750	6000	7250	2750	5250	6750	8000	2100	4750	6000	7250	18	
200*	2500	5000	6500	7700	1850	4500	5750	7100	2500	5000	6500	7700	1850	4500	5750	7100	20	
225*	2250	4800	6000	7450	1500	4300	5400	6900	2250	4800	6000	7450	1500	4300	5400	6900	23	
250*	2000	4650	5300	7250	1150	4150	4750	6600	2000	7650	5300	7250	1150	4150	4750	6600	26	
280	2000	4300	5000	6900	1150	3800	4250	6400	2000	4300	5000	6900	1150	3800	4250	6400	26	37
315	1200	3000	4800	5500	500	2100	4000	5000	1200	3900	5750	7200	500	3500	5100	6200	37	45
355	700	2300	4300	5250	220	1600	3750	4800	700	3650	5250	6500	220	3000	4700	5900	45	60
355X	350	1900	4100	5000	100	1750	3500	4500	700	1900	4100	5000	250	1750	3500	4500	54	86
400	350	1600	3900	4800	100	1100	3100	4300	350	3200	4800	6200	250	2800	4300	5300	54	81
450	300	1300	3000	4500	100	800	2700	4000	300	2750	4500	5800	150	1750	4000	4600	65	93

***** = **Valid for good quality lithium grease,** working temperature not exceeding 90°C, applications with horizontal motor shaft and nominal loads. i.

For applications with vertical motor shaft halve the values in the table.

For working temperatures over 90 °C halve the values in the table every 15 °C temperature increase.

The maximum working temperature, relating to lithium grease with a good quality mineral oil base is equal to 110°C.

ELECTRICAL INSULATED BEARING

The rolling bearings of electric motors are potentially subject to current passages that quickly damage the surfaces of runners and rolling bodies and degrade their grease.

The risk of damage increases in the increasingly popular electric motors equipped with frequency converters, especially in applications with sudden variations in speed. In bearings on such motors, there is an additional risk due to the presence of high frequency currents caused by the parasitic capacities existing within the motor.

The electrically insulated bearing has the outer surface of the external ring coated with a layer of aluminium oxide 100 µm thick, able to withstand voltages of 1,000 V d.c., practically eliminating issues caused by current passage.

Seipee recommends using electrically insulated bearings in motors equipped with frequency converters from size 250.

3.9 MAXIMUM APPLICABLE RADIAL LOADS

For belt-pulley coupling, the end of the motor shaft carrying the pulley is subject to radial force $F_{r,N}$ applied to a distance x [mm] from the support on the end of the shaft length E.

The maximum radial load relatively applicable relates to the mechanical strength of the motor shaft and not bearing duration.

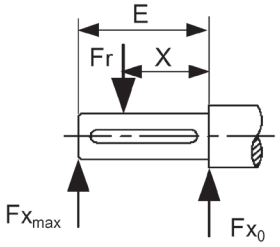
MAXIMUM APPLICABLE RADIAL LOADS AT 50 HZ

Tab. 3.9

Motor	E [mm]		Radial forces- F_0 (no axial forces) [N]							
			2 Pol.		4 Pol.		6 Pol.		8 Pol.	
	2 Pol.	4~8 Pol.	X_{max} (x = E)	X_0 (x = 0)	X_{max} (x = E)	X_0 (x = 0)	X_{max} (x = E)	X_0 (x = 0)	X_{max} (x = E)	X_0 (x = 0)
25.000 hours										
56	20		200	240	200	240	-	-	-	-
63	23		400	490	400	490	400	490	-	-
71	30		740	815	740	815	740	815	740	815
80	40		970	1120	970	1120	970	1120	970	1120
90 S	50		1050	1210	1050	1210	1050	1210	1050	1210
90 L	50		1050	1210	1050	1210	1050	1210	1050	1210
100 L	60		1800	2280	1800	2280	1800	2280	1800	2280
112 M	60		1800	2280	1800	2280	1800	2280	1800	2280
132 S-M	80		2100	2600	2100	2600	2100	2600	2100	2600
20.000 hours										
160 M	110		2740	3540	3300	4085	3355	4100	3270	4200
160 L	110		2600	3400	3000	3700	2900	3600	3370	4170
180 M	110		3385	4100	3485	4270	-	-	-	-
180 L	110		-	-	3485	4270	3800	4700	3900	4785
200 L	110		4685	5600	5200	6285	5700	6800	5700	6800
225 S	110	140	-	-	5900	7300	-	-	6900	8500
225 M	110	140	5185	6100	5700	7085	5700	7100	6485	8000
250 M	140		6285	7700	7000	8700	7600	9400	7800	9600
280 S	140		6000	7300	7800	9200	8900	10600	9200	11700
280 M	140		6000	7300	7800	9200	8900	10600	9200	11700
315 S	140	170	6000	7300	9400	11400	9600	13000	9600	14400
315 M-L	140	170	6400	7400	9700	11500	11100	13200	12200	19500
355 M-L	170	210	6550	7350	12900	15300	13600	17600	13600	19400
355 X	170	210	6550	7350	13000	15200	13600	17500	13000	19400
400 M-L	170	210	6850	7650	11500	15600	11500	17800	11500	19700
450 M-L	170	210	-	-	15200	17000	17000	19000	19000	21300

For operation at a certain frequency ff different from 50 Hz, multiply the table values for (50 / ff)(1 / 3).
For longer bearing lives, multiply the table loads by the following factors: 0.87 (30,000 hours); 0.79 (40,000 hours); 0.74 (50,000 hours). For the JMM series, reduce the loads outlined in the table by 20%.

If the radial load is applied between sections X_0 (x = 0) e X_{max} (x = E) at a distance X [mm] from section X_0, its maximum value $F_{r\,max,\,X}$ can be assumed equal to:



where:

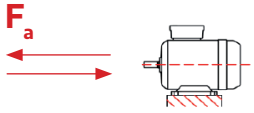
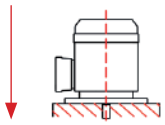
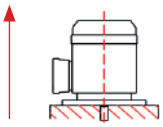
$F_{r\,max,\,Xo}$ [N]: Maximum radial load corresponding to section X_0
$F_{r\,max,\,X\,max}$ [N]: Maximum radial load corresponding to section X_{max}
E [mm]: Distance of shaft end from support

• 3.10 MAXIMUM APPLICABLE AXIAL LOADS

The maximum axial loads applicable without application of additional radial loads* are outlined in the following table::

Tab. 3.10

■ MAXIMUM APPLICABLE AXIAL LOADS AT 50 HZ

Motor	Axial forces - F_a (no radial forces) [N]											
Drawings	F_a 				F_a 				F_a 			
poles	2	4	6	8	2	4	6	8	2	4	6	8
56	233	267	-	-	153	183	-	-	230	275	-	-
63	293	443	493	-	257	307	357	-	385	460	535	-
71	410	547	640	723	413	550	647	730	620	825	970	1095
80	553	732	867	980	562	743	878	985	843	1115	1318	1478
90 S	593	788	927	1048	605	800	943	1060	908	1200	1415	1590
90 L	593	788	927	1048	605	800	943	1060	908	1200	1415	1590
100 L	883	1270	1550	1785	888	1278	1562	1793	1333	1918	2343	2690
112 M	880	1265	1547	1780	890	1276	1563	1795	1335	1915	2345	2693
132 S	1273	1677	1993	2240	1293	1720	2022	2274	1940	2580	3033	3412
160 M	1900	2300	2460	2770	1899	2343	2510	2762	2849	3515	3765	4143
160 L	1910	2100	2090	2450	1920	2130	2127	2500	2880	3195	3190	3750
180 M	2227	2400	-	-	2200	2437	-	-	3300	3655	-	-
180 L	-	2387	2533	2813	-	2438	2595	2900	-	3658	3893	4350
200 L	2973	3420	3620	3627	2988	3227	3422	3398	4483	4840	5133	5098
225 S	-	3693	-	4140	-	3482	-	3845	-	5223	-	5768
225 M	2920	3413	3673	3980	3082	3392	3385	3685	4623	5088	5078	5528
250 M	4027	4380	4627	4733	3782	4100	4317	4375	5673	6150	6475	6563
280 S	3483	4667	5500	6200	3567	4717	5550	6400	5350	7075	8325	9600
280 M	3483	4667	5500	6200	3567	4717	5550	6400	5350	7075	8325	9600
315 S	3460	5600	6600	7333	3517	5750	6633	7750	5275	8625	9950	11625
315M-L	3367	5500	6433	7217	3800	6050	7167	7733	5700	9075	10750	11600
355M-L	3300	7000	8300	9400	3783	7733	9210	11200	5675	11600	13825	16800
355 X	3033	6733	7867	8900	3633	7417	8717	9967	5450	11125	13075	14950
400 M-L	3100	6733	7900	8967	3600	7483	8400	9483	5400	11225	14600	14225
450 M-L	-	7033	8000	9200	-	8133	9900	11100	-	12200	14850	16650

For operation at a certain frequency ff different from 50 Hz, multiply the table values for (50 / ff)(1 / 3).
For longer bearing lives, multiply the table loads by the following factors: 0.79 (30,000 hours); 0.71 (40,000 hours); 0.66 (50,000 hours).
For the JMM series, reduce the loads outlined in the table by 20%.

* Consult Seipee motors for the direction of the forces

3.11 DYNAMIC BALANCING

The dynamic balancing of the rotor is performed with half a key inserted in the end of the shaft, in accordance with **DIN ISO 8821.**

Seipee motors are designed as standard with "N" degree of vibration; it is possible to supply motors with "R" degree of vibration on request. The limit values for mechanical vibration are given in the following table:

Tab. 3.11

MAXIMUM INTENSITY OF MECHANICAL VIBRATIONS

Axis height H [mm]		56 < H ≤ 132			132 < H ≤ 280			280 < H		
Vibration degree	**Mounting**	**Movement [µm]**	**Speed [mm/s]**	**Accelerazione [m/s²]**	**Move. [µm]**	**Speed [mm/s]**	**Accel. [m/s²]**	**Move. [µm]**	**Speed [mm/s]**	**Accel. [m/s²]**
N normal	Free suspension	25	1,6	2,5	35	2,2	3,5	45	2,8	4,4
	Rigid mounting	21	1,3	2,0	29	1,8	2,8	37	2,3	3,6
R reduced	Free suspension	11	0,7	1,1	18	1,1	1,7	29	1,8	2,8
	Rigid mounting				14	0,9	1,4	24	1,5	2,4

ATTENTION

The position and dimension of the key is outlined in the technical drawings for each motor series..

3.12 SOUND LEVELS

The sound power values permitted for rotating electrical machinery are established in Standard **EN 60034-9**.

The noise level is calculated **by the sound pressure level**, from the average of the values measured at 1m from the external surface of the motor in the free field and in the reflective plane, in accordance with Directive **EN 60651** and indicated in dB(A).
The speed depends on the network frequency and the number of poles on the motor.

The values shown in the table are valid for the empty motor and 50 Hz frequency at nominal voltage, with a tolerance of +3db(A).

Values at 60 Hz are higher by increasing the values in the table by about 2 dB(A).

For switchable pole motors, the values will be those corresponding to the highest speed.

PRESSURE AND SOUND POWER

Motor	JM, GM, GMD, JMM, JMK, GMK Series								IE3/IE2 - JM, GM, GMD, JMM, JMK, GMK Series							
	2 poles at no load		4 poles at no load		6 poles at no load		8 poles at no load		2 poles at no load		4 poles at no load		6 poles at no load		8 poles at no load	
	L pA	L wA	L pA	L wA	L pA	L wA	L pA	L wA	L pA	L wA	L pA	L wA	L pA	L wA	L pA	L wA
56	48	57	43	52	-	-	-	-	-	-	-	-	-	-	-	-
63	50	61	44	53	39	50	-	-	50	61	44	53	39	50	-	-
71	54	65	47	56	41	53	40	51	54	65	47	56	41	53	40	51
80	59	70	50	59	44	55	42	53	56	67	46	57	44	55	42	53
90	62	74	52	61	47	58	45	56	58	69	48	58	45	57	45	56
100	66	77	56	65	51	62	48	59	63	75	50	60	48	60	48	59
112	67	78	59	68	53	65	52	63	65	76	55	67	52	64	52	63
132	70	81	61	72	58	69	54	66	67	78	59	71	55	67	54	66
160	74	86	63	75	60	72	57	70	69	80	62	72	57	69	55	68
180	75	89	65	78	62	74	59	71	70	80	63	75	59	71	58	70
200	76	90	66	79	63	75	61	73	72	84	64	76	61	73	60	72
225	77	91	67	81	64	76	62	74	74	86	65	78	62	74	61	73
250	79	93	71	83	66	78	63	75	77	91	66	79	63	75	62	74
280	80	94	75	86	69	82	66	79	78	92	69	82	66	79	63	76
315	81	95	77	90	73	86	70	83	80	94	74	87	71	83	69	82
355	84	98	82	96	79	92	86	89	82	97	80	93	77	89	87	90
400	86	100	85	98	82	96	80	93	86	100	83	96	80	92	82	95
450	88	102	87	100	84	97	81	94	88	102	87	100	84	97	81	94

3.13 IP DEGREE OF PROTECTION

The degree of mechanical protection is established in accordance with IEC 60034-5 and is indicated by the writing IP followed by two characteristic digits.

In Seipee motors, the IP55 standard protection against water and dust penetration is guaranteed by a sealing ring mounted on the front shield. The sealing rings have good vibration resistance and good thermal stability and are resistant to diluted acids and mineral oils.

IP XY -▶ X = solid bodies Y = liquids

PROTECTION AGAINST SOLID BODIES

Degree	Level of protection
0	No protection
1	Protection against solid bodies over 50 mm
2	Protection against solid bodies over 12 mm
3	Protection against solid bodies over 2.5 mm
4	Protection against solid bodies over 1 mm
5	Protection against solid bodies (no harmful deposits)
6	No dust entry

PROTECTION AGAINST LIQUIDS

Degree	Level of protection
0	No protection
1	Protected against vertical falling drops of water (condensate)
2	Protected against vertical falling drops of water with an inclination up to 15°
3	Protected against rainwater with an inclination up to 60°
4	Protected against water sprays from all directions
5	Protected against water sprays from all directions
6	Protected against pressure water jets (similar to sea waves)
7	Protected against temporary submersion (between 0.15 and 1 m)
8	Protected against the effects of continuous submersion

3.14 VENTILATION

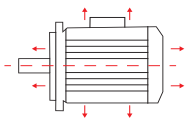
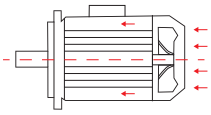
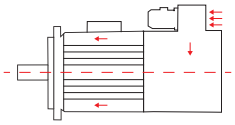
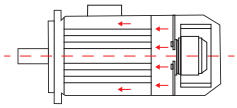
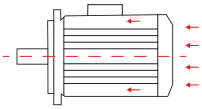
In compliance with **standard IEC 60034-6**, Seipee motors are ventilated with cooling methods **IC411**, i.e. the “machine cooled by its own surface using ambient liquid (air) that circulates along the machine”.

Cooling is carried out by a fan external to the motor body, with two-directional radial blades, fitted on the NDE shaft and protected by a special fan cover in steel sheeting

ATTENTION

Accidental shuttering of the fan cover grate can also affect motor cooling.
It is recommended to maintain a minimum distance of ¼ of the diameter of the opening of the air intake between the end of the fan cover and any obstacle.

VENTILATION MODE

IC 410	Machine closed, cooled from the surface by natural conversion and radiation. No external fan.	
IC 411	Machine closed. Smooth or grooved ventilated housing. External fan, assembled on the shaft.	
IC 416 R*	Machine closed. Smooth or grooved closed housing. Radial external automated fan (R) supplied with the machine for specific applications	
IC 416	Machine closed. Smooth or grooved closed housing. Axial external automated fan supplied with the machine.	
IC 418	Machine closed. Smooth or grooved closed housing. No external fan. Ventilation ensured by the air flow coming from outside.	

Use of asynchronous motors with speed variation using variator for frequency or voltage, makes particular precautions compulsory.

This is because, in case of prolonged operation at low speed, the ventilation loses its effectiveness, and it is therefore advisable to install a forced ventilation system with constant flow.

Vice versa, in the event of prolonged operation at high speeds, the noise emitted by the ventilation system can be annoying, and it is therefore recommended to opt for a forced ventilation system.

The characteristics of the servo-fan and the variation **ΔL** of the measurement **LB** (see “motor dimensions”) are outlined in the following table

AUXILIARY AXIAL FAN CHARACTERISTICS

Tab. 3.14

Motor Size	Poles	Phases	V ~ ± 10%	Hz	W ass.	A ass.	Poles	Protection	Weight [Kg]	ΔL [mm]
63	2~8	1	230	50/60	17/13	0,13/0,10	2	IP54	1,1	60
71	2~8	1, 3	230, Y 400	50/60, 50	17/13 55	0,13/0,10 0,26	2	IP54	1,0 2,2	70 130
80	2~8	1, 3	230, Y 400	50/60, 50	17/13 55	0,13/0,10 0,26	2	IP54	1,2 2,3	65 110
90	2~8	1, 3	230, Y 400	50/60, 50	31/24 55	0,24/0,18 0,26	2	IP54	1,6 2,4	70 110
100	2~8	1, 3	230, Y 400	50/60	31/24 45/43	0,24/0,18 0,13/0,09	2	IP54	1,6 2,1	75
112	2~8	1, 3	230, Y 400	50/60	70/65 45/43	0,35/0,30 0,13/0,09	2	IP54	2,2 2,5	85
132	2~8	1, 3	230, Y 400	50/60	64/78 77/101	0,30/0,34 0,32/0,36	2, 4	IP55	2,8 7,0	70
160	2~8	3	400/480	50/60	43/62	0,31/0,35	4	IP55	8,0	120
180	2~8	3	400/480	50/60	97/138	0,32/0,35	4	IP55	9,0	140
200	2~8	3	400/480	50/60	81/116	0,22/0,24	6	IP55	11,0	195
225	2~8	3	400/480	50/60	115/169	0,25/0,28	6	IP55	12,0	180
250	2~8	3	400/480	50/60	114/168	0,24/0,27	6	IP55	14,0	225
280	2~8	3	400/480	50/60	187/262	0,64/0,70	8	IP55	19,0	230
315	2~8	3	400/480	50/60	199/285	0,64/0,70	8	IP55	24,0	210
355	2~8	3	400/480	50/60	238/349	0,64/0,72	8	IP55	29,0	215
355X	2~8	3	400/480	50/60	238/349	0,64/0,72	8	IP55	29,0	360
400	2	3	Δ 400	50	2600	5,0	4	IP54	33,5	380
	4~8			50	2530	4,9			33,5	
450	4~8	Consult Seipee								

The auxiliary ventilation power terminals are located inside an auxiliary terminal box attached to the fan cover. Before making the electrical connection make sure the power supply corresponds to the electrical data shown on the plate.

NOTE

Check the rotation direction of the three-phase fan corresponds to that indicated by the arrow placed on the fan cover, otherwise reverse two of the three phases of power supply.

3.15 ELECTRICAL DESIGN

3.16 STATIC WINDING SYSTEM

Seipee motors are built with **a class F insulation system**, in compliance with **EN 60034-1.** Class F/B insulation system for all motors with standardised power; Class B or B/F insulation system for the remaining single-phase and three-phase motors.
Double glazed copper wire with an autoclave impregnation system is used with high quality resins, which allow use in a tropical climate without the need for further treatments. Accurate separation of phase windings (in cavity or head); accurate insulation of the "braid" (cables at the beginning of the phase).
All Seipee motors are equipped with phase separators for inverter duty.
It is possible to perform class H insulation on request.

INSULATION CLASS B (130)

- Nominal ambient 40 °C
- Maximum temperature margin permitted 80K
- Temperature margin on hot point 10K

INSULATION CLASS F (155)

- Nominal ambient 40 °C
- Maximum temperature margin permitted 105K
- Temperature margin on hot point 10K

INSULATION CLASS H (180)

- Nominal ambient 40 °C
- Maximum temperature margin permitted 125K
- Temperature margin on hot point 10K

3.17 POWER YIELD BASED ON AMBIENT TEMPERATURE

With the ambient temperature over 40°C, there is a reduction in power supply.

Ambient temperature [°C]	25	30 - 40	45	50	55	60
P / P_N	1,07	1,00	0,95	0,90	0,85	0,80

3.18 POWER YIELD BASED ON ALTITUDE

With altitude over 1000 metres above sea level, there is a reduction is power supply.

Altitude s.l.m. [m]	0 ~ 1000	1500	2000	2500	3000	3500	4000
P / P_N	1,00	0,97	0,93	0,89	0,85	0,80	0,74

3.19 WINDING PROTECTION AGAINST OVER-TEMPERATURE

The temperature probes are indispensable for protection of the electric motor from over-temperature.
The terminals of the thermal protection probes are located inside the terminal box.

BIMETAL THERMAL PROBES (PTO)

As standard on motors
JM 160 and GM 160 ~ 450

Characteristics

They are three probes connected in series with normally closed contact inserted in the motor winding.

The contact opens when the winding temperature reaches and exceeds the intervention value.

$V_{N, max}$ = 250 [V]
$I_{N, max}$ = 1.6 [A]

THERMISTOR THERMAL PROBES (PTC)

As standard on all motors ≥0.75kW

Characteristics

These are three thermistors connected in series inserted in the winding in accordance with DIN 44081/44082, for connection to specific release equipment.

There is a sudden change in resistance that causes the release when the winding temperature reaches and exceeds the intervention value.
150 C for class F insulation
160 C for class H insulation

TEMPERATURE SENSOR PT100

Option required

Characteristics

This is a temperature sensor in accordance with DIN 751, for connection to specific release equipment.

Winding: three PT100 sensors inserted in the winding, one for each phase. Terminals located inside the motor terminal box.

Bearings: a PT100 sensor inserted on the bearing support (control side, side opposite control). Terminals placed inside a shunt box fastened to the motor housing.

3.20 OVERLOAD

At the operating temperature, the three-phase motors are able to sustain an overload of 1.5 times the nominal torque for 15 seconds at the nominal voltage. This overload complies with EN 60034-1 and does not cause excessive motor heating.

3.21 HOURLY START-UPS

The maximum number of permitted hourly starts is given in the following table, provided that the additional moment of inertia of the rotor: load torque increasing with the speed square up to the nominal torque and starts at constant intervals.

Axis height	Number of permitted hourly start-ups		
	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

• 3.22 THREE-PHASE MOTOR POWER SUPPLY DIFFERENT FROM NOMINAL VALUES

Seipee electric motors with three-phase power supply are designed for use on the European mains **230/400V ± 10% at 50Hz**.

This means that the same motor can also be connected to the following electrical mains:
220/380V ±5% - 230/400V ±10% - 240/415V ±5%

The same electric motors can operate with frequency at 60hz with different electrical performances and quantities, as shown in the following table

■ THREE-PHASE MOTOR NON-NOMINAL POWER SUPPLY

Tab. 3.22

Nominal power supply	Alternative supply					Corrective factors with reference to nominal supply at 50 Hz					
	Frequency	Voltage [V]				P	n	I	T	I_s	T_s, T_{max}
	[Hz]	diff. %	Δ	Y	diff. %	[kW]	[min^{-1}]	[A]	[Nm]	[A]	[Nm]
Δ 230 [V] Y 400 [V]	50	-4,3%:	220	380	: -5,0%	1	1	0,95 ÷ 1,05	1	0,96	0,90
		4,3% :	240	415	: 3,8%	1	1	0,95 ÷ 1,05	1	1,04	1,08
	60	-20,6% (1)	220	380	(1) -20,8%	1	1,19	0,95 ÷ 1,05	0,84	0,79	0,63
		-17,0% (1)	230	400	(1) -16,7	1	1,2	0,95	0,85	0,83	0,80
		-7,9% (2)	255	440	(2) -8,3%	1,1	1,2	0,95 ÷ 1	0,92	0,92	0,84
		-4,3% :	265	460	: -4,2%	1,15	1,2	0,95 ÷ 1,05	1	0,96	0,92
		Nom. :	**277**	**480**	**: Nom.**	**1,2**	**1,2**	**1**	**1**	**1**	**1**
Δ 400 [V]	50	-5,0% :	380	--	--	1	1	0,95 ÷ 1,05	1	0,95	0,90
		3,8% :	415	-	--	1	1	0,95 ÷ 1,05	1	1,04	1,08
	60	-20,8% (1)	380	--	--	1	1,19	0,95 ÷ 1,05	0,84	0,79	0,63
		-17,0% (1)	400	--	--	1	1,2	0,95	0,85	0,83	0,80
		-8,3% (2)	440	--	--	1,1	1,2	0,95 ÷ 1	0,92	0,92	0,84
		-4,2% :	460	--	--	1,15	1,2	0,95 ÷ 1,05	1	0,96	0,92
		Nom. :	**480**	--	--	**1,2**	**1,2**	**1**	**1**	**1**	**1**

(1) = Supply voltage not recommended for heavy duty and prolonged motor operation. The motor can work with this power supply, but it must have full load start-ups; the power required must not exceed the nominal value. Over-temperature of the motor can be greater.
(2) = The motor can work with this power supply, but must not have full load start-ups.

* Consult Seipee for voltages and frequencies not indicated in the table

ATTENTION

The motor yield can vary when powered at voltage/frequency values different from nominal ones.

• 3.23 INVERTER-ACTIVATED MOTORS

Tall Seipee asynchronous three-phase motors in standard configuration are equipped with winding with phase separators for use with inverters..

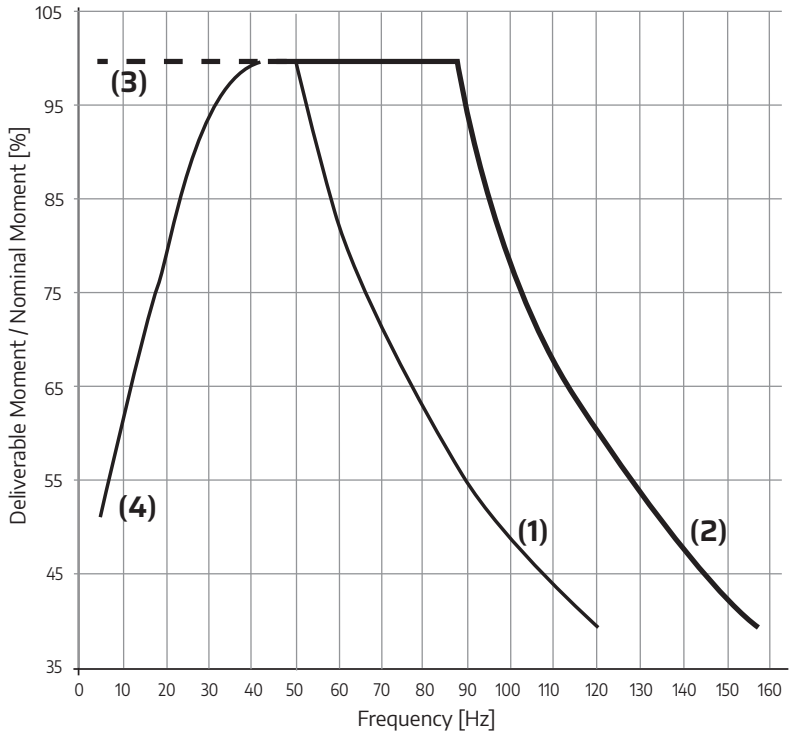
The following information must be taken into account:
Maximum output voltage of the inverter on the motor UN ≤ 500V with peak of U_{peak} ≤ 1500V and voltage gradients dU/dt ≤1,5 kV/µs. For situations where higher voltages or peaks are required, it is necessary to provide special insulation systems for which the manufacturer must be consulted.

The torque (T) that can be delivered from the Seipee motor, under inverter follows the graphic below.

▸ In applications where the load torque curve is quadratic to the speed, the motors operate by delivering the nominal torque.

1) Operation > 50hz, with inverter input voltage equal to the nominal motor voltage: constant power operation P @ PN , while the torque released by the motor decreases progressively as the frequency increases. The current value must never exceed the nominal value on the motor plate.
2) Operation > 50 Hz, with nominal voltage of the motor under 1.73 times the input voltage: constantly torque T @ TN up to 87 Hz, supplied power from the motor increases progressively (P(87Hz) @ PN x 1.73); the absorbed current value must not exceed the nominal value outlined on the motor plate.

The motors designed at Δ/Y 230/400V 50Hz can work with delta connection at a maximum frequency of 87Hz. You are however advised to comply with the mechanical speed limit
3) For applications with constant torque < 35 Hz, the motor requires servo-ventilation. With operation < 50Hz with servo-ventilated or auto-ventilated motor with intermittent service, the torque remains constant.
4) Nominal torque in Nm = 9550 x (nominal power [kW] / rotation speed [min-1]). The nominal torque of self-ventilated motors with 50 Hz operation will be reduced as shown in the graphic below. Depending on the adjustment range, it is advisable to use auxiliary servo-ventilation.



▸ Depending on the operating point, the type of inverter and the switching current, the motors generate higher noise levels, ranging approximately between 4 and 10 dB(A), compared to motors powered directly from the grid. Even motors operated at a speed higher than 50hz have a higher sound level, due to the noise of the fan, therefore we recommend the use of forced ventilation.
▸ Seipee recommends using electrically insulated bearings from size 250 for motor under inverter use

3.24 TOLERANCES

All industrial motors compliant with **standard EN 60034-1,** are subject **to permitted tolerances in production**, established on the basis of guaranteed values. The standard outlines the following::

1

The tolerances outlined below must be guaranteed. On the contrary, this must be stipulated.

2

Attention should be paid to the different interpretation of the term "guarantee". In fact, in some countries, there is a difference between guaranteed values and characteristic or declared values.

3

When you specify a tolerance in only one sense, the value has no limits in the other sense.

ELECTRICAL TOLERANCES TABLE

Characteristic	Tolerances
Performance η	-0.15 (1 - η) a $P_N \leq 150Kw$ -0.1 (1 - η) a $P_N > 150Kw$
Power factor cos φ	(1 - cos φ) / 6 [minimum 0.02, maximum 0.07]
Sliding s	±20% of sliding a $P_{N \geq 1kW}$ ±30% of sliding a $P_{N < 1kW}$
Blocked rotor current I_A	+20% of the guaranteed starting current (no lower limit)
Starting torque M_A	-15% e +25% of the guaranteed starting torque
Maximum torque M_K	-10%
Moment of inertia J	± 10%

MECHANICAL TOLERANCES

The dimensions of the asynchronous motors are indicated in **standard IEC 60072-1,** which indicates the following permitted tolerances::

ELECTRICAL TOLERANCES TABLE

Characteristic	Designation	Tolerances	
Axis height	H	Up to 250 Over 250	-0,5 mm -1 mm
Diameter of the shaft end	D	From 11 to 28 mm From 38 to 48 mm From 55 to 100 mm	j6 k6 m6
Width of key	F		H9
Flange centring	M	Up to 132 Over 132	J6 H6

TYPE OF **SERVICE**

4.

4 TYPES OF SERVICE

4.1 SERVICE TYPES

The values of the motors indicated in the tables refer to motors **operating in service mode S1**, **continuous operation with constant load.**

Load: the set of values of electrical and mechanical quantities characterising the requirements imposed on a rotating machine by an electrical circuit or a mechanical device, at a given moment.

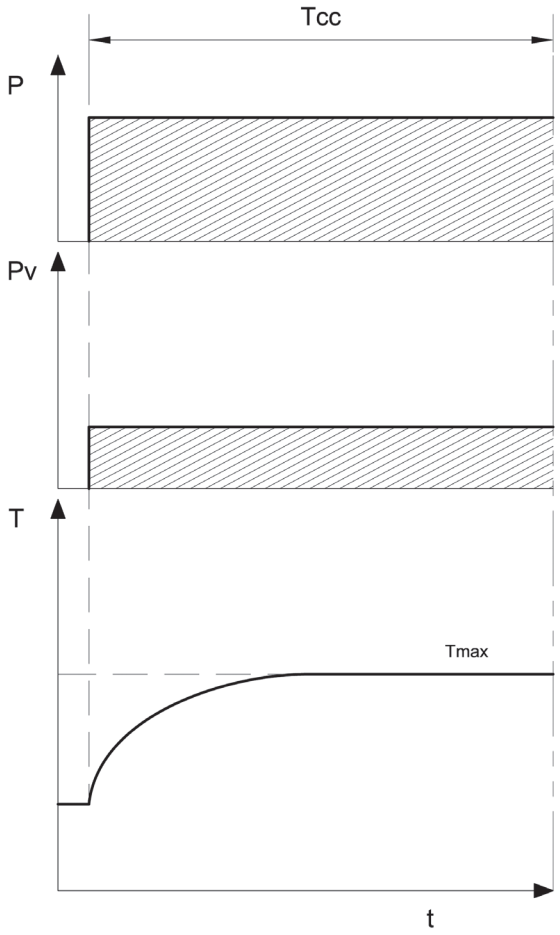
Service: the definition of the load or loads to which the machinery is subjected, including (if applicable) the starting, electric braking, no load operation and rest periods, and their duration and sequence over time**.**

The **standards EN 60034-1** also cover the following types of service:

CONTINUOUS SERVICE – SERVICE S1

Sufficient duration constant load operation on reaching thermal balance.

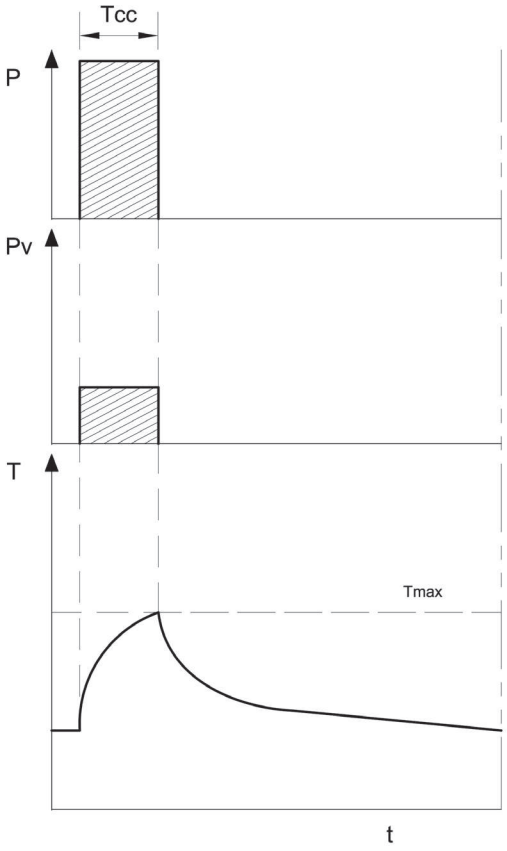
P = Load
Pv = Electrical losses
T = Temperature
t = Time
Tcc = Operating time at constant load
Tmax = Maximum temperature reached



LIMITED DURATION SERVICE – SERVICE S2

Constant load operation for a certain period of time, under that required to reach thermal equilibrium, followed by a rest period at sufficient duration to re-establish equality between the temperature of the machine and that of the cooling fluid, with a tolerance of 2 K.

P = Load
Pv = Electrical losses
T = Temperature
t = time
Tcc = Operating time at constant load
Tmax = Maximum temperature reached

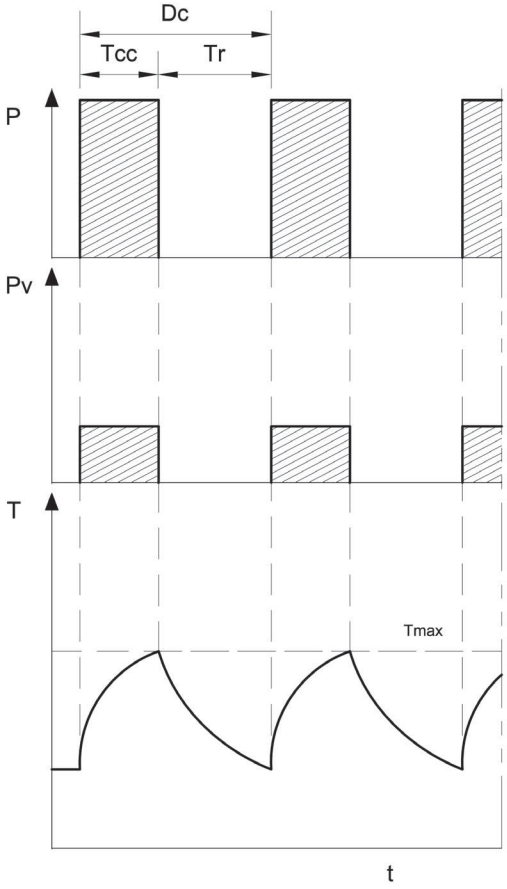


PERIODIC INTERMITTENT SERVICE – SERVICE S3

Sequence of identical operating cycles, each including a period of constant load operation and a rest period. In this service, the cycle is such the starting current does not significantly influence over-temperature.
The periodic service implies the thermal equilibrium is not reached during the load period.

P = Load
Pv = Electrical losses
T = Temperature
t = time
Dc = Duration of a cycle
Tcc = Operating time at constant load
Tr = Rest time
Tmax = Maximum temperature reached

Intermittency ratio = Tcc / (Tcc+Tr) * 100%

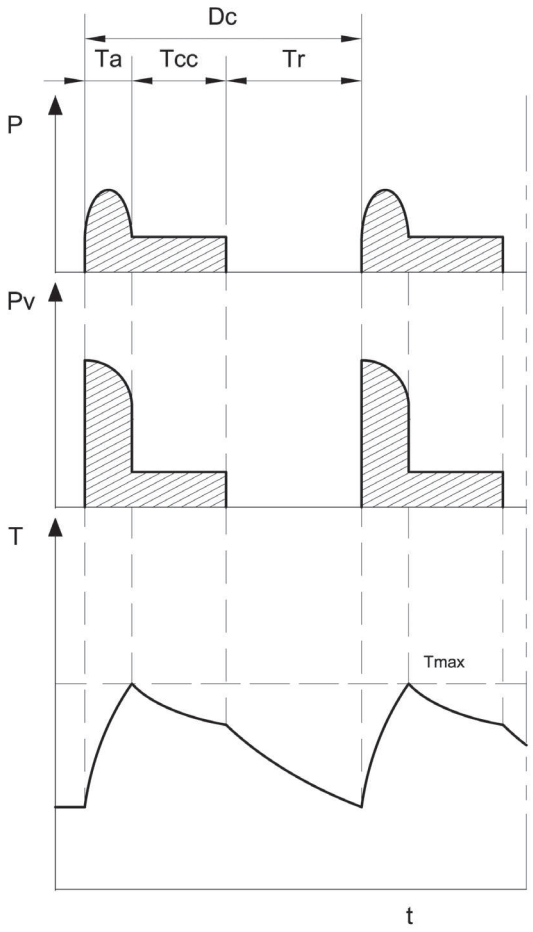


PERIODIC INTERMITTENT SERVICE WITH STARTING – SERVICE S4

Sequence of identical operating cycles, each including a non-marginal starting phase, a period of constant load operation and a rest period.
The periodic service implies the thermal equilibrium is not reached during the load period.

P = Load
Pv = Electrical losses
T = Temperature
t = time
Dc = Duration of a cycle
Ta = Starting or acceleration time
Tcc = Tempo di funzionamento a carico costante
Tr = Rest time
Tmax = Maximum temperature reached

Intermittency ratio = (Ta+Tcc) / (Ta+Tcc+Tr) * 100%



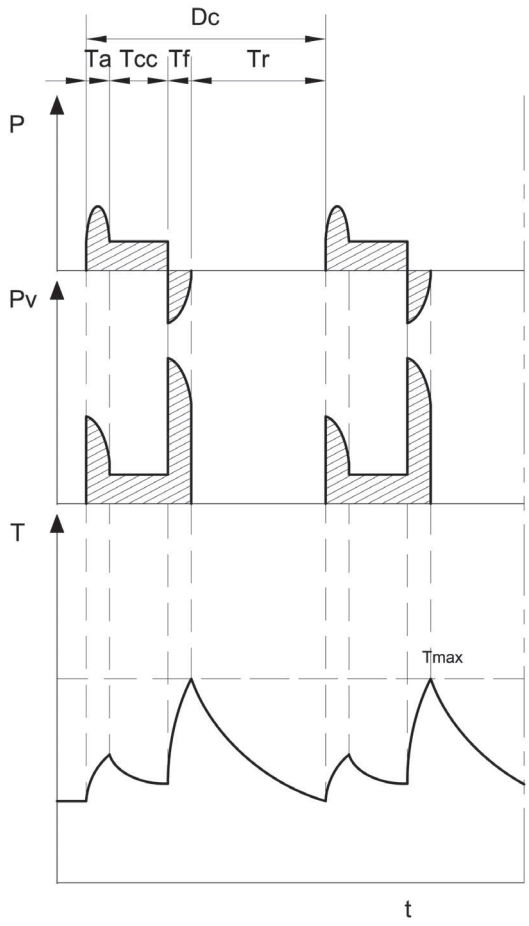
PERIODIC INTERMITTENT SERVICE WITH ELECTRICAL BRAKING – SERVICE S5

Sequence of identical operating cycles, each including a starting phase, a period of constant load operation, a rapid electrical braking phase and a rest period.

The periodic service implies the thermal equilibrium is not reached during the load period.

P = Load
Pv = Electrical losses
T = Temperature
t = time
Dc = Duration of a cycle
Ta = Starting or acceleration time
Tcc = Operating time at constant load
Tf = Electrical braking time
Tr = Rest time
Tmax = Maximum temperature reached

Intermittency ratio = (Ta+Tcc+Tf) / (Ta+Tcc+Tf+Tr) * 100%



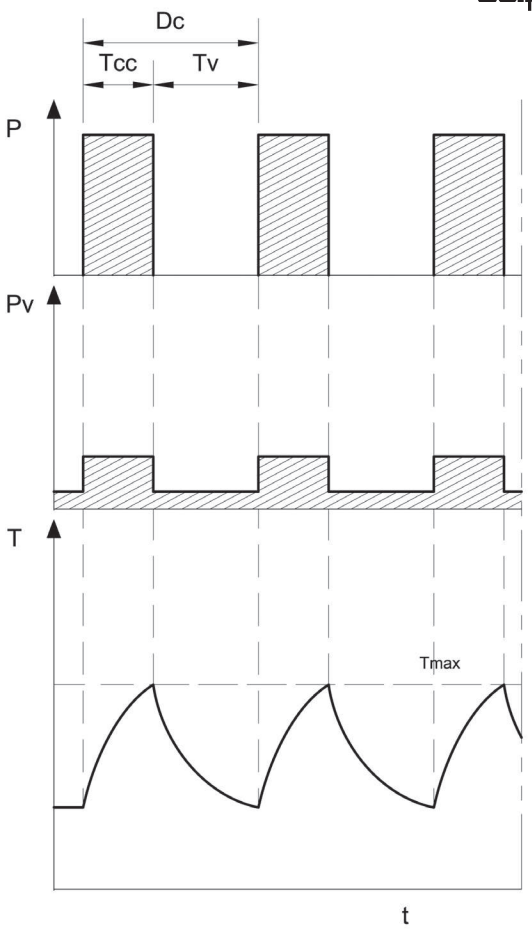
PERIODIC INTERRUPTED SERVICE – SERVICE S6

Sequence of identical operating cycles, each including a period of constant load operation and an operating period with no load. There are no rest periods.

The periodic service implies the thermal equilibrium is not reached during the load period.

P = Load
Pv = Electrical losses
T = Temperature
t = time
Dc = Duration of a cycle
Tcc = Operating time at constant load
Tv = No load operating time
Tmax = Maximum temperature reached

Intermittency ratio = Tcc / (Tcc+Tv) * 100%

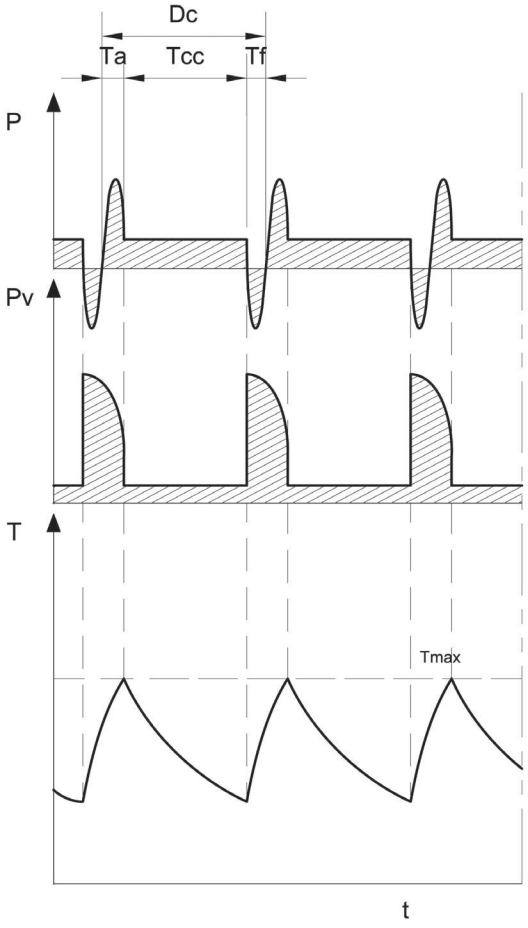


PERIODIC INTERMITTENT SERVICE WITH ELECTRICAL BRAKING – SERVIZIO S7

Sequence of identical operating cycles, each including a starting phase, a period of constant load operation and an electrical braking phase.
There are no rest periods.
The periodic service implies the thermal equilibrium is not reached during the load period.

P = Load
Pv = Electrical losses
T = Temperature
t = time
Dc = Duration of a cycle
Ta = Starting or acceleration time
Tcc = Operating time at constant load
Tf = Electrical braking time
Tmax = Maximum temperature reached

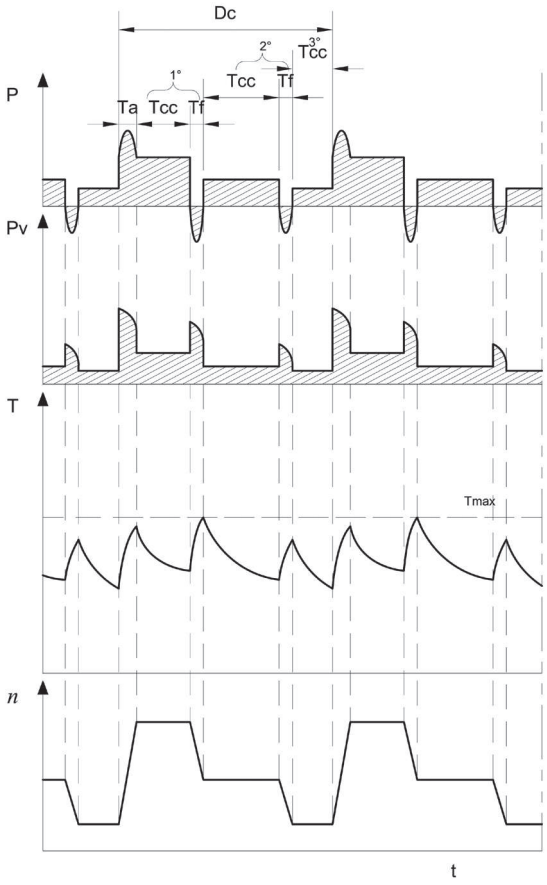
Intermittency ratio = 1



PERIODIC SERVICE INTERRUPTED WITH VARIATION RELATING TO LOAD AND SPEED – SERVICE S8

Sequence of identical operating cycles, each comprising a period of constant load operation corresponding to a predetermined rotational speed, followed by one or more operating periods with other constant loads corresponding to different rotational speeds (achieved for example by changing the number of poles in the case of induction motors).

There are no rest periods.
The periodic service implies the thermal equilibrium is not reached during the load period.

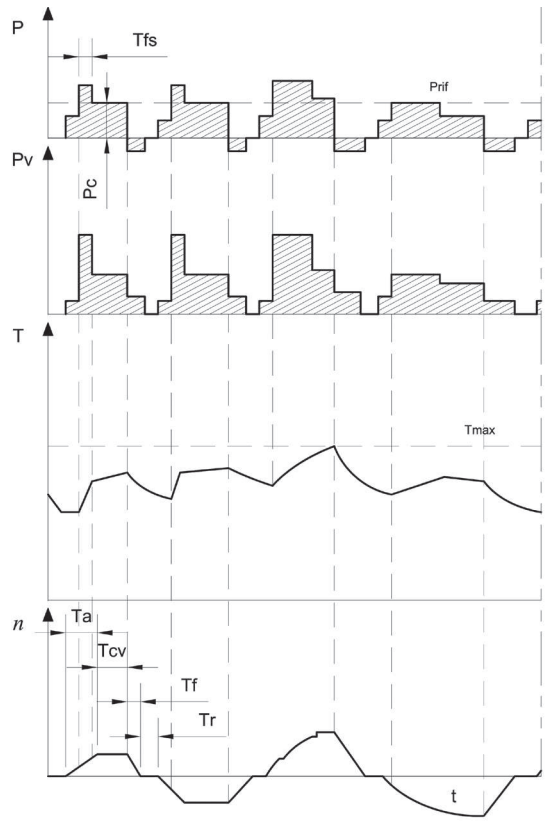


P = Load
Pv = Electrical losses
T = Temperature
n = Speed
t = time
Dc = Duration of a cycle
Tf 1° - 2° - 3° = Electrical braking time
Ta = Starting or acceleration time
Tcc 1° - 2° - 3° = Constant load operating time
Tmax = Maximum temperature reached

Intermittency ratio =
(Ta+Tcc1) / (Ta+Tcc1+Tf1+Tcc2+Tf2+Tcc3) * 100%
(Tf1+Tcc2) / (Ta+Tcc1+Tf1+Tcc2+Tf2+Tcc3) * 100%
(Tf2+Tcc3) / (Ta+Tcc1+Tf1+Tcc2+Tf2+Tcc3) * 100%

SERVICE WITH NON-PERIODIC VARIATIONS OF LOAD AND SPEED – SERVICE S9

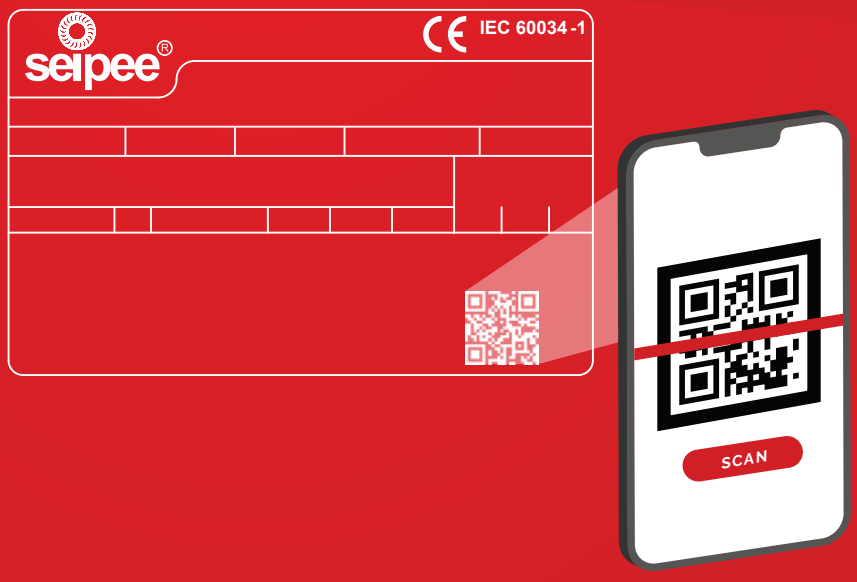
Service in which the load and speed vary in a non-periodic manner in the permitted operating field. This service includes overloads frequently applied which can be broadly higher than full load values.



P = Load
Pv = Electrical losses
T = Temperature
n = Speed
t = time
Ta = Starting or acceleration time
Tcv = Variable load operating time
Tf = Electrical braking time
Tr = Rest time
Tfs = Overload operating time
Pc = Full load
Tmax = Maximum temperature reached

NAME OF **MOTOR**

Did you know that we have updated the Seipee motor plates with QR Code that allow you to consult, with a single touch, the technical manual of your motor?



5.

5 NAME OF MOTOR

To make an order, you must indicate some essential information:

1. **Efficiency:** IE4 – IE3 – IE2
2. **Motor type:** 1ph (single-phase) / 3ph (three-phase)
3. **Speed or number of poles:** 2 – 4 – 6 – 8 poli / 1000- 1500 – 3000rpm
4. **Motor series:** JM - GM - JMD - GMD – JMK - GMK – JMM etc.
5. **Axis height:** 56 - 63 - 71 - 80 - 90 - 100 - 112 - 132 - 160 - 180 - 200 - 225 - 250 - 280 - 315 - 355 - 400 etc.
6. **Power:** 0,37 kW, etc.
7. **Structural format:** B3 – B5 – B5V1 – B3/B5 – B14 – B3/B14 etc.
8. **Voltage and frequency:** 230-400V 50Hz / 400-690V 50Hz / 230-460V 60Hz etc.
9. **Possible accessories or non-standard executions:** see respective chapter

EXAMPLE OF MOTOR ORDER

IE3 - 3ph - 4 Poli - JM - 112Ma - 4 kW - B5 - 230-400 V 50 Hz

1 2 3 4 5 6 7 8

Efficiency	Type	Speed/Poles	Series	Axis heigth	Power	Shape	Voltage/Frequency
IE4, IE3, IE2	1ph	2, 4, 6, 8, 4/6, 4/8	JM / GM	56 ~ 450	[kW]	B3, B5, B14, B35, B34	230-400V 50Hz
			JMK / GMK				400-690V 50Hz
	3ph		JMD / GMD				230-460V 60Hz
			JMM				etc

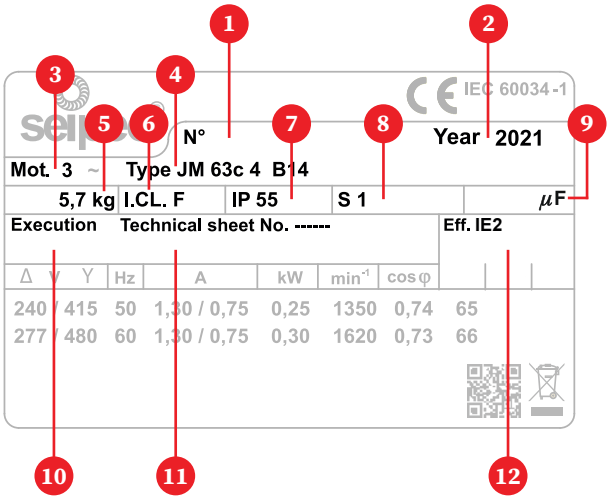
The following pages will use the following symbols and units of measurement:

cos φ	=	Nominal power factor	
η	=	Performance (P_{resa} / $P_{absorbed}$)	
I_N	=	Nominal current	
I_S	=	Inrush current	
J	=	Moment of inertia	
n_N	=	Nominal speed	
P_N	=	Nominal power	[kW]
Tmax	=	Maximum torque	[Nm]
T_N	=	Nominal torque	[Nm]
T_S	=	Peak torque	[Nm]
Øi	=	Internal diameter	[mm]
Øe	=	External diameter	[mm]
C	=	Running capacitor	[µF]
C_E	=	Starting capacitor	[µF]
*	=	Power or corresponding power	

5.1 PLATE DATA

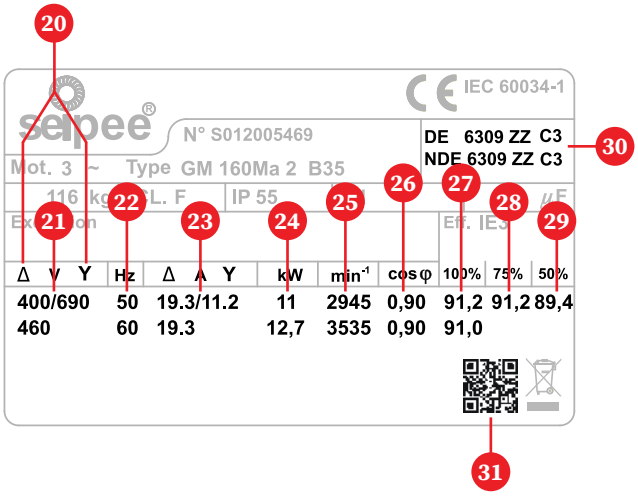
All motors are supplied with an aluminium plate All the plates are laser etched and bear the electric motor data in compliance with reference legislation

EXAMPLE JM / JMM SERIES



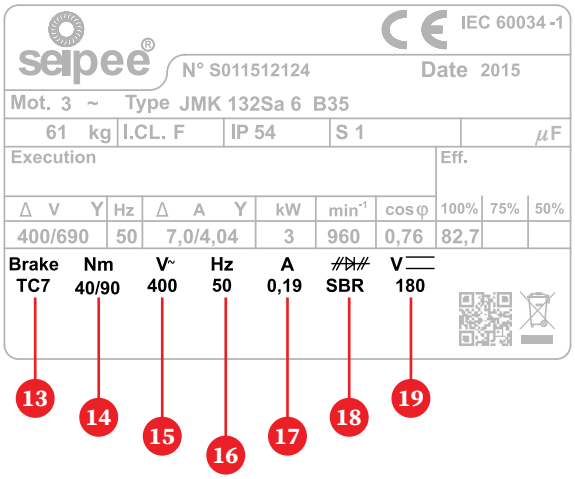
1. Serial number
2. Year
3. Number of phases
4. Type of motor / size / number of poles / designation / mounting type
5. Weight of motor
6. Insulation class
7. Protection class
8. Duty
9. Capacitor capacitance (JMM series)
10. Auxiliary capacitor capacitance (JMM series)
11. Special mounting type, if applicable
12. Efficiecy class if possible

EXAMPLE SERIE GM/GMM SERIES



20. Phase connection
21. Brake nominal
22. Rated frequency
23. Current rating
24. Rated power
25. Rated speed
26. Power factor
27. Efficiency Full load 100%
28. Efficiency 75% load
29. Efficiency 50% load
30. Size and type of bearings
31. QR Code

EXAMPLE MOTORS WITH BRAKE



13. Brake type
14. Braking torque
15. Brake nominal voltage in a.c.
16. Brake frequency
17. Current absortion of the brake
18. Rectifier type (only on c.c.)
19. Brake Nominal voltage in d.c.

OTHER EXAMPLES