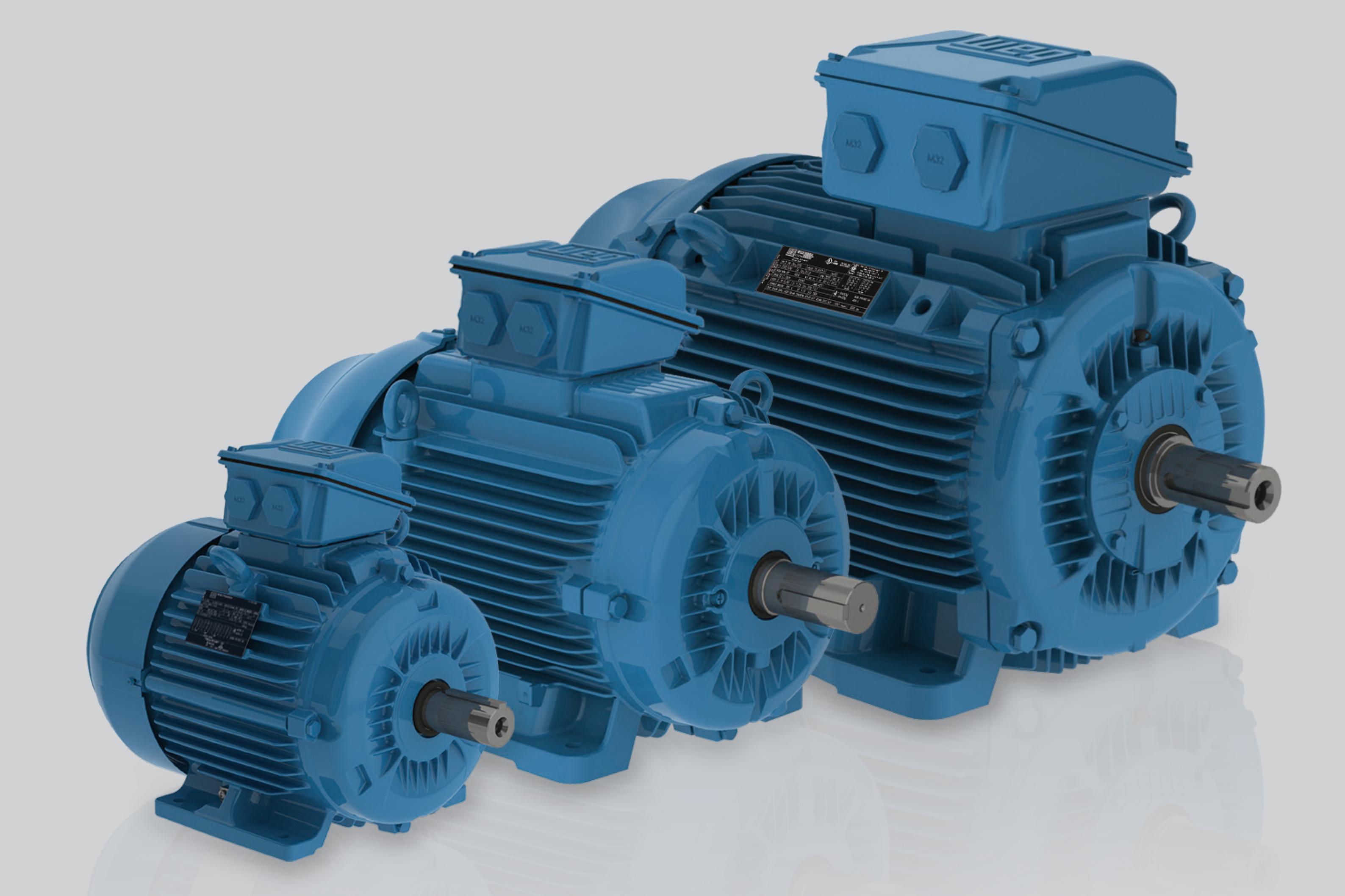
B&P Elektromotoren

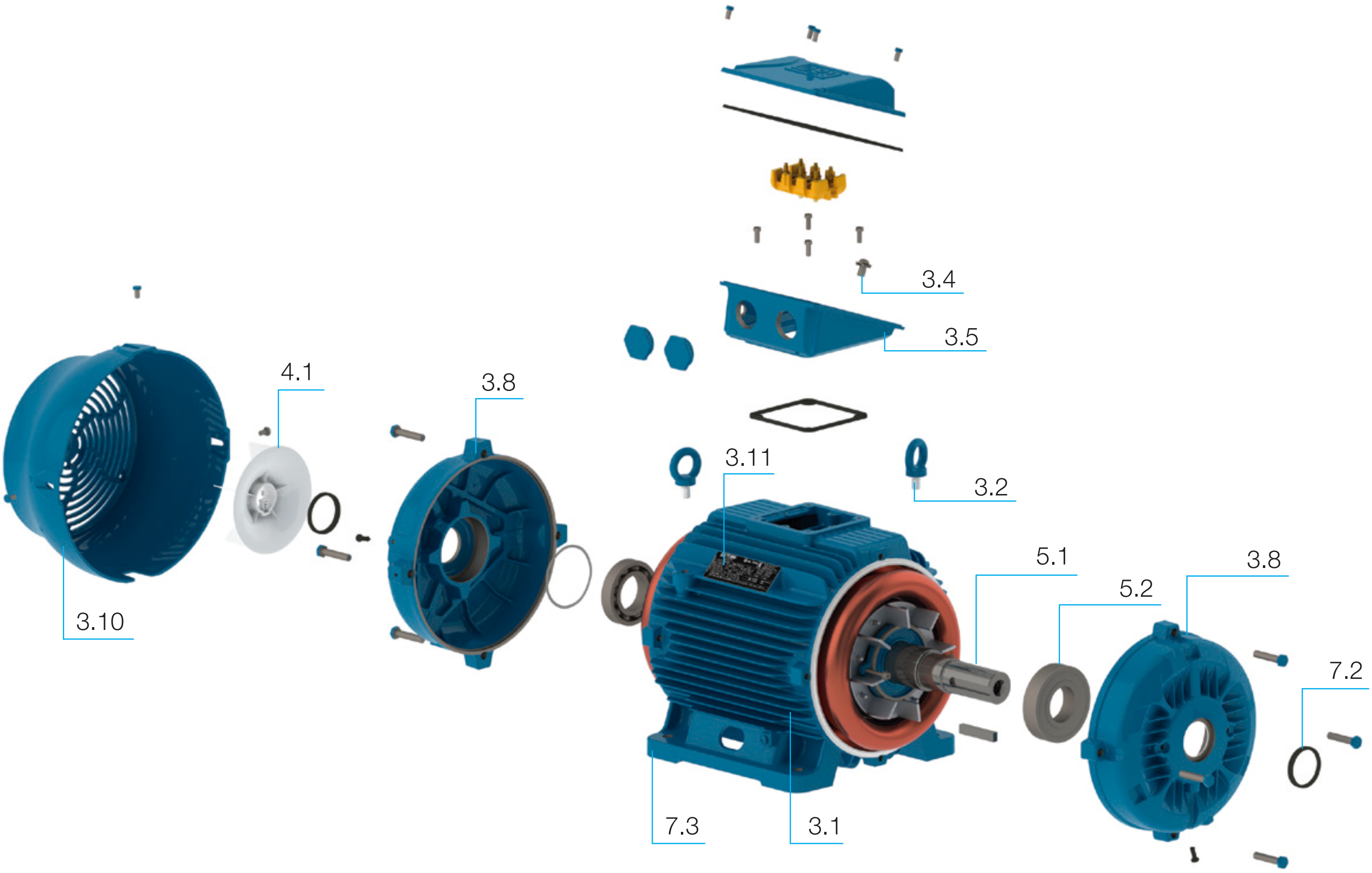
W22

Three-Phase Electric Motor

Technical Catalogue
European Market



Motors | Automation | Energy | Transmission & Distribution | Coatings



Visual Index

Efficiency values for W22 motors are prepared in accordance with the test standard IEC 60034-2-1:2014, with stray load losses determined directly by the summation of losses.

The output versus frame ratio for all W22 motors follows the EN 50347 standard, thus allowing direct replacement of existing lower efficiency motors with High (IE2), Premium (IE3) or Super Premium (IE4) machines.

A further characteristic of the W22 electrical design is that it was conceived in such way that its efficiency remains practically constant in the 75% to 100% load range. Therefore, even when the motor is not running at full load its efficiency is not affected (see figure 2).

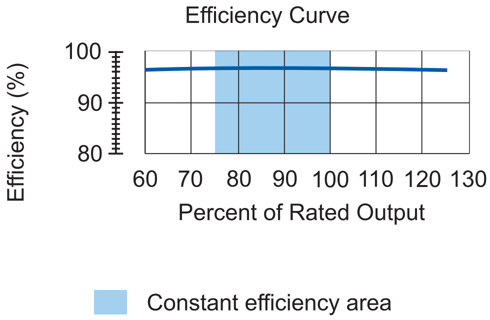


Figure 2 - Typical efficiency curve of W22 line

2. Standards

W22 motors meet the requirements and regulations of the latest versions of the following International Standards:

IEC 60034-1 Rotating electrical machines - Part 1: Rating and performance.
IEC 60034-2-1 Rotating electrical machines - Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles).
IEC 60034-5 Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - classification.
IEC 60034-6 Rotating electrical machines - Part 6: Methods of cooling (IC code).
IEC 60034-7 Rotating electrical machines - Part 7: Classification of types of enclosures and mounting arrangements (IM code).
IEC 60034-8 Rotating electrical machines - Part 8: Terminal markings and direction of rotation.
IEC 60034-9 Rotating electrical machines - Part 9: Noise limits.
IEC 60034-11-1 Rotating electrical machines - Part 11-1: Thermal protection.
IEC 60034-12 Rotating electrical machines - Part 12: Starting performance of single-speed three-phase cage induction motors.
IEC 60034-14 Rotating electrical machines - Part 14: Mechanical vibration of certain machines - Limits of vibration.
IEC 60034-30-1 Rotating electrical machines - Part 30: Efficiency classes for single-speed three-phase cage induction motors.
IEC 60072-1 Dimensions and output series for rotating electrical machines - Part 1: Frame numbers 56 to 400 and flange numbers 55 to 1080.
EN 50347 General purpose three-phase induction motors having standard dimensions and outputs - frame numbers 56 to 315 and flange numbers 65 to 740.

3. Construction Details

The information included in this technical catalogue refers to the standard construction features and most common variations for W22 Low Voltage General Purpose Motors in frame sizes from IEC 63 to 355A/B.
W22 motors for special and/or customized applications are available on request. For more information, please, contact your WEG office or distributor.

3.1 Frame

The W22 frame (figure 3) is manufactured in FC-200 (EN GJL 200) cast iron providing high levels of mechanical strength to cater for the most demanding applications. The cooling fins are designed to minimize the accumulation of liquids and dust on the motor.

Figure 3 - W22 Frame

The motor feet are completely solid for optimal mechanical strength (figure 4), allowing easier alignment and installation.

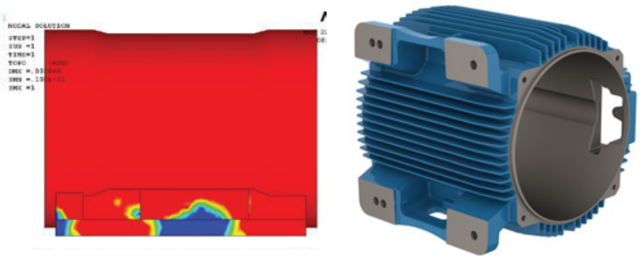


Figure 4 - Solid feet

3.2 Eyebolts

Eyebolts are provided as standard from frame size 100L. The positions of the eyebolts are shown in the table 3:

Number of eyebolts	Description
1	Frames 100L to 200L Motors with feet and with side mounted terminal box
2	Frames 100L to 200L Motors with feet and with top mounted terminal box
2	Frames 100L to 200L - Motors without feet and with C or FF flange
2	Frames 225S/M to 355A/B - Motors with feet and side or top mounted terminal box. These motors have four threaded holes in the upper part of the frame for fastening of the eyebolts (figure 5)
2	Frames 225S/M to 355A/B - Motors without feet and with C or FF flange. These motors have four threaded holes in the upper part of the frame for fastening of the eyebolts and two more threaded holes in the bottom part

Table 3 - Eyebolts

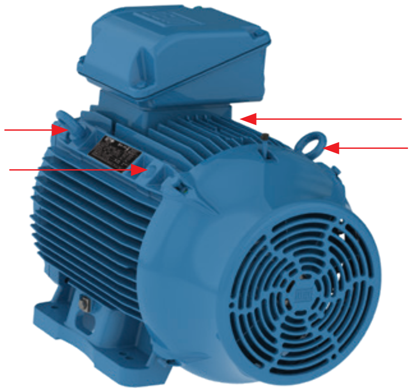


Figure 5 - Motor with four threaded holes for fastening of the eyebolts

3.3 Points for Vibration Monitoring

To allow easy maintenance, specifically vibration testing, the 160 to 355 frames are designed with flat areas on both ends for better placement of accelerometers (figure 6).
These flat areas are provided in both vertical and horizontal planes. As an option M8 threads for SPM accelerometers can be supplied.

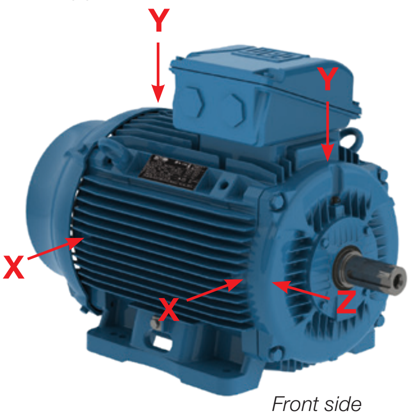


Figure 6 - Flat surfaces for vibration monitoring on the top, front and side.

3.4 Earth Terminals

All frames from 63 to 355A/B are provided with an earth terminal located inside the terminal box (see figure 7). Motors in frames 225S/M to 355A/B are also fitted with an earth terminal on the frame. It is located on the same side of the main terminal box cable entry (see figure 7) and is responsible to equalize electrical potential and provide greater safety for operators. Capable of terminating cables from 25 mm^2 to 185 mm^2.

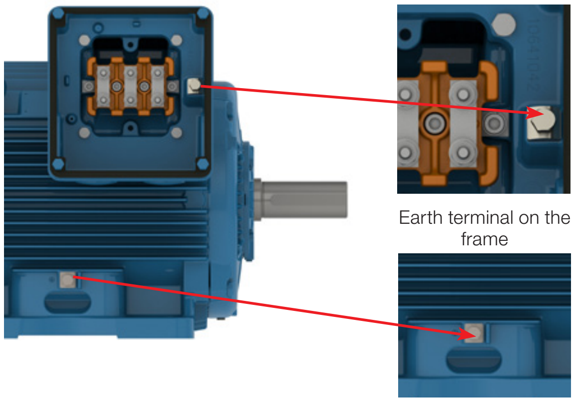


Figure 7 - Earth terminal inside the terminal box and on the frame

Optionally, an external earth terminal can be provided for motors in frame sizes 63 to 200, and, for frame sizes 80 to 355A/B a second external earth terminal as indicated in figure 8.

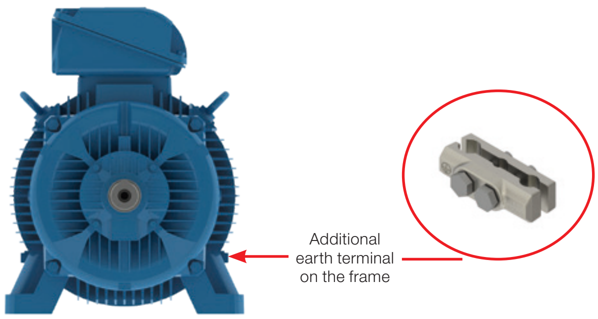


Figure 8 - Additional earth terminal position on the frame.

3.5 Terminal Box

The terminal box of W22 motors is produced in FC-200 (EN GJL 200) cast iron, which is the same material used for the frame and endshields. It is diagonally split for easier handling of leads and connections.
For the frame size range 63 to 200 the terminal box position is centralized on the motor frame and can be supplied in two configurations - top (standard) or left / right side (optional).
A motor with a side mounted terminal box (B3R or B3L) can have the terminal box position located on the opposite side through modification.
For frame sizes 225S/M to 355A/B the terminal box is positioned towards the drive end of the motor and on top as standard.
This arrangement allows improvement of the airflow over the cooling fins, thus reducing motor operating temperatures.

Terminal box position on either the left or right hand side of the motor is possible through the use of an adaptor (see figure 9).

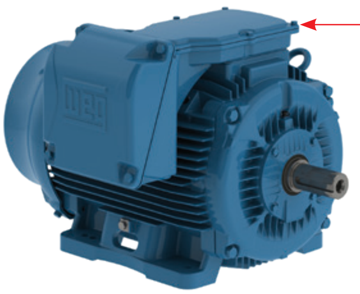


Figure 9 - Terminal box mounted on the left side viewing from drive end shaft

When supplied from the factory with a side mounted terminal box arrangement, this can be positioned on the opposite side simply by rotating the adaptor.
Similarly, by removing the adaptor and adjusting the length of the motor leads, the terminal box can be positioned on top of the motor.
The flexibility of terminal box positions on the W22 motor offered by the adaptor can be seen in figure 10.

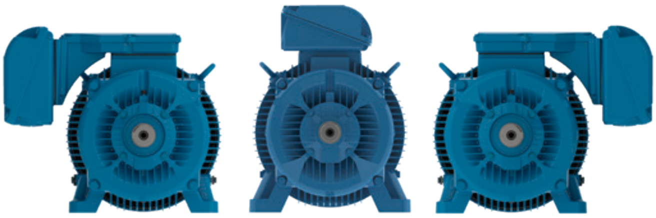


Figure 10 - Terminal box mounted on both sides and on top (versatility)

Conversely, factory supplied motors with the terminal box position on top can be modified to side mounting by fitting the adaptor and extending the motor leads.

Note: For all terminal box position modifications please contact WEG or your local WEG service centre.

For all frames, the terminal box can be rotated in 90° increments. Motors in IEC frame sizes 315L, 355M/L and 355A/B are supplied as standard with removable cast iron cable gland plates. As an option, the gland plates can be supplied undrilled.
Motors are supplied with plastic threaded plugs in the cable entries for protection against ingress of solid objects during transport.
In order to guarantee the degree of protection, cable glands must comply with at least the same degree of protection as that indicated on the motor nameplate. Lack of compliance with such detail can invalidate the motor warranty. If required, please contact the WEG Service Area for further advice.

3.6 Power Supply Connection Leads

Motor power supply leads are marked in accordance with IEC 60034-8 and are connected to a terminal block made from a polyester based resin BMC (Bulk Moulding Compound), duly reinforced with fibre glass (see figure 11).

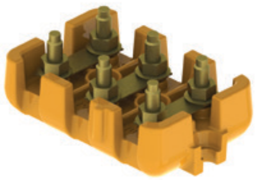


Figure 11 - BMC terminal block

Motors in frame size 355A/B are provided with a staggered terminal block arrangement, as indicated in figure 12.

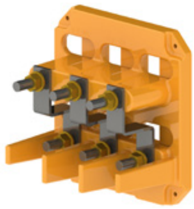


Figure 12 - 355A/B staggered terminal block

3.7 Accessory Connection Leads

Accessory terminals are assembled onto connectors whenever the motor is supplied with a terminal block. They may be assembled inside the main power terminal box or in a separate accessory terminal box (figure 13).
Whether the accessory terminals are assembled inside the main power or a separate terminal box, an M20x1,5 threaded hole is provided for fitting of cable glands for the incoming connection leads.
In the Terminal Box Drawings Section of this technical catalogue it is possible to check the permissible number of connectors which may be assembled inside the main power and accessory terminal boxes.

Figure 13 - Accessory terminal box attached to power terminal box

For all frame sizes, there is also the option of providing a dedicated terminal box for the connection of space heaters, or two separate accessory terminal boxes, as shown in figure 14.

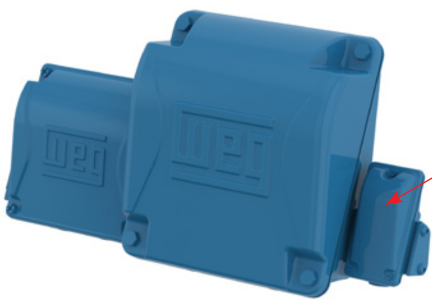


Figure 14 - Two accessory terminal boxes attached to power terminal box

3.8 Endshields

The drive end shield (figure 15) is designed with fins for improved thermal heat dissipation, to ensure lower bearing operating temperatures, resulting in extended lubrication intervals.

For the frames 225S/M to 355A/B, where ventilation is critical for thermal performance of the motor, the endshield fastening screws are located in such a way so as not to obstruct the airflow across any cooling fin, thus contributing to better thermal exchange.

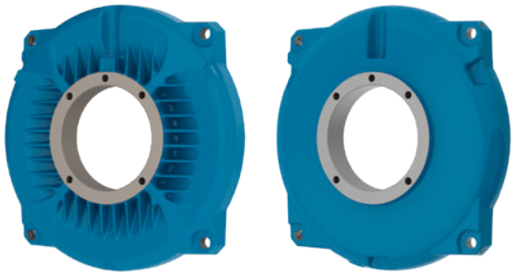
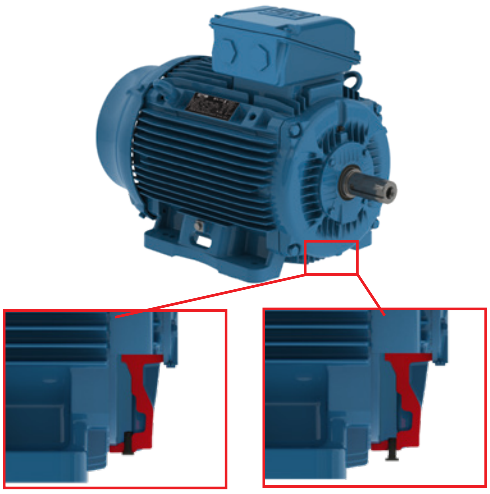


Figure 15 - Drive and non-drive endshields

3.9 Drains

The endshields have holes for drainage of any water that may condense inside of the frame. These holes are supplied with rubber drain plugs, as indicated in figure 16. Motors supplied with rubber drain, threaded drain or any other open/close drain plugs must be opened periodically to allow the exit of condensed water. For environments with high water condensation levels and motor with IP55 degree of protection, the drain plugs can be mounted in open position.



Drain plug closed *Drain plug open*

Figure 16 - Detail of the drain plug position on drive endshield.

3.10 Fan Cover

The fan cover is made of steel for frames 63 to 132 and FC-200 (EN GJL 200) cast iron for frames 160 to 355. The cast iron fan covers have an aerodynamic design, which results in a significant reduction in noise level and optimized airflow between frame fins for heat exchange improvement. Figure 17 shows the aerodynamic design of the cast iron fan cover.

Figure 17 - Fan cover

3.11 Nameplate

The nameplate details information relating to the construction and performance characteristics of the motor. It is also necessary to indicate on the nameplate the IE code and nominal efficiency of the motor at full load (and 3/4 and 1/2 load where space permits), as required by IEC 60034-30-1.

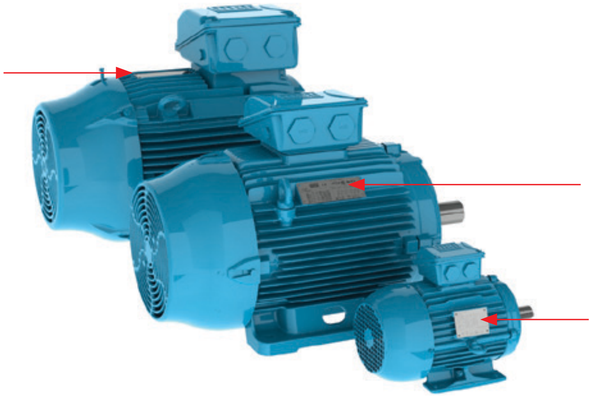


Figure 18 - Nameplate position of W22 motors

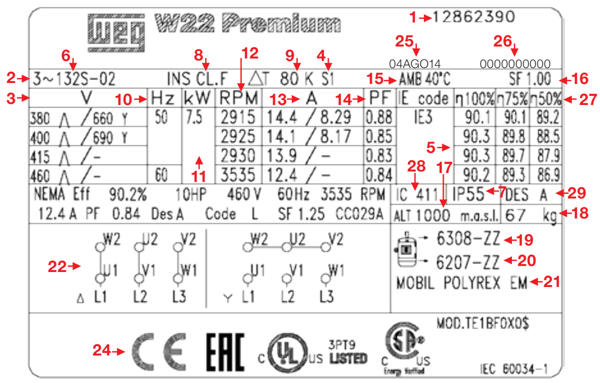


Figure 19 - Nameplate layout for frames 63 to 132

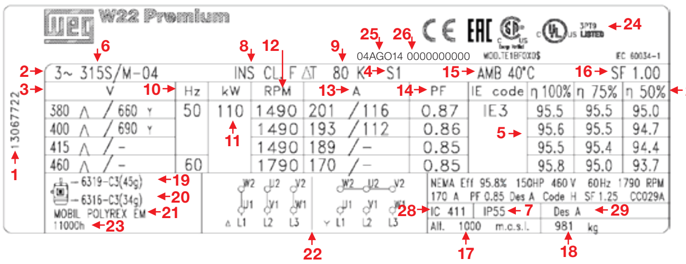


Figure 20 - Nameplate layout for frames 160 to 355

1 - Motor code
2 - Number of phases
3 - Rated operating voltage
4 - Service duty
5 - Efficiency Code - IE
6 - Frame size
7 - Degree of protection
8 - Insulation class
9 - Temperature rise
10 - Frequency
11 - Motor rated power
12 - Full load speed (rpm)
13 - Rated operating current
14 - Power factor
15 - Ambient temperature
16 - Service factor
17 - Altitude
18 - Motor weight
19 - Drive end bearing type and amount of grease (where applicable)
20 - Non-drive end bearing type and amount of grease (where applicable)
21 - Type of grease for bearings
22 - Connection diagram
23 - Relubrication intervals in hours
24 - Certification labels
25 - Manufacturing date
26 - Serial number
27 - Partial load efficiencies
28 - Cooling method
29 - Design

4. Cooling System and Noise Level / Vibration Level / Impact Resistance

4.1 Cooling System

The W22 standard motors are totally enclosed fan cooled (TEFC - IC 411), as per IEC 60034-6 (figure 21).
Non-ventilated versions (TENV - IC 410), air over (TEAO - IC 418) and motors with forced ventilation (TEBC - IC416) are available on request. Further information regarding the TEBC - IC 416 option can be found in Section 13 - Variable speed drive application.

Figure 21 - Cooling system

The cooling system (fan, non drive endshield and fan cover) is designed to minimize the noise level and improve thermal efficiency (figure 22).

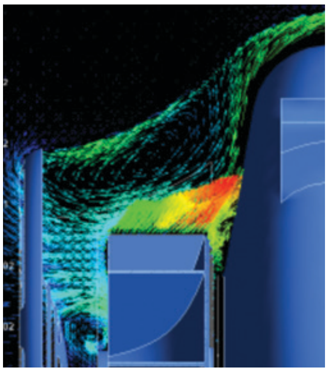


Figure 22 - Cooling system operation

4.2 Noise Level

W22 motors comply with IEC 60034-9 Standard and the corresponding sound pressure levels. Tables 4 and 5 show sound pressure levels in dB(A) which are obtained upon tests at 50 Hz and 60 Hz.

Frame	IEC 50 Hz Sound pressure level - dB(A) at 1 meter			
	2 poles	4 poles	6 poles	8 poles
63	52	44	43	-
71	56	43	43	41
80	59	44	43	42
90	64/ 62(*)	49	45	43
100	67	53	44	50
112	64	56	48	46
132	68/ 67(*)	60/ 56(*)	52	48
160	67	61	56	51
180	67	61	56	51
200	72/ 69(*)	65/ 63(*)	60	53
225	75/ 74(*)	66/ 63(*)	61	56
250	75/ 74(*)	66/ 64(*)	61	56
280	77	69	65	59
315S/M	77	71	67	61
315 L	78	74/ 73(*)	68	61
355M/L	80	76/ 74(*)	73	70
355A/B	83	76	73	70

(*) Values for IE3 and IE4 motors.

Table 4 - Sound pressure levels for 50 Hz motors

Frame	IEC 60 Hz Sound pressure level - dB(A) at 1 meter			
	2 poles	4 poles	6 poles	8 poles
63	56	48	47	-
71	60	47	47	45
80	62	48	47	46
90	68	51	49	47
100	71	54	48	54
112	69	58	52	50
132	72	61	55	52
160	72	64	59	54
180	72	64	59	54
200	76/ 74(*)	68/ 66(*)	62	56
225	80/ 79(*)	70/ 67(*)	64	60
250	80/ 79(*)	70/ 68(*)	64	60
280	81	73	69	63
315S/M	81	75	70	64
315L	82	79/ 77(*)	71	64
355M/L	84	81/ 78(*)	77	75
355A/B	89	81	77	75

(*) Values for IE3 and IE4 motors.

Table 5 - Sound pressure levels for 60 Hz motors

The noise level values shown in tables 4 and 5 are taken at 1 metre at no load. Under load the IEC 60034-9 Standard foresees an increase of the sound pressure levels as shown in table 6.

Frame (mm)	2 poles	4 poles	6 poles	8 poles
90 ≤ H ≤ 160	2	5	7	8
180 ≤ H ≤ 200	2	4	6	7
225 ≤ H ≤ 280	2	3	6	7
H = 315	2	3	5	6
355 ≤ H	2	2	4	5

Table 6 - Maximum expected increase of sound pressure level for loaded motors.

Note: These values refer to operating frequencies of 50 Hz and 60 Hz.
The overall noise level can be reduced by up to 2 dB (A) with the installation of a drip cover.

4.3 Vibration Level

Vibration of an electrical machine is closely related to its assembly on the application and, thus, it is generally desirable to perform vibration measurements under installation and operational conditions. However, to allow evaluation of the vibration generated by the electrical machine itself in a way to allow reproducibility of the tests and the obtaining of comparative measurements, it is necessary to perform such measurements with the machine uncoupled, under controlled test conditions. The test conditions and vibration limits described here are those found in IEC 60034-14.
The severity of vibration is the maximum value of vibration found among all the recommended measurement points and directions. Table 7, below, indicates the recommended admissible values of vibration severity under IEC standard 60034-14 for the frames IEC 56 to 400, for degrees of vibration A and B.
W22 motors (> frame 80, 2P and > frame 71, 4P and up) are dynamically balanced with half key and the standard version meets the vibration levels of Grade A (without special vibration requirements) described in IEC 60034-14 Standard. As an option, motors can be supplied in conformance with vibration of Grade B. The RMS speed and vibration levels in mm/s of Grades A and B are shown in table 7.

Vibration	Frame	56 ≤ H ≤ 132	132 < H ≤ 280	H > 280
	Assembly	Vibration speed RMS (mm/s)	Vibration speed RMS (mm/s)	Vibration speed RMS (mm/s)
Grade A	Free suspension	1,6	2,2	2,8
Grade B	Free suspension	0,7	1,1	1,8

Table 7 -Speed and vibration levels

4.4 Impact Resistance

The W22 motor complies with impact level IK08 (mechanical impact of 5J) as defined in EN 62262:2002 - Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code) - therefore ensuring superior mechanical strength for the most demanding applications.

5. Shaft / Bearings

5.1 Shaft

The shaft steel material for W22 standard motors is AISI 1040/45, in frames IEC 63 to 315S/M, and AISI 4140 for frames 315L, 355M/L and 355A/B. When supplied with roller bearings, the shaft material must be AISI 4140. Information regarding the maximum allowable radial and axial loads on shaft ends is given in tables 9, 10 and 11.
Important: when equipped with a roller bearing, it is necessary to lock the non-drive end bearing which obliges replacement of the non-drive end bearing cap.
Shafts of W22 motors are supplied with an open profile keyway, with a threaded centre hole, and can optionally be provided with a second shaft end. Dimensions of motor shafts can be found in Section 18 - Mechanical Data.
For highly corrosive environments, W22 motors may also be supplied with AISI 316 or AISI 420 stainless steel shafts.

Note: 2 pole motors will have as an option only the shaft end in stainless steel AISI 316.

5.2 Bearings

W22 motors are supplied with deep groove ball bearings as standard (figure 23). Optionally, for frame sizes 132 and above, NU series roller bearings can be fitted to motors intended for heavy duty applications where high radial loads may occur e.g. pulley and belt drives.

Figure 23 - Ball bearing view

The nominal bearing life L10h is 20.000 or 40.000 hours in conformance with maximum radial and axial loads as described in tables 9, 10 and 11. When direct coupled to the load (without axial or radial thrusts), the L10h bearing life can be extended to 50.000* hours.
** For regreasable motors. Other configurations contact WEG.*

In standard configuration, with ball bearings, the drive end bearing is locked axially from frame 160. To compensate for any axial movement the motors are fitted with pre-load washers for frames 63 to 200 and with pre-load springs for frames 225 to 355. When provided with roller bearings, the non-drive end bearing is locked and the axial movement is compensated by the axial play of the front roller bearing. Minimum and maximum admissible radial loads for roller bearings are shown in table 10 on page 16.
The lifetime of the bearing is dependent on its type and size,

the radial and axial mechanical loads it is submitted to, operating conditions (environment, temperature, mounting orientation), rotational speed and grease life. Therefore, bearing lifetime is closely related to its correct use, maintenance and lubrication. Respecting the quantity of grease and lubrication intervals allows bearings to reach the indicated lifetime. W22 motors in IEC frames 225S/M and above are provided as standard with grease fittings in each endshield to permit the relubrication of the bearings (optional for frames 90 to 200). The quantity of grease and lubrication intervals are stamped on the motor nameplate. The lubrication intervals are shown in tables 12 and 13 on page 17. It must be emphasized that excessive lubrication, i.e. a quantity of grease greater than that recommended on the motor nameplate, can result in the increase of bearing temperatures leading to reduced operating hours.

Note:
1. L10h lifetime means that at least 90% of the bearings submitted to the maximum indicated loads will reach the number of hours indicated. The maximum admissible radial and axial loads for the standard configuration are shown in tables 9, 10 and 11. The values of the maximum radial load consider axial load as nil. The values of the maximum axial load consider radial load as nil. For bearing lifetimes with combined axial and radial loads condition contact WEG.
2. The radial force value Fr usually results from information recommended in the catalogues of pulley / belt manufacturers.
When this information is not available, the force Fr, under operation, can be calculated based on the output power, on coupling design characteristics with pulleys and belts and on the type of application. So we have:

$$Fr = \frac{19{,}1 \times 10^6 \times P_n}{n_n \times dp} \times ka \text{ (N)}$$

Where:

Fr is the radial force caused by pulley and belt coupling [N];
Pn is the motor rated power [kW];
n_n is the motor rated speed per minute [rpm];
dp is the pitch diameter of the drive pulley [mm];
ka is a factor that depends on belt tension and type of application (table 8).

	Groups and basic types of application	ka factor of the application	
		V belts	Plane belts
1	Fans and blowers, centrifugal pumps, winding machines, compressors, machine tools with outputs up to 22 kW (30 HP)	2,0	3,1
2	Fans and blowers, centrifugal pumps, winding machines, compressors, machine tools with outputs higher than 22 kW (30 HP)	2,4	3,3
3	Presses, vibrating screens, piston and screw compressors, pulverisers, helicoidal conveyors, woodworking machines, textile machines, kneading machines, ceramic machines, pulp and paper industrial grinders (for all power range).	2,7	3,4
4	Overhead cranes, hammer mills, metal laminators, conveyors, gyratory crushers, jaw crushers, cone crushers, cage mills, ball mills, rubber mixers, mining machines, shredders (for all power range).	3,0	3,7

Table 8 - ka factor

Important:
1 - Special applications
Motor operation under adverse operating conditions, such as higher ambient temperatures and altitudes or abnormal axial / radial loads, may require specific lubrication measures and alternative relubrication intervals to those indicated in the tables provided within this technical catalogue.
2 - Roller bearings
Roller bearings require a minimum radial load so as to ensure correct operation. They are not recommended for direct coupling arrangements, or for use on 2 pole motors.
3 - Frequency inverter driven motors
Bearing life may be reduced when a motor is driven by a frequency drive at speeds above nominal. Speed itself is one of the factors taken into consideration when determining motor bearing life.
4 - Motors with modified mounting configurations
For motors supplied with horizontal mounting but working vertically, lubrication intervals must be reduced by half.
5 - Figures for radial thrusts
The figures given in the tables below for radial thrusts take into consideration the point upon which the load is applied, either at the centre of the shaft (L/2) or at the end of the shaft (L), figure 24.

Note: On motors with second shaft end, refer to WEG for details of the maximum permissible axial and radial loads.

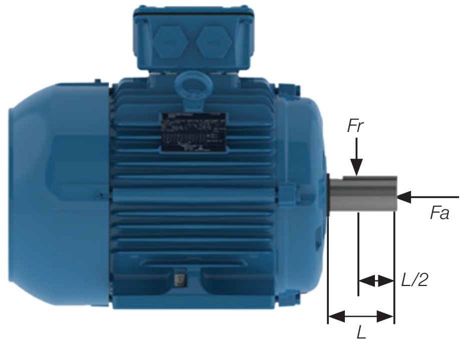


Figure 24 - Radial and axial thrust on motor shaft

5.2.1 Permissible Loads

Radial Thrust - Ball Bearings

Frame	Maximum permissible radial thrust - 50 Hz - Fr in (kN) 20.000 hours							
	2 poles		4 poles		6 poles		8 poles	
	L	L/2	L	L/2	L	L/2	L	L/2
63	0,3	0,4	0,3	0,4	0,3	0,4	0,3	0,4
71	0,5	0,5	0,5	0,6	0,5	0,6	0,6	0,7
80	0,6	0,6	0,7	0,7	0,7	0,8	0,8	1,0
90	0,6	0,7	0,7	0,8	0,8	0,9	0,9	1,0
100	0,9	1,0	1,0	1,1	1,2	1,3	1,3	1,4
112	1,2	1,3	1,4	1,5	1,6	1,8	1,7	1,9
132	1,8	2,0	2,2	2,4	2,4	2,7	2,6	2,9
160	2,3	2,6	2,6	2,9	2,7	3,3	2,7	3,7
180	3,1	3,5	3,6	4,0	4,2	4,7	4,2	5,2
200	3,7	4,0	4,2	4,7	4,9	5,4	5,7	6,2
225	5,1	5,5	5,2	6,3	5,3	7,0	5,7	8,1
250	4,9	5,3	5,2	5,7	6,5	7,1	6,0	8,2
280	5,0	5,4	6,7	7,2	7,8	8,4	8,7	9,4
315S/M	4,3	4,7	7,0	7,7	8,1	8,8	9,0	9,8
315L	4,6	5,0	4,0	7,3	6,2	8,2	9,1	9,8
355M/L	4,8	5,1	8,5	9,3	9,6	10,4	11,6	12,6
355A/B	4,5	4,7	5,1	7,4	7,4	8,0	6,9	10,6

Table 9.1 - Maximum permissible radial thrusts for ball bearings (horizontal mounting)

Radial Thrust - Ball Bearings

Maximum permissible radial thrust - 50 Hz - Fr in (kN) 40.000 hours								
Frame	2 poles		4 poles		6 poles		8 poles	
	L	L/2	L	L/2	L	L/2	L	L/2
63	0,2	0,2	0,3	0,3	0,3	0,4	0,3	0,4
71	0,3	0,3	0,4	0,4	0,5	0,5	0,5	0,6
80	0,5	0,5	0,5	0,6	0,6	0,6	0,7	0,7
90	0,5	0,5	0,5	0,6	0,6	0,7	0,7	0,8
100	0,7	0,7	0,7	0,8	0,9	1,0	1,0	1,1
112	0,9	1,0	1,0	1,1	1,2	1,4	1,3	1,4
132	1,4	1,6	1,6	1,8	1,8	2,0	2,0	2,2
160	1,8	2,0	1,9	2,1	2,2	2,4	2,5	2,7
180	2,4	2,7	2,7	3,0	3,2	3,5	3,6	3,9
200	2,8	3,0	3,2	3,5	3,7	4,0	4,3	4,7
225	3,9	4,3	4,3	4,7	4,7	5,2	5,6	6,2
250	3,7	4,1	3,8	4,2	4,9	5,4	5,7	6,3
280	3,8	4,1	4,9	5,4	5,8	6,3	6,5	7,0
315S/M	3,1	3,4	4,9	5,4	5,7	6,2	6,3	6,9
315L	3,4	3,6	4,0	4,9	5,1	5,5	6,4	6,9
355M/L	3,3	3,6	5,8	6,3	6,5	7,1	8,2	8,9
355A/B	3,0	3,2	4,1	4,4	4,2	4,5	5,3	6,8

Table 9.2 - Maximum permissible radial thrusts for ball bearings (horizontal mounting).

Radial Thrust - Roller Bearings

Maximum permissible radial thrust - 50 Hz - Fr in (kN) 40.000 hours						
Frame	4 poles		6 poles		8 poles	
	L/2	L	L/2	L	L/2	L
160	5,0	3,2	5,1	3,3	5,1	3,3
180	8,8	5,5	8,8	5,6	8,8	5,6
200	11,2	7,3	11,2	7,4	11,3	7,4
225S/M	12,9	7,6	12,9	7,6	13,0	7,8
250S/M	13,7	8,9	13,8	8,9	13,7	8,9
280S/M	19,3	12,6	19,4	12,8	19,6	12,9
315S/M	25,8	12,9	27,4	13,0	27,4	13,2
315L	21,5	10,1	20,1	9,4	26,1	12,2
355M/L	34,0	17,3	33,5	16,4	33,5	16,1
355A/B	31,4	14,9	25,4	12,0	28,4	13,5

Table 10 - Maximum permissible radial thrusts for roller bearings (horizontal mounting)

Note: the values given for roller bearings consider AISI 4140 steel shafts.

Axial Thrust - Ball Bearings

Maximum permissible axial thrust - 50 Hz - Fa in (kN) - 20.000 hours							
Frame	Poles	Horizontal		Vertical with shaft upwards		Vertical with shaft downwards	
		Pushing	Pulling	Pushing	Pulling	Pushing	Pulling
63	2	0,2	0,2	0,2	0,2	0,2	0,2
	4	0,3	0,3	0,3	0,3	0,3	0,3
	6	0,3	0,4	0,3	0,4	0,4	0,3
	8	0,3	0,4	0,3	0,4	0,4	0,3
71	2	0,2	0,3	0,2	0,3	0,2	0,3
	4	0,3	0,4	0,3	0,4	0,3	0,4
	6	0,4	0,5	0,4	0,5	0,4	0,5
	8	0,5	0,6	0,4	0,6	0,5	0,6
80	2	0,3	0,4	0,3	0,4	0,3	0,4
	4	0,4	0,6	0,3	0,6	0,4	0,5
	6	0,5	0,7	0,4	0,7	0,5	0,7
	8	0,6	0,8	0,5	0,9	0,6	0,8
90	2	0,4	0,4	0,3	0,5	0,4	0,4
	4	0,5	0,6	0,5	0,7	0,5	0,6
	6	0,6	0,7	0,6	0,8	0,6	0,7
	8	0,8	0,9	0,7	0,9	0,8	0,8
100	2	0,4	0,6	0,3	0,7	0,4	0,6
	4	0,5	0,8	0,4	0,9	0,5	0,8
	6	0,7	1	0,6	1,1	0,7	1
	8	0,8	1,2	0,7	1,3	0,8	1,1
112	2	0,5	0,8	0,5	0,9	0,6	0,7
	4	0,7	1,1	0,7	1,2	0,8	1
	6	1	1,4	0,9	1,5	1	1,3
	8	1,1	1,5	1	1,7	1,1	1,4
132	2	0,7	1,3	0,6	1,5	0,8	1,2
	4	1	1,8	0,8	2,1	1	1,7
	6	1,2	2,2	1,1	2,5	1,3	2,1
	8	1,4	2,5	1,2	2,8	1,4	2,3
160	2	2,4	1,7	0,2	2,1	2,8	1,5
	4	3	2,3	2,7	2,7	3,4	2
	6	3,4	2,7	3,1	3,3	4	2,4
	8	3,9	3,2	3,6	3,7	4,4	2,9
180	2	3,2	2,3	2,9	2,8	3,7	2
	4	3,9	3	3,6	3,7	4,6	2,7
	6	4,7	3,8	4,2	4,5	5,3	3,3
	8	5,2	4,4	4,8	5,1	6	3,9
200	2	3,6	2,6	3,1	3,3	4,3	2,1
	4	4,5	3,5	4	4,3	5,3	3
	6	5,2	4,2	4,7	5,1	6,1	3,7
	8	6	5	5,5	5,9	6,9	4,5
225	2	4,6	3,8	3,8	4,9	5,7	3,1
	4	5,8	5	5	6,3	7,1	4,2
	6	6,7	5,9	5,7	7,6	8,4	4,9
	8	7,8	7	6,9	8,5	9,3	6,1
250	2	4,5	3,7	3,7	4,9	5,6	3
	4	5,4	4,7	4,2	6,6	7,4	3,4
	6	6,8	6	5,4	8	8,8	4,6
	8	7,8	7,1	6,6	8,9	9,7	5,9
280	2	4,4	3,7	3,2	5,4	6,2	2,4
	4	6,3	5,5	4,6	8	8,8	3,9
	6	7,6	6,8	5,8	9,4	10,2	5
	8	8,5	7,8	6,6	10,6	11,4	5,8
315S/M	2	4,1	3,3	2,4	5,9	6,7	1,6
	4	6,8	6	4,3	10	10,7	3,5
	6	8	7,2	5,2	11,9	12,7	4,5
	8	9,1	8,3	6,2	13,2	14	5,5
315L	2	3	2,2	1,1	5	5,7	0,4
	4	4,5	3,7	1,4	8,2	8,9	0,6
	6	5,2	4,4	1,9	9,5	10,3	1,2
	8	6,3	5,5	3,4	10	10,8	2,6
355M/L	2	4,4	3,7	1,1	8,8	9,5	0,3
	4	7,7	7	3,2	13,9	14,7	2,5
	6	9,1	8,4	4,7	15,3	16	3,9
	8	10,9	10,2	6,4	17,2	17,9	5,7
355A/B	2	4,1	3,3	On request			
	4	6,8	6				
	6	7,8	7				
	8	9,8	9				

Table 11.1 - Maximum pemissible axial thrusts for ball bearings (horizontal mounting).

Axial Thrust - Ball Bearings

Maximum permissible axial thrust - 50 Hz - Fa in (kN) - 40.000 hours							
Frame	Poles	Horizontal		Vertical with shaft upwards		Vertical with shaft downwards	
		Pushing	Pulling	Pushing	Pulling	Pushing	Pulling
63	2	0,1	0,1	0,1	0,1	0,1	0,1
	4	0,2	0,2	0,2	0,2	0,2	0,2
	6	0,2	0,2	0,2	0,2	0,2	0,2
	8	0,2	0,2	0,2	0,2	0,2	0,2
71	2	0,1	0,2	0,1	0,2	0,1	0,2
	4	0,2	0,3	0,2	0,3	0,2	0,2
	6	0,2	0,3	0,2	0,3	0,2	0,3
	8	0,3	0,4	0,3	0,4	0,3	0,4
80	2	0,2	0,3	0,1	0,3	0,2	0,3
	4	0,2	0,4	0,2	0,4	0,2	0,3
	6	0,3	0,5	0,3	0,5	0,3	0,4
	8	0,4	0,6	0,3	0,6	0,4	0,5
90	2	0,2	0,3	0,2	0,3	0,2	0,2
	4	0,3	0,4	0,3	0,4	0,3	0,3
	6	0,4	0,5	0,4	0,5	0,4	0,4
	8	0,5	0,6	0,5	0,6	0,5	0,5
100	2	0,2	0,4	0,2	0,4	0,2	0,3
	4	0,3	0,5	0,2	0,6	0,3	0,5
	6	0,4	0,7	0,3	0,8	0,4	0,6
	8	0,5	0,8	0,4	0,9	0,5	0,7
112	2	0,3	0,5	0,3	0,6	0,3	0,4
	4	0,4	0,7	0,4	0,8	0,5	0,6
	6	0,6	0,9	0,5	1,1	0,6	0,8
	8	0,7	1	0,6	1,2	0,7	0,9
132	2	0,4	0,9	0,3	1,1	0,5	0,8
	4	0,6	1,2	0,5	1,4	0,6	1,1
	6	0,8	1,5	0,6	1,8	0,8	1,3
	8	0,9	1,7	0,7	2	0,9	1,5
160	2	1,8	1,1	1,6	1,5	2,2	0,9
	4	2,2	1,5	1,9	1,9	2,6	1,2
	6	2,5	1,8	2,2	2,3	3,1	1,5
	8	2,9	2,2	2,5	2,7	3,4	1,8
180	2	2,4	1,5	2,1	2	2,9	1,2
	4	2,9	2	2,5	2,6	3,5	1,6
	6	3,4	2,5	3	3,2	4,1	2,1
	8	3,9	3	3,5	3,7	4,6	2,6
200	2	2,7	1,7	2,2	2,4	3,4	1,2
	4	3,3	2,3	2,8	3,1	4,1	1,8
	6	3,8	2,8	3,3	3,8	4,8	2,3
	8	4,4	3,4	3,9	4,3	5,3	2,9
225	2	3,4	2,6	2,7	3,7	4,5	1,9
	4	4,2	3,5	3,4	4,7	5,5	2,6
	6	4,8	4	3,8	5,7	6,5	3
	8	5,7	4,9	4,8	6,4	7,1	4,1
250	2	3,4	2,5	2,5	3,7	4,5	1,8
	4	3,9	3,1	2,6	5	5,9	1,8
	6	4,9	4,1	3,6	6,2	7	2,8
	8	5,8	4,9	4,5	6,8	7,6	3,8
280	2	3,3	2,5	2	4,3	5,1	1,2
	4	4,6	3,8	2,9	6,2	7	2,1
	6	5,4	4,7	3,6	7,3	8	2,8
	8	6,1	5,4	4,2	8,2	9	3,4
315	2	2,9	2,2	1,2	4,8	5,5	0,4
	4	4,7	4	2,2	7,9	8,6	1,4
	6	5,6	4,8	2,8	9,4	10,2	2
	8	6,4	5,6	3,4	10,4	11,2	2,6
315L	2	3	2,2	1,1	5	5,7	0,4
	4	4,5	3,7	1,4	8,2	8,9	0,6
	6	5,2	4,4	1,9	9,5	10,3	1,2
	8	6,3	5,5	3,4	10	10,8	2,6
355M/L	2	3,1	2,4	0,6	6,7	7,5	0,2
	4	5,5	4,7	1,9	1,1	11,6	1,2
	6	6,3	5,6	2,8	11,8	12,7	2
	8	7,6	6,8	3,8	13,2	13,7	2,9
355A/B	2	2,9	2,2	On request			
	4	4,6	3,9				
	6	5,2	4,5				
	8	6,5	5,8				

Table 11.2 - Maximum permissible axial thrusts for ball bearings (horizontal mounting)

Lubrication Intervals (Ambient ≤ 40°C at Rated Speed)

Lubrication intervals (hours)			
Frame	Poles	50 Hz	60 Hz
160	2	25000	25000
	4		
	6		
	8		
180	2	25000	25000
	4		
	6		
	8		
200	2	25000	25000
	4		
	6		
	8		
225	2	5000	4000
	4	14000	12000
	6	20000	17000
	8	24000	20000
250	2	5000	4000
	4	14000	12000
	6	20000	17000
	8	24000	20000
280	2	5000	4000
	4	13000	10000
	6	18000	16000
	8	20000	20000
315	2	5000	4000
	4	11000	8000
	6	16000	13000
	8	20000	17000
355	2	5000	4000
		4000	On request
	4	9000	6000
	6	13000	11000
	8	19000	14000

Table 12 - Lubrication intervals for ball bearings (horizontal mounting).

Note: the amount of grease is indicated on the nameplate.

Lubrication intervals (hours)			
Frame	Poles	50 Hz	60 Hz
160	4	25000	25000
	6		
	8		
180	4	25000	25000
	6		
	8		
200	4	25000	21000
	6		25000
	8		
225	4	11000	9000
	6	16000	13000
	8	20000	19000
250	4	11000	9000
	6	16000	13000
	8	20000	19000
280	4	9000	7000
	6	14000	12000
	8	19000	17000
315	4	7000	5000
	6	12000	9000
	8	17000	15000
355	4	5000	4000
	6	9000	7000
	8	14000	13000

Table 13 - Lubrication intervals for roller bearings (horizontal mounting).

Note: the amount of grease is indicated on the nameplate.

5.2.2 Bearing Monitoring

W22 motors can, on request, be equipped with bearing temperature detectors to provide continuous monitoring of bearing operating conditions. Most commonly used is the Pt-100 temperature detector

This type of monitoring is extremely important considering that it directly affects the grease and bearing lives particularly on motors equipped with regreasing facilities.

6. Mounting Forms

Motors are supplied, as standard, in the B3T foot configuration, with the terminal box on top.

Figure 25 - B3T mounting

The mounting configuration for the W22 motor lines comply with IEC 60034-7 standard. Standard mounting forms and their variations are shown in table 14. After the designation, a characteristic letter is used to define the terminal box position. So, the mounting code IM B3 can be seen in WEG documents as detailed below (without IM code).

B3L - terminal box on left hand side of the motor frame
B3T - terminal box on top of the motor frame
B3R - terminal box on right hand side of the motor frame

Note: The terminal box position is defined viewing the motor from the shaft end. Mounting forms and their variations are indicated in table 14.

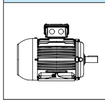
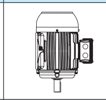
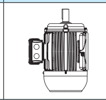
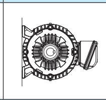
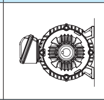
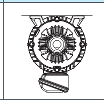
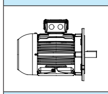
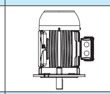
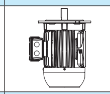
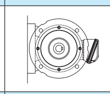
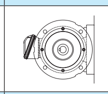
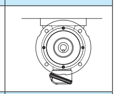
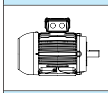
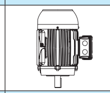
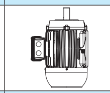
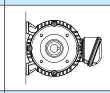
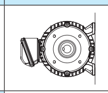
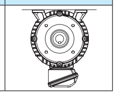
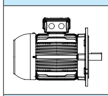
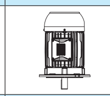
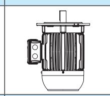
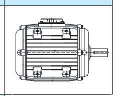
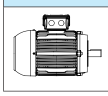
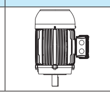
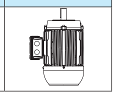
Basic mountings	Other type of mounting				
IM B3	IM V5	IM V6	IM B6	IM B7	IM B8
IM 1001	IM 1011	IM 1031	IM 1051	IM 1061	IM 1071
					
IM B35	IM V15	IM V36	- *)	- *)	- *)
IM 2001	IM 2011	IM 2031	IM 2051	IM 2061	IM 2071
					
IM B34	IM V17	IM V37	- *)	- *)	- *)
IM 2101	IM 2111	IM 2131	IM 2151	IM 2161	IM 2171
					
IM B5	IM V1	IM V3	IM B30		
IM 3001	IM 3011	IM 3031			
					
IM B14	IM V18	IM V19			
IM 3601	IM 3611	IM 3631			
					

Table 14 - Mountings configurations

** Non-defined mountings by IEC 60034-7.*

Important:

1. The mountings IM B34 and IM B14 with C-DIN flange, in accordance with standard EN 50347, are limited to frame size 132. As an option, C Flanges in accordance with NEMA MG 1 Part 4 standard are available for frames 63 to 355M/L.
2. For motors mounted vertically shaft down fitting of a drip cover / impact canopy is recommended to prevent ingress of small objects into the fan cover. The increase in total length of the motor with drip cover / impact canopy is shown in the Section 20.
3. For motors mounted vertically with shaft up and installed in environments containing liquids, the use of a rubber slinger is recommended to prevent the ingress of liquid into the motor through the shaft.

7. Degree of Protection / Sealing System / Painting

7.1 Degree of Protection

As per IEC 60034-5, the degree of protection of a rotating electrical machine consists of the letters IP (ingress protection), followed by two characteristic numerals, with the following definitions:

a) First characteristic numeral: refers to protection of persons against or approach to live parts and against contacts with moving parts (other than smooth rotating shafts and the like) inside the enclosure and protection of the machine against ingress of solid and foreign objects.

b) Second characteristic numeral: protection of machines against harmful effects due to ingress of water.

As standard, W22 motors have the degree of protection IP55. According to IEC 60034-5, this defines the degree of protection as follows:

a) First characteristic numeral 5: machine protected against dust. The enclosure is protected against contact with moving parts. Ingress of dust is not totally prevented, but dust does not enter in sufficient quantity to interfere with satisfactory operation of the machine.

b) Second characteristic numeral 5: Machine protected against water jets. Water projected by a nozzle against the machine from any direction shall have no harmful effect.

7.2 Sealing System

V-Ring seals are utilized on the shafts of W22 foot mounted motors in frame sizes 63 to 200. For frames 225S/M to 355A/B shaft sealing is provided using the exclusive WSeal®, which consists of a double lipped V-Ring with a metallic cap (see figure 26).
This configuration operates like a labyrinth preventing ingress of water and dust into the motor.

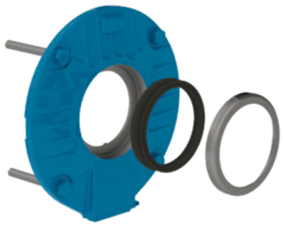


Figure 26 - WSeal®

Alternatively, W22 motors are available with other sealing arrangements, for example, oilseal, taconite labyrinth and the WEG exclusive W3 Seal® (see Section 16 - Optional features). When fitted with a flange, the recommended seal is either a lip seal (no contact with liquid) or oilseal (direct contact with liquid).

7.3 Painting

Figure 27 - WEG internal painting plan

The standard painting plans utilized on W22 motors meet the atmospheric corrosive category “C2” as indicated in the DIN EN ISO 12944-2 standard. They are designed for use on motors installed in normal environments, slightly severe, sheltered or non-sheltered, for industrial use, with low relative humidity, normal temperature variations and the presence of SO_2.
Motor frame sizes 63 to 132 utilize WEG internal painting plan 207A (semi-matt), which consists of:

Primer: One coat of red oxide, alkyd based primer, with minimum thickness of 20 μm.
Finishing: One coat of styrenated alkyd based synthetic enamel paint, with minimum thickness of 30 μm.
And, motors in frame sizes 160-355 utilise the WEG internal paint plan 203A (semi-gloss):

Primer: One coat of red oxide, alkyd based primer, with minimum dry coat thickness of 20 μm.

Finishing: One coat of alkyd based synthetic enamel paint, with minimum dry coat thickness of 40 μm.

Note:
These painting plans are not recommended for direct exposure to acid steam, alkalis, solvents and salty environments.
Alternative painting plans are available on request, which are suitable to guarantee additional protection in aggressive environments, either protected or unprotected (see section 16 - Optional features).

7.3.1 Tropicalized Painting

The integrity of the insulation system is the primary consideration when determining the lifetime of an electric motor. High humidity can result in premature deterioration of the insulation system, therefore for any ambient temperature with relative humidity above 95%, it is recommended to coat all internal components of the motor with an epoxy painting, also known as tropicalization.

8. Voltage / Frequency

As defined in IEC 60034-1 the combination of voltage and frequency variations are classified as Zone A or Zone B, as per figure 28.

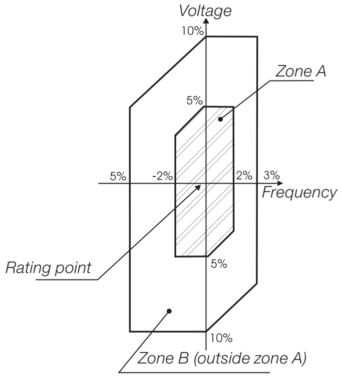


Figure 28 - Rated voltage and frequency limits for electric motors

IEC 60034-1 states that the motor must be suitable to perform its main function (supply torque) continuously within Zone A. However, this motor may not fully meet its performance characteristics due to power supply voltage and frequency variation, which can result in temperature rise above the rated value.
The motor must also be suitable to perform its main function (supply torque) at Zone B. However, the performance characteristic changes will be greater than those operating in Zone A. The temperature rise will also be higher than that at rated voltage and frequency and when operating within Zone A. Prolonged operation near the boundaries of Zone B is not recommended.

9. Overload Capacity

As per IEC 60034-1, motors having rated output not exceeding 315 kW and rated voltages not exceeding 1 kV shall be capable of withstanding a current equal to 1,5 times the rated current for not less than 2 minutes.

10. Ambient and Altitude

Unless otherwise specified, the rated outputs shown in the electrical data tables within this catalogue refer to continuous duty operation S1, as per IEC 60034-1 and under the following conditions:

- ambient temperature range -20 °C to +40 °C
- altitudes up to 1000 metres above sea level

For operating temperatures and altitudes differing from those above, the factors indicated in table 15 must be applied to the nominal motor power rating in order to determine the derated output (Pmax).

Pmax = Pnom x correction factor

T (°C)	Altitude (m)								
	1000	1500	2000	2500	3000	3500	4000	4500	5000
10							0,97	0,92	0,88
15						0,98	0,94	0,90	0,86
20					1,00	0,95	0,91	0,87	0,83
25				1,00	0,95	0,93	0,89	0,85	0,81
30			1,00	0,96	0,92	0,90	0,86	0,82	0,78
35		1,00	0,95	0,93	0,90	0,88	0,84	0,80	0,75
40	1,00	0,97	0,94	0,90	0,86	0,82	0,80	0,76	0,71
45	0,95	0,92	0,90	0,88	0,85	0,81	0,78	0,74	0,69
50	0,92	0,90	0,87	0,85	0,82	0,80	0,77	0,72	0,67
55	0,88	0,85	0,83	0,81	0,78	0,76	0,73	0,70	0,65
60	0,83	0,82	0,80	0,77	0,75	0,73	0,70	0,67	0,62
65	0,79	0,76	0,74	0,72	0,70	0,68	0,66	0,62	0,58
70	0,74	0,71	0,69	0,67	0,66	0,64	0,62	0,58	0,53
75	0,70	0,68	0,66	0,64	0,62	0,60	0,58	0,53	0,49
80	0,65	0,64	0,62	0,60	0,58	0,56	0,55	0,48	0,44

Table 15 - Correction factors for altitude and ambient temperature

11. Insulation & Temperature Rise

W22 motors are supplied with class F insulation and Class B (80 K) temperature rise at normal operating conditions (unless otherwise specified).

The difference between the temperature of the class F insulation (105 K) and the temperature rise of the design (80 K) means that, in practice, W22 motors are suitable to deliver outputs above the rated values up to a limit where the temperature rise reaches the temperature rise value of the insulation class.

The ratio between temperature rise and service factor is given by the equation below:

$$\Delta T_{FINAL} \cong (S.F.)^2 \times \Delta T_{INITIAL}$$

From the above calculation, we can conclude that the service factor is approximately 1.15. This reserve of temperature permits W22 motors with class B temperature rise (80 K) to operate continuously under the following conditions:

- Up to 15% above their rated output, considering 40 °C ambient temperature and 1000 m.a.s.l. or;
- At ambient temperatures up to 55°C or altitudes up to 3000 m.a.s.l. maintaining their nominal rated output.

Important: Please note that under these conditions the combined ambient and temperature rise may reach class F limits.

Table 16 shows the safety margins per thermal class.

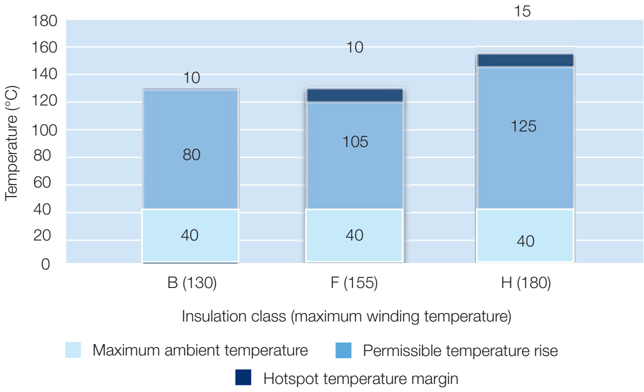


Table 16 - Safety margins per thermal class.

Bearing lubrication intervals will change under operating conditions other than 40 °C maximum ambient temperature and 1000 metres above sea level. Contact WEG for further information.

All W22 motors are wound with the WISE® insulation system which consists of enamelled wire impregnated with solvent free resin which protects motors at temperatures up to 200 °C. The WISE® system also permits motor operation with variable speed drives (see section 13).

11.1 Space Heaters

The use of space heaters is recommended in two situations:

- Motors installed in environments with relative air humidity up to 95%, in which the motor may remain idle for periods greater than 24 hours;
- Motors installed in environments with relative air humidity greater than 95%, regardless of the operating schedule. It should be highligthed that in this situation it is strongly recommended that an epoxy painting, more commonly known as tropicalization, is applied to the internal components of the motor. More information can be found in section 7.3.

The supply voltage for space heaters must be defined by the Customer. For all frame sizes, W22 motors can be provided with space heaters suitable for 110-127 V, 220-240 V and 380-480 V. As an option, dual voltage heaters of 110-127 / 220-240 V can be supplied for motor frame sizes 112 to 355A/B, through reconnection of the heater cables inside the terminal box.

The power rating and number of space heaters fitted depends on the size of the motor as indicated in table 17 below:

Frame	Quantities	Total power rated (W)
63 to 80	1	7,5
90 and 100	1	11
112	2	22
132 and 160	2	30
180 and 200	2	38
225 and 250	2	56
280 and 315	2	140
355	2	174

Table 17 - Power and quantity of space heaters

12. Motor Protections

Protections available for the W22 motor line can be classified as follows:

- Based on operating temperature
- Based on operating current

Refer to section 15 for further details of the standard and optional protection types available for W22 motors.

12.1 Protection Based on Operating Temperature

Continuous duty motors must be protected from overload either by a device integrated into the motor or via an independent protection system, usually a thermal relay with rated or setting current, equal to or below the value obtained when multiplying the power supply rated current (In), as per table 18.

Service factor	Relay setting current
1,0 up to 1,15	In x S.F.
≥ 1,15	(In x S.F.) - 5%

Table 18 - Relay setting current referred to service factor

12.1.1 Pt-100

Figure 29 - Pt-100

These are temperature detectors with operating principle based on the properties that some materials vary the electric resistance with the variation in temperature (usually platinum, nickel or copper). They are also fitted with calibrated resistances that vary linearly with temperature, allowing continuous reading of motor operating temperature through a monitoring display, with high precision rate and response sensitivity.

The same detector can serve as alarm (with operation above the regular operating temperature) and trip (usually set up for the maximum temperature of the insulation class).

12.1.2 Thermistor (PTC)

Figure 30 - Thermistor (PTC)

A thermistor is a non-linear resistance temperature detector, made from semi-conductor material. Each specific thermistor has its own unique resistance vs. temperature characteristic i.e. they have one pre-set, non-adjustable tripping point.

PTC (positive temperature coefficient) thermistors have a resistance that increases dramatically at its defined tripping temperature. This sudden variation in resistance blocks the PTC current which causes the output relay to operate and the main circuit to switch off.

Thermistors are compact, do not wear, and feature faster response times when compared to other types of thermal protectors, although they do not allow continuous monitoring of motor operating temperature.

Together with their electronic circuits, these thermistors provide full protection against overheating caused by overload, under or overvoltage or frequent reversing operations.

Where thermistor protection is required to provide both alarm and trip operation, it is necessary for each phase of the motor winding to be equipped with two sets of appropriately rated thermistors.

WEG Automation offers a range of electronic relays 'RPW' intended specifically to read the PTC signal and operate its output relay. For further information please visit the website www.weg.net.

12.1.3 Bimetallic Thermal Protectors

These are silver-contact thermal sensors, normally closed, that operate at certain temperature rise. When their operating temperature decreases, they return to their original position instantaneously, allowing the silver contact to close again.

The bimetallic thermal protectors are series-connected with the contactor coil, and can be used either as alarm or trip.

There are also other types of thermal protectors such as Pt-1000, KTY and thermocouples. Contact your local WEG office for further information.

12.2 Protection Based on Operating Current

Overloads are processes which usually see the temperature increase gradually. To overcome this problem, the thermal protectors described in item 12.1 are quite suitable. However, the only way to protect motors against short-circuit currents is the application of fuses. This type of protection depends directly on the motor current and is highly effective in cases of locked rotor.

WEG Automation supplies a range of fuses in versions D and NH. Visit the website www.weg.net for further information.

13. Variable Speed Drive Application

13.1 Considerations Regarding Voltage Spikes and the Insulation System

The stator windings of W22 motors are wound with class F insulation (class H optional) and are suitable for either DOL starting or via a variable speed drive. They incorporate the WEG exclusive insulation system - WISE® (WEG Insulation System Evolution) - which ensures superior electrical insulation characteristics.

The stator winding is suitable for variable speed drive application, taking into account the limits shown in table 19.

Motor rated voltage	Voltage Spikes 1) At motor terminals (phase-phase)	*dV/dt* 2) At motor terminals (phase-phase)	Rise time 2)	Time between pulses
$V_{rated} < 460$ V	≤ 1600 V	≤ 5200 V/µs	≥ 0,1 µs	≥ 6 µs
$460 \text{ V} \leq V_{rated} < 575$ V	≤ 2000 V	≤ 6500 V/µs		
$575 \text{ V} \leq V_{rated} \leq 1000$ V	≤ 2400 V	≤ 7800 V/µs		

1) Peak voltage in the case of unipolar pulses. Peak-to-peak voltage in the case of bipolar pulses.
2) dV/dt and Rise time definition according to Nema Std. MG1 - Part 30.

Table 19 - Supportability of random wound motors' insulation system.

Notes:

1 - If one or more of the above conditions is not respected, a filter (load reactor or dV/dt filter) must be installed in the output of the VSD.

2 - General purpose motors with rated voltage greater than 575 V, which at the time of purchase did not have any indication of operation with VSD, are able to withstand the electrical limits set in the table above for rated voltage up to 575 V. If such conditions are not fully satisfied, output filters must be used.
3 - General purpose motors of the dual voltage type, for example 400/690 V or 380/660 V, which at the time of purchase were not specified for VSD operation, , are permitted to be operated with the VSD at the higher voltage provided that the limits defined in the table above for rated voltage up to 460 V are fully respected. Otherwise, a load reactor or a dV/dt filter must be installed in the VSD output.

13.2 Influence of the VSD on the Motor Temperature

Motors operating with frequency inverters may present a higher temperature rise than when operating under sinusoidal supply. This occurs due to the combined effects of the loss increase resulting from the PWM harmonics and the reduction in ventilation experienced by self-ventilated motors when operating at low frequencies. There are basically three solutions to avoid excessive overheating of the motor in VSD applications:

- Torque derating (oversizing of the self-ventilated motor frame size);
- Forced ventilation (use of an independent cooling system);
- Optimal Flux Solution (exclusive to applications where both motor and drive are WEG).

13.2.1 Torque Derating Criteria

In order to maintain the temperature rise of WEG motors within acceptable levels, when supplied by VSD, the speed range-related loadability limits established in figures 31 (for operation under constant flux condition) or 32 (for operation under optimal flux condition) must be observed.

Notes:

1 - These derating curves relate to the motor thermal capability only and do not concern the insulation class. Speed regulation will depend on VSD mode of operation and proper adjustment.
2 - Torque derating is usually necessary when the motor is required to driveconstant torque loads (e.g. screw compressors, conveyors, extruders, etc.). For squared torque loads, such as pumps and fans, no torque derating is normally required.
3 - W22 motors in frame sizes 90S and above can be blower cooled (independently ventilated) under request. In such cases, the motor will be suitable for VSD operation without torque derating regardless the load type.
4 - For operation above base (nameplate) speed, mechanical issues must be also observed. Please refer to table 20 for the maximum limits for safe operation.

13.2.2 Constant Flux Condition

Applicable when the motor is supplied by any commercial drive operating with any control scheme other than the Optimal Flux available in WEG drives.

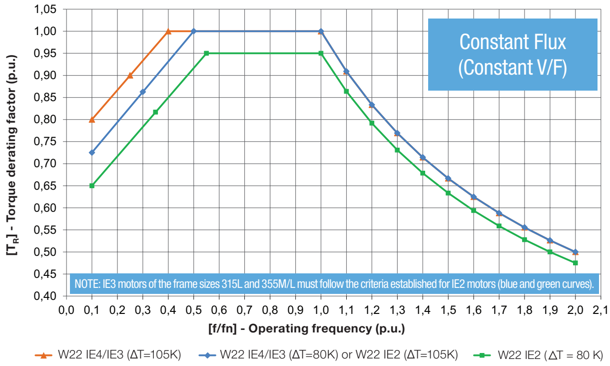


Figure 31 - Derating curves for constant flux condition

13.2.3 Optimal Flux Condition

The study of the composition of the overall motor losses and its relation to operation parameters such as the frequency, the magnetic flux, the current, and the speed variation led to the determination of an optimal flux value for each operating frequency. The implementation of this solution within the CFW-11 and CFW-700 control algorithms mean that the motor optimal flux condition can be automatically applied by the drive throughout the speed range, resulting in a continuous minimization of losses. As a consequence of this loss minimization, the use of the optimal flux control provides higher efficiency and lower temperature rise. Therefore, the torque derating factors for this operating condition are lower than for constant V/f, as shown in figure 32.

The optimal flux solution was developed for low frequency applications with constant torque loads. It should not be used for variable torque loads nor when the operating speed range includes points above the base (rated) frequency. The Optimal Flux Solution may be only applied under the following conditions:

- The motor has an efficiency class IE2 or above;
- The motor is controlled by a WEG drive (CFW-11 or CFW-700);
- Sensorless vector control is used.

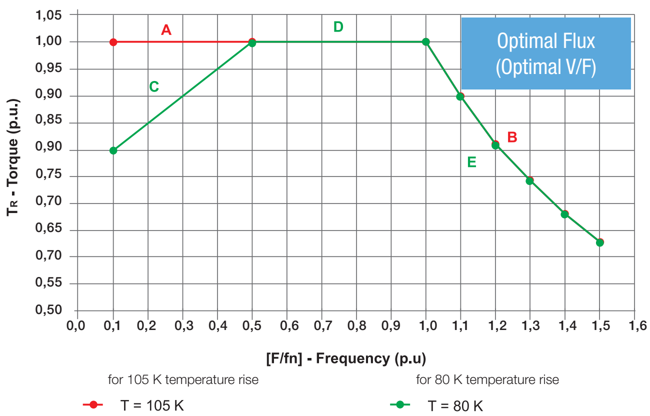


Figure 32 - Derating curves for Optimal Flux condition

Output (kW)	Maximum safe operating speeds (rpm) TEFC Motors		
	2 poles	4 poles	6 poles
0,18	7200	3600	2400
0,25	7200	3600	2400
0,37	7200	3600	2400
0,55	7200	3600	2400
0,75	7200	3600	2400
1,1	7200	3600	2400
1,5	7200	3600	2400
2,2	7200	3600	2400
4,0	7200	3600	2400
5,5	5400	3600	2400
7,5	5400	3600	2400
11	5400	3600	2400
15	5400	3600	2400
18,5	5400	2700	2400
22	5400	2700	2400
30	4500	2700	2400
37	4500	2700	2400
45	3600	2700	2400
55	3600	2700	2400
75	3600	2700	1800
90	3600	2700	1800
110	3600	2700	1800
150	3600	2250	1800
185	3600	2250	1800
220	3600	2250	1800
260	3600	1800	1800
300	3600	1800	-
330	3600	1800	-
370	3600	1800	-

Table 20 - Maximum safe operating speeds (rpm) for W22 motors driven by VSD

Notes:

1 - The values in table 20 are related to mechanical limitations. For operation above nameplate speed, the electrical limitations (motor torque capability) must be also observed.

2 - The limits established in table 20 are in accordance with the IEC 60034-1 Table 17.

3 - The permissible overspeed value is 10% above the limits given in Table 20 (not to exceed 2 minutes in duration) except where the maximum safe operating speed is the same as the synchronous speed at 60 Hz - in such case, please contact WEG.

4 - Operation above nameplate speed may require specially refined motor balancing. In such case, vibration and noise limits per IEC 60034-14 and IEC 60034-9, respectively, are not applicable.

5 - Bearing life will be affected by the length of time the motor is operated at various speeds.

6 - For speeds and ratings not covered by the table above, please contact WEG.

13.3 Considerations Regarding Bearing Currents

Motors for variable speed drive applications up to frame size 280S/M, do not generally require any special considerations with respects to the bearings. However, for frame sizes 315S/M upwards additional measures should be taken in order to avoid detrimental bearing currents. This can be accomplished by utilisation of an insulated bearing or insulated hub endshield and a shaft grounding brush mounted on the opposite side. W22 motors will normally be supplied duly protected per such recommendations when operation with VSD is specified at the time of purchase. Otherwise, WEG can modify motors that were not originally supplied with such protection under request.

13.4 Forced Ventilation

For those cases where an independent cooling system is required, W22 motors can be supplied with forced ventilation, as shown in figure 33.

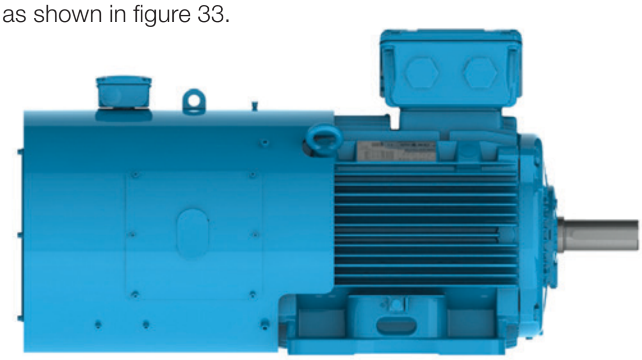


Figure 33 - Forced ventilation for W22 motors

When forced ventilation is assembled on the motor in the factory, the overall motor length will be increased, see Section 21. External Motor Dimensions with Forced Ventilation.
As a local stock modification option, an alternative forced ventilation kit can be fitted. Please contact your local WEG office for details of these dimensions.

13.5 Encoders

W22 motors may be supplied with encoders for speed control in closed loop. Encoders can be fitted to motors with either forced ventilation(TEBC) or with shaft mounted cooling fan (TEFC). When encoders are fitted, TEFC motors may not have a second shaft end or be fitted with drip cover.
The following models of encoder are available for supply:

- Dynapar - B58N - 1024ppr (hollow shaft)- frames 90 to 355
- Leine & Linde - XH861 - 1024ppr (hollow shaft)- frames 160 to 355
- Hengstler - RI58 - 1024ppr (hollow shaft) *
- Hubner Berlin - HOG 10 - 1024ppr (hollow shaft)*

*These models can be supplied on request.

Note: *The encoders described above have 1024 pulses per revolution. Optionally, models with 2048 pulses per revolution are available.*

For more information on VSD motor applications, visit our website (www.weg.net) and download the Technical Guide - Induction motors Fed by PWM (code 50029350).

14. Tolerances for Electrical Data

The following tolerances are permissible in accordance with IEC 60034-1:

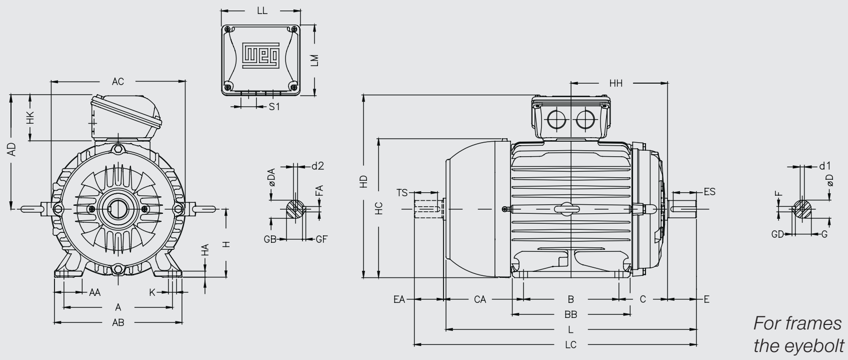
Efficiency (η)	-0,15 (1-η) for Pnom ≤ 150 kW / -0,1 (1-η) for Pnom > 150 kW Where η is a decimal number
Power factor	$\frac{1 - \cos \Phi}{6}$ Minimum 0,02 and Maximum 0,07
Slip	± 20% for Pnom ≥ 1 kW and ± 30 % for Pnom < 1 kW
Starting current	20% (without lower limit)
Starting torque	- 15% + 25%
Breakdown torque	- 10 %
Moment of inertia	± 10 %

Table 21 - Tolerances for electrical data

18. Mechanical Data

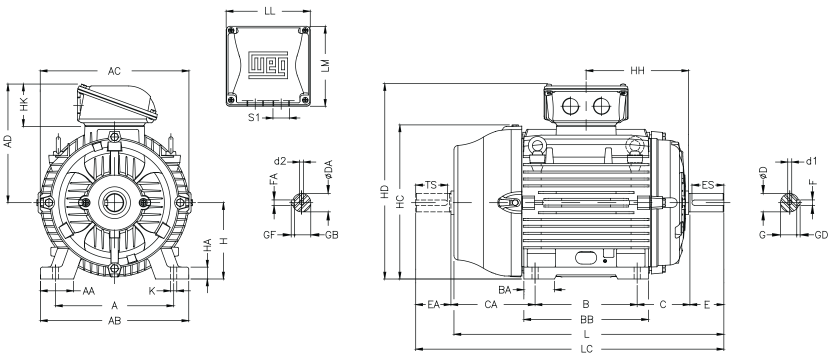
Foot Mounted Motors, Terminal Box Top

Frames 63 to L132M/L

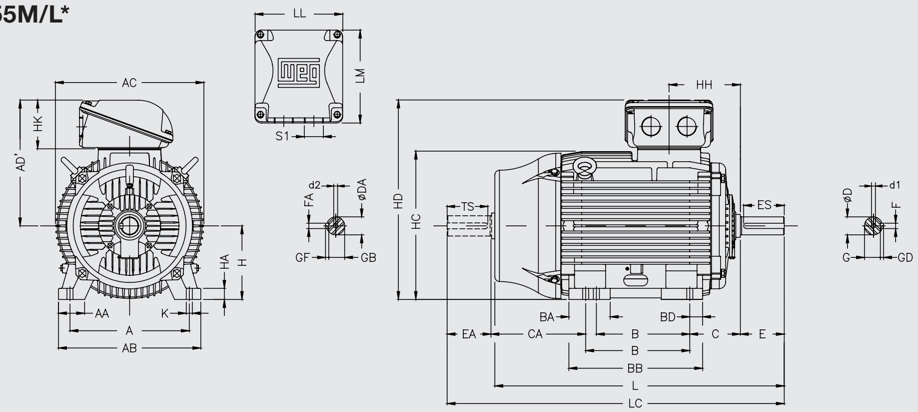


For frames 132S, 132M/L and 132M, the eyebolt will be fitted at 50°.

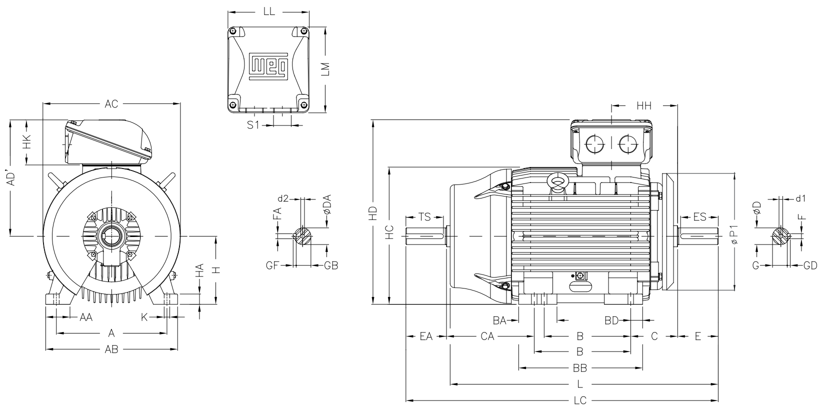
Frames 160M to 200L



Frames 225 to 355M/L*



Frame 355A/B*



** Some outputs in frame sizes 315 and 355 are equipped with an air deflector at the DE, in these cases, the dimension P1 will be 700 mm and 734 mm for frames 315 and 355 respectively.*

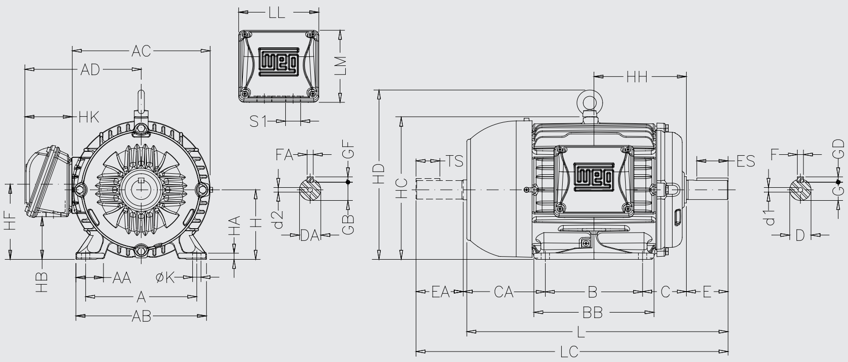
Frame	A	AA	AB	AC	AD	AD'	B	BA	BB	BD	C	CA	DE Shaft end						NDE Shaft end					
													D	E	ES	F	G	GD	DA	EA	FA	TS	GB	GF
63	100	25,5	116	125	123	-	80	-	95	-	40	78	11j6	23	14	4	8,5	4	9j6	20	3	12	7,2	3
71	112	28,5	132	141	131		90		113,5		45	88	14j6	30	18	5	11	5	11j6	23	4	14	8,5	4
80	125	30,5	149	159	140		100		125,5		50	93	19j6	40	28	6	15,5	6	14j6	30	5	18	11	5
L80												118												
90S	140	37	164	179	149				131		56	135	24j6	50	36	8	20	7	16j6	40		28	13	
L90S																								
90L							125		156															
L90L																								
100L	160	40	188	206	159		140		173		63	118	28j6	60	45		24		22j6	50	6	36	18,5	6
L100L												162												
112M	190	40,5	220	226	192				177		70	128							24j6		8		20	7
L112M												158												
132S	216	45,5	248	272	220				187		89	150	38k6	80	63	10	33	8	28j6	60		45	24	
L132S																								
132M							178		225															
132M/L							178/203		250															
L132M/L																								
160M	254	44	292	329	266		210	63	254		108	174	42k6	110	80	12	37	8	42k6	110	12	80	37	8
160L							254		298															
L160L																								
180M	279	57	329	360	281		241	-	294		121	200	48k6			14	42,5	9	48k6		14		42,5	9
L180M																								
180L							279		332															
L180L																								
200L	318	82	385	402	319		305	82	370		133	222	55m6			16	49	10						
225S/M*	356	80	436	455	-	384	286/311	124	412	41	149	319/294	55m6		100				55m6		16	100	49	10
225S/M													60m6	140	125	18	53	11	60m6	140	18	125	53	11
250S/M*	406	100	506	486		398	311/349	146	467	59	168	354/316	60m6				53	11	60m6					
250S/M													65m6				58							
280S/M*	457		557	599		472	368/419	151	517	49	190	385/334	65m6			18	58	11	60m6					
280S/M													75m6			20	67,5	12	65m6				58	
315S/M*	508	120	630	657		530	406/457	184	626	70	216	443/494	65m6	140	125	18	58	11	60m6				53	
315S/M													80m6	170	160	22	71	14	65m6				58	
315L*						576	508	219	752	81	216	502	65m6	140	125	18	58	11	60m6				53	
315L													80m6	170	160	22	71	14	65m6				58	
355M/L*	610	140	750	736		620	560/630	230	760	65	254	483/413	75m6	140	125	20	67,5	12	60m6				53	11
355M/L													100m6	210	200	28	90	16	80m6	170	22	160	71	14
355A/B*						728	710/800	325	965	70	254	528/438	75m6	140	125	20	67,5	12	60m6	140	18	125	53	11
355A/B													100m6	210	200	28	90	16	80m6	170	22	160	71	14

Frame	H	HA	HC	HD	HH	HK	L	LC	LL	LM	S1	K	D1	D2	Bearing	
															DE	NDE
63	63	7	130	186	80	59	216	241	108	98	2xM20x1,5	7	EM4	EM3	6201 ZZ	6201 ZZ
71	71		145	202	90		250	276					DM5	EM4	6202 ZZ	6202 ZZ
80	80	8	163	220	100		277	313				10	DM6	DM5	6204 ZZ	6203 ZZ
L80							301	338								
90S	90	9	182	239	106		305	350			2xM25x1,5		DM8	DM6	6205 ZZ	6204 ZZ
L90S							334	381								
90L					118,5		329	375								
L90L							360	406								
100L	100	10	203	259	133		376	431				12	DM10	DM8	6206 ZZ	6205 ZZ
L100L							414	475								
112M	112		226	304	140	80	394	448	140	133	2xM32x1,5				6207 ZZ	6206 ZZ
L112M							429	478								
132S	132	16	274	352	159		452	519					DM12	DM10	6308 ZZ	6207 ZZ
L132S							476	544								
132M					178		489	557								
132M/L					190,5		515	582								
L132M/L							538,5	607								
160M	160	17	331	426	213	101	598	712	198,5	190	2xM40x1,5	14,5	DM16	DM16	6309 ZZ-C3	6209 ZZ-C3
160L					235		642	756								
L160L							676	790								
180M	180	19	366	461	241,5		664	782							6311 ZZ-C3	6211 ZZ-C3
L180M							706	824							6311 C3	6211 Z-C3
180L					260,5		702	820							6311 ZZ-C3	6211 ZZ-C3
L180L							744	862								
200L	200	30	407	519	285,5	120	767	880	230	220	2xM50x1,5	18,5	DM20		6312 ZZ-C3	6212 ZZ-C3
225S/M*	225	34	453	609	212	153	856	974	269	285				DM20	6314 C3	6314 C3
225S/M							886	1034								
250S/M*	250	43	493	648	214	153	965	1113			2xM63x1,5	24				
250S/M																
280S/M*	280	42	580	752	266	152	1071	1223	314	312						
280S/M															6316 C3	6316 C3
315S/M*	315	48	644	845	264	176	1244	1392	379	382		28			6314 C3	6314 C3
315S/M							1274	1426							6319 C3	6316 C3
315L*				891	285	220	1355	1506	404	436					6314 C3	6314 C3
315L							1385	1536							6319 C3	6316 C3
355M/L*	355	50	723	975	339		1412	1577			2xM80x2		DM20		6316 C3	6314 C3
355M/L							1482	1677					DM24		6322 C3	6319 C3
355A/B*				1083	340	328	1607	1772	460	544			DM20		6316 C3	6314 C3
355A/B							1677	1872					DM24		6322 C3	6319 C3

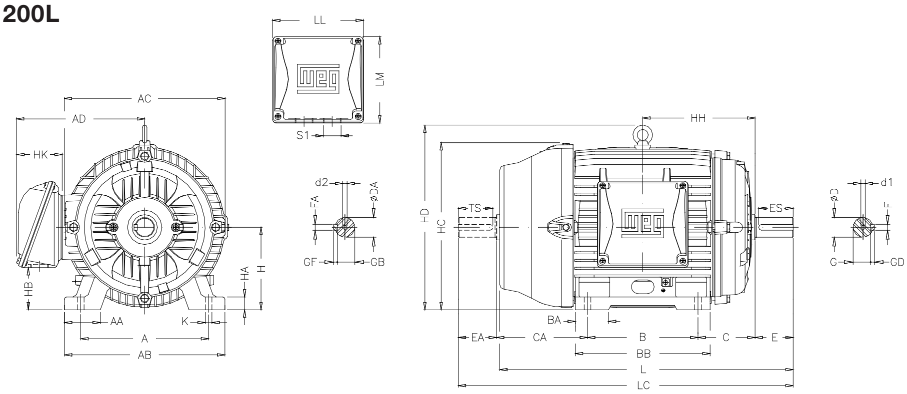
Notes:
(*) Dimension applicable to 2 pole motors.
(**) All dimensions are in mm.

Foot mounted motors, Terminal Box Left or Right Side

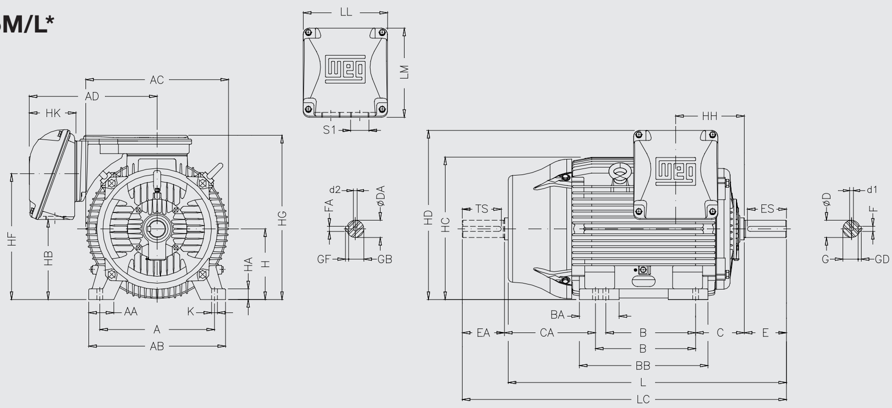
Frames 63 to 132M/L



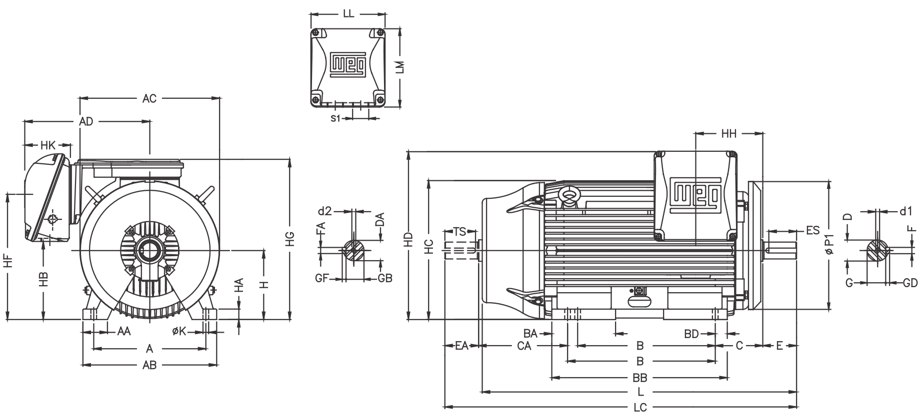
Frames 160M to 200L



Frames 225 to 355M/L*



Frame 355A/B*



** Some outputs in frame sizes 315 and 355 are equipped with an air deflector at the DE, in these cases, the dimension P1 will be 700 mm and 734 mm for frames 315 and 355 respectively.*

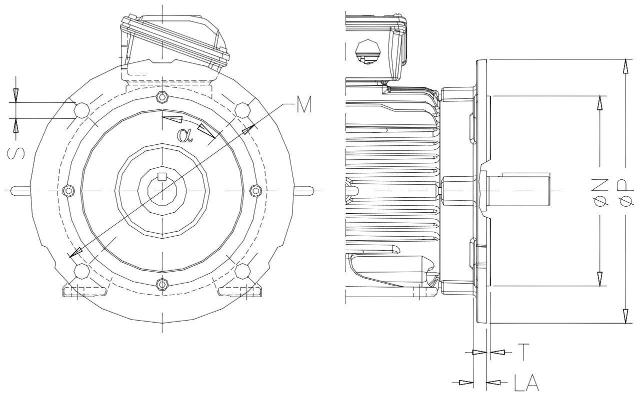
Frame	A	AA	AB	AC	AD	B	BA	BB	BD	C	CA	DE Shaft						NDE Shaft					
												D	E	ES	F	G	GD	DA	EA	TS	FA	GB	GF
63	100	25,5	116	125	123	80	-	95	-	40	78	11j6	23	14	4	8,5	4	9j6	20	12	3	7,2	3
71	112	28,5	132	141	131	90		113,5		45	88	14j6	30	18	5	11	5	11j6	23	14	4	8,5	4
80	125	30,5	149	159	140	100		125,5		50	93	19j6	40	28	6	15,5	6	14j6	30	18	5	11	5
L80											142												
90S	140	37	164	179	149			131		56	135	24j6	50	36	8	20	7	16j6	40	28		13	
L90S																							
90L						125		156															
L90L																							
100L	160	40	188	206	159	140		173		63	118	28j6	60	45		24		22j6	50	36	6	18,5	6
L100L											162												
112M	190	40,5	220	226	192			177		70	128							24j6			8	20	7
L112M											158												
132S	216	45,5	248	272	220			187		89	150	38k6	80	63	10	33	8	28j6	60	45		24	
L132S																							
132M						178		225															
132M/L						178/203		250															
L132M/L																							
160M	254	44	292	329	266	210	63	254		108	174	42k6	110	80	12	37		42k6	110	80	12	37	8
160L						254		298															
L160L																							
180M	279	57	329	360	281	241	-	294		121	200	48k6			14	42,5	9	48k6			14	42,5	9
L180M																							
180L						279		332															
L180L																							
200L	318	82	385	402	319	305	82	370		133	222	55m6			16	49	10						
225S/M*	356	80	436	455	410	286/311	124	412	41	149	319/294			100				55m6		100	16	49	10
225S/M												60m6	140	125	18	53	11	60m6	140	125	18	53	11
250S/M*	406	100	506	486		311/349	146	467	59	168	354/316								140	125	18		
250S/M												65m6				58							
280S/M*	457		557	599	445	368/419	151	517	49	190	385/334												
280S/M												75m6			20	67,5	12	65m6				58	
315S/M*	508	120	630	657	525	406/457	184	626	70	216	494/443	65m6		125	18	58	11	60m6				53	
315S/M												80m6	170	160	22	71	14	65m6				58	
315L*						508	219	752	81		443/494	65m6	140	125	18	58	11	60m6				53	
315L												80m6	170	160	22	71	14	65m6				58	
355M/L*	610	140	750	736	609	560/530	230	760	65	254	483/413	75m6	140	125	20	67,5	12	60m6	140	125	18	53	
355M/L												100m6	210	200	28	90	16	80m6	170	160	22	71	14
355A/B*					701	710/800	325	955	70		528/438	75m6	140	125	20	67,5	12	60m6	140	125	18	53	11
355A/B												100m6	210	200	28	90	16	80m6	170	160	22	71	14

Frame	H	HA	HB	HC	HD	HF	HG	HH	HK	LL	LM	K	L	LC	S1	d1	d2	Bearing	
																		DE	NDE
63	63	7	25,5	130	156,3	68,5	-	80	59	108	98	7	216	241	2xM20x1,5	EM4	EM3	6201 ZZ	6201 ZZ
71	71		33	145	163,8	76		90					250	276		DM5	EM4	6202 ZZ	6202 ZZ
80	80	8	43,5	163	174,3	87		100				10	277	313		DM6	DM4	6204 ZZ	6203 ZZ
L80													301	360					
90S	90	9	45	182	182,4	90		106					305	350	2xM25x1,5	DM8	DM6	6205 ZZ	6204 ZZ
L90S													334	381					
90L								118,5					329	375					
L90L													360	406					
100L	100	10	61,5	205	244	106,4		133				12	376	431		DM10	DM8	6206 ZZ	6205 ZZ
L100L													414	475					
112M	112		54,5	235	280	112		140	80	140	133		394	448	2xM32x1,5			6207 ZZ	6206 ZZ
L112M													429	478					
132S	132	16	75	274	319	132		159					452	519		DM12	DM10	6308 ZZ	6207 ZZ
L132S													476	544					
132M								178					489	557					
132M/L								190,5					515	582					
L132M/L													538,5	607					
160M	160	17	79	331	380	-		213	101	198,5	190	14,5	598	712	2xM40x1,5	DM16	DM16	6309 ZZ-C3	6209 ZZ-C3
160L								235					642	756					
L160L													676	790					
180M	180	19	92	366	413			241,5					664	782				6311 ZZ-C3	6211 ZZ-C3
L180M													706	824				6311 C3	6211 Z-C3
180L								260,5					702	820				6311 ZZ-C3	6211 ZZ-C3
L180L													744	862					
200L	200	30	119	407	464			285,5	119,5	230	220	18,5	767	880	2xM50x1,5	DM20		6312 ZZ-C3	6212 ZZ-C3
225S/M*	225	34	254	453	541	421	534	212	153	269	285		856	974			DM20	6314 C3	6314 C3
225S/M													886	1034					
250S/M*	250	43	297	493	583	463	577	214				24	965	1113	2xM63x1,5				
250S/M																			
280S/M*	280	42	386	580	700	572	686	266	152	314	312		1071	1223					
280S/M																		6316 C3	6316 C3
315S/M*	315	48		644	768	592	751	264	176	379	382	28	1244	1392				6314 C3	6314 C3
315S/M													1274	1426				6319 C3	6316 C3
315L*			336		774	575	760	285	220	404	436		1355	1506				6314 C3	6314 C3
315L													1385	1536				6319 C3	6316 C3
355M/L*	355	50	461	723	898	700	885	339					1412	1577	2xM80x2	DM20		6316 C3	6314 C3
355M/L													1482	1677		DM24		6322 C3	6319 C3
355A/B*			411		949			340	328	460	544		1607	1772		DM20		6316 C3	6314 C3
355A/B													1677	1872		DM24		6322 C3	6319 C3

Notes:
(*) Dimension applicable to 2 pole motors.
(**) All dimensions are in mm.

Flange Mounted Motors

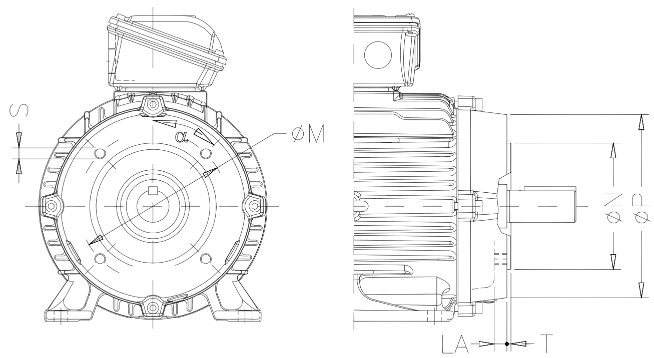
"FF" Flange



Frame	Flange	LA	M	N	P	S	T	α	N° of holes
63	FF-115	5,5	115	95	140	10	3	45°	4
71	FF-130	7	130	110	160		3,5		
80	FF-165	9	165	130	200	12			
90		10							
100	FF-215	12,5	215	180	250	15	4		
112									
132	FF-265	12	265	230	300				
160	FF-300	18	300	250	350	19	5		
180									
200	FF-350		350	300	400				
225	FF-400		400	350	450			22°30'	8
250	FF-500	20	500	450	550				
280		18							
280	FF-600	22	600	550	660/780*	24	6		
315S/M									
315L		16							
355	FF-740	22	740	680	800/880*				

**Only for motors fitted with air deflector in drive end side.*
*** Dimensions are in mm.*

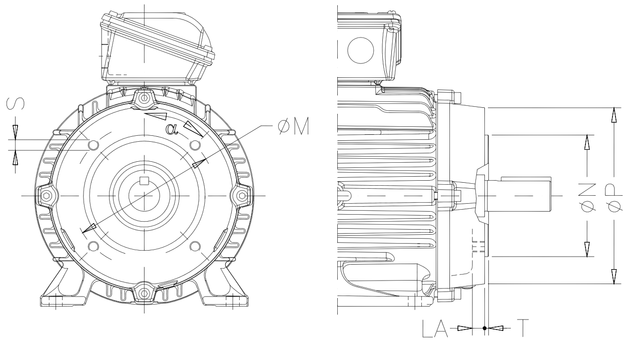
"C-DIN" Flange



Frame	Flange	LA	M	N	P	S	T	α	N° of holes
63	C-90	9,5	75	60	90	M5	2,5	45°	4
71	C-105	8	85	70	105	M6			
80	C-120	10,5	100	80	120		3		
90	C-140	10,5	115	95	140	M8			
100	C-160	12	130	110	160		3,5		
112		13,5							
132	C-200	15,5	165	130	200	M10			

** Dimensions are in mm.*

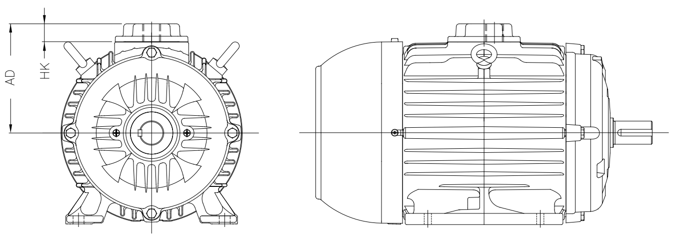
"NEMA C" Flange



Frame	Flange	LA	M	N	P	S	T	α	N° of holes
63	FC-95	4,5	95,2	76,2	143	UNC 1/4"x20	4	45°	4
71		10							
80									
90	FC-149	15	149,2	114,3	165	UNC 3/8"x16			
100		12							
112	FC-184	13,5	184,2	215,9	225	UNC 1/2"x13	6,3		
132		15,5							
160		26							
180	FC-228	20	228,6	266,7	280				
200									
225	FC-279	25	279,4	317,5	395	UNC 5/8"x11		22°30'	8
250	FC-355		355,6	406,4	455				
280									
315S/M	FC-368		368,3	419,1					
315L		18,5							
355M/L		40							
355A/B		33,5							

Dimensions are in mm.

Dimensions for motors with terminal box base

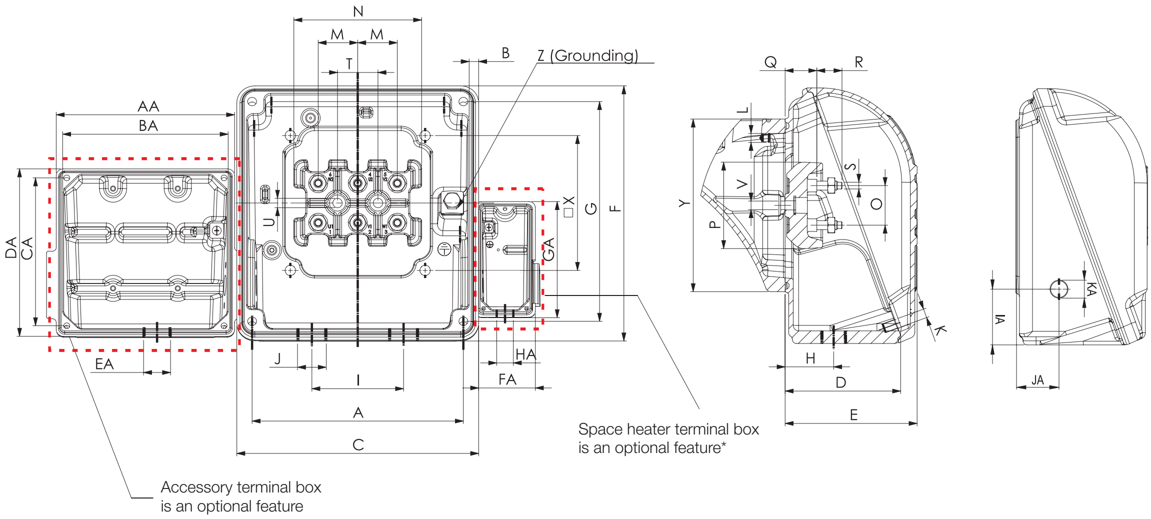


Frame	Threaded hole <= M20 or 1/2"		Threaded hole > M20 or 1/2"	
	HK	AD	HK	AD
63	40	106	40	106
71		114		114
80	20	103	30	113
90		113		123
100		123		133
112	25	140	45	160
132		168		188

The optional terminal box base is not available in B30D, B30E, and B30T mountings.

Dimensions are in mm.

19. Terminal Box Drawings



Frame	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
63	90	3,5	108	51,5	59	98	85	27	42	2xM20x1,5	M5x0,8	M5x0,8	16	75	16	35	13,5	12	M4x0,7	20	5,8
71																					
80																					
90										2xM25x1,5											
100																					
112	117	2,5	140	71	80	133	117	36,5	54	2xM32x1,5	M6x1,0	M6x1,0	23		23	52	17	16	M5x0,8	23	6,5
132																					
160	175	4	198,5	90	101	190	175	46	84	2xM40x1,5	M8x1,25	M8x1,25	28	90	28	60	21,5	20,5	M6x1	28	6,6
180																					
200	204	4,5	230	107	119,5	220	204	59	94	2xM50x1,5			35	112	35	74	24	24	M8x1,25	35	9,5
225S/M	235	12,5	269	133	153	285	260	71	110		M10x1,5	M10x1,5	44	140	44	94	28	28	M10x1,5	45	10,5
250S/M										2xM63x1,5											
280S/M	275	13,5	314		152	312	275		126		M12x1,75	M12x1,75	45	153	45	108	34	40	M12x1,75		
315S/M	340	14,5	379	162	176	382	345	78	160												
315L	365		404	202	220	436	390	97	200			M14x2,0	65	210	65	146	48	48	M16x2,0	65	
355M/L										2xM80x2											
355A/B	415	-	460	267	328	544	678	187	140		M10x1,5	M12x1,75	80	-	105	-	-	-		-	-

Frame	V	X	Y	Z	AA	BA	CA	DA	EA	FA	GA	HA	IA	JA	KA	Max number of connectors		
																Main	Accessories	Space heater
63	M5x0,8	56	77	0,5-6 mm²	109	90	85	98	M20x1,5	68	101,4	M20x1,5	23	17,5	M20x1,5	4	16	4
71			78															
80			81															
90			77										25	22,5				
100			81															
112		70	107	2-10 mm²									35	20		6		
132			103															
160	M6x1,0	110	140	5,2-25 mm²	139	117	117	133					47	40		15	26	
180																		
200	M8x1,25	120	155	5,2-35 mm²									47	45				
225S/M	M10x1,5	150	192	25-50 mm²							131,2		62	48				
250S/M			197															
280S/M			204	35-70 mm²									77	56				
315S/M		200	260										82	69				
315L		260	300	85-120 mm²									97	79				
355M/L																		
355A/B	4xM6x1,5	290											57	95				

Notes:
(*) Space heater terminal box is a special feature for frame sizes 63 to 112.
(**) Dimensions are in mm.

20. Drip Cover Data

Utilization of a drip cover / impact canopy increases the total length of the motor. The additional land length can be seen at table 22.

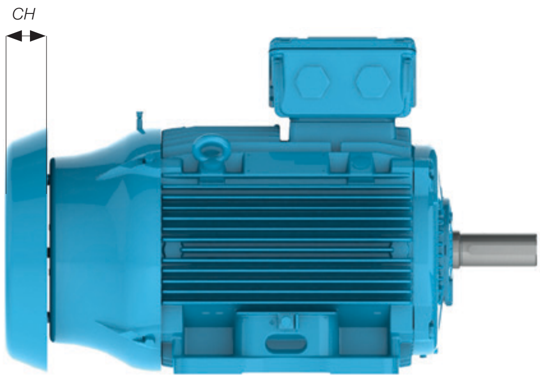


Figure 34 - Motor with drip cover

Frame	Dimension CH (increase motor length (mm))
63	18
71	
80	
90	
100	28
112	31
132	
160	47
180	57
200	67
225S/M	81
250S/M	
280S/M	91
315S/M	
315L	
355M/L	
355A/B	

Table 22 - Drip cover dimensions

21. External Motor Dimensions with Forced Ventilation

The use of forced ventilation increases the overall motor length, according to the table below.

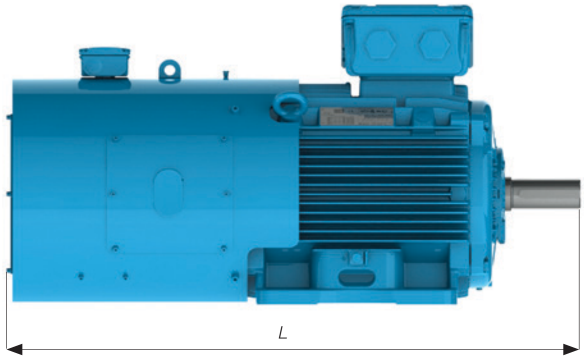


Figure 35 - Motor with forced ventilation

Frame size	Poles	Total motor length in mm (L)	
		Without forced ventilation	With forced ventilation
90S	All	304	548
L90S	All	335	579
90L	All	329	573
L90L	All	360	604
100L	All	376	646
L100L	All	418	690
112M	All	394	660
L112M	All	423	690
132S	All	452	715
132M	All	489	753
132M/L	All	515	778
160M	All	598	855
160L	All	642	899
180M	All	664	908
180L	All	702	946
200M	All	729	976
200L	All	767	1014
225S/M	2	856	1140
	4/8	886	1170
250S/M	2	965	1217
	4/8	965	1217
280S/M	2	1071	1348
	4/8	1071	1348
315S/M	2	1244	1459
	4/8	1274	1489
315L	2	1353	1568
	4/8	1389	1598
355M/L	2	1412	1786
	4/8	1482	1856
355A/B	2	1607	1981
	4/8	1677	2051

Table 23 - Forced ventilation dimensions

22. Silencer

The silencer for W22 motors reduces the noise level up to 5 dB(A), and it is available on 225 to 355 frames for foot-mounted and flange-mounted motors.
It is made of 2 mm steel or stainless steel plate and is internally covered by a sound absorbing material.
For foot-mounted the silencer fits loosely over the motor, and has a rubber strip to seal against the floor.

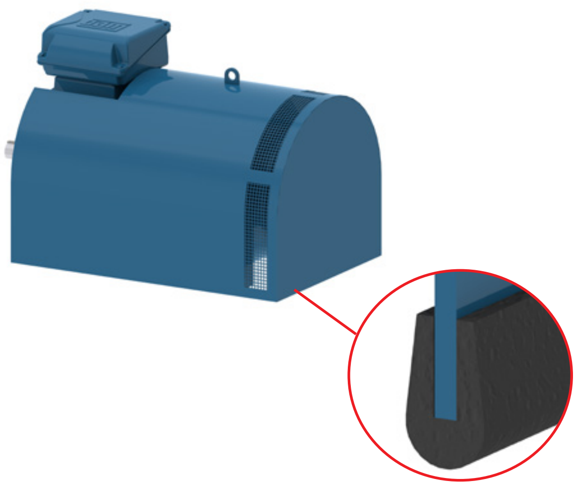
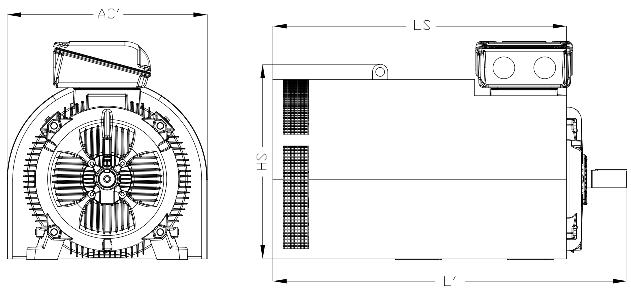


Figure 36 - Silencer for W22 motors.

Silencer dimensional



Frame	AC'	L'	LS	HS
225S/M	564	955*	760	567
		985		
250S/M	604	1065	830	612
280S/M	704	1205	950	687
315S/M	784	1387*	1150	762
		1417		
355M/L	854	1587*	1305	834
		1657		
355A/B	854	1782*	1500	834
		1852		

** Dimension for 2-pole motors.*
*** Dimensions are in mm.*

Table 24 - Silencer dimensional

23. Leveling screws and dowel pins

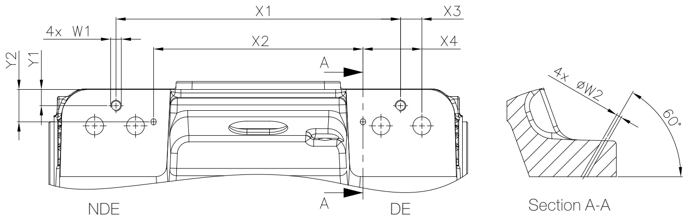


Figure 37 - Dimensions for motors with dowel pins and leveling screws

Frame	Threaded hole W1	Ø W2	X1	X2	X3	X4	Y1	Y2
160 M	M10x1,5	5	160	126	25	42	10	25
160 L	M10x1,5	5	204	170	25	42	10	25
180 M	M10x1,5	5	201	171	20	35	15	30
180 L	M10x1,5	5	239	209	20	35	15	30
200 M	M10x1,5	5	227	197	20	35	15	30
200 L	M10x1,5	5	265	235	20	35	15	30
225 S/M	M12x1,75	5	311	201	25	65	20	35
250 S/M	M12x1,75	5	349	219	25	65	20	35
280 S/M	M16x2,0	5	369	259	25	85	20	35
315 S/M	M16x2,0	5	457	281	50	100	30	50
315L	M16x2,0	5	508	361	50	115	30	50
355 M/L	M16x2,0	5	530	350	50	140	30	50
355 A/B	M16x2,0	5	710	545	50	140	30	50

** Dimensions are in mm.*

Table 25 - Dimensions for motors with dowel pins and leveling screws

24. Packaging

24.1 Frames 63 to 132

W22 motors in frames 63 to 132 are packaged in cardboard boxes (see figure 38), following the dimensions, weights and volumes of the tables 26 and 27.

Figure 38 - Cardboard box

Frame	External height (m)	External width (m)	External lenght (m)	Weight (kg)	Volume (m³)
63	0,26	0,21	0,30	0,2	0,02
71					
80	0,27	0,26	0,36	0,7	0,02
L80	0,32	0,27	0,43	0,9	0,04
90S					
90L					
L90S					
L90L					
100L	0,33	0,27	0,46	1,4	0,04
L100L					
112M	0,36	0,30	0,46	1,5	0,05
L112M	0,42	0,33	0,60	1,5	0,08
132S	0,42	0,33	0,60	1,7	0,08
132M					
132M/L					

Table 26 - Cardboard box dimensions, weights and volumes for top mounting.

Frame	External height (m)	External width (m)	External length (m)	Weight (kg)	Volume (m³)
63	0,20	0,24	0,28	0,2	0,01
71	0,20	0,28	0,30	0,2	0,01
80	0,21	0,28	0,36	0,7	0,02
L80	0,24	0,32	0,40	0,8	0,03
90S					
L90S					
90L					
L90L	0,26	0,34	0,43	1,0	0,04
100L	0,27	0,35	0,46	1,6	0,04
L100L	0,32	0,37	0,50	1,4	0,06
112M	0,31	0,38	0,46	1,7	0,05
L112M	0,31	0,38	0,53	1,5	0,06
132S	0,35	0,48	0,60	2,1	0,10
132M					
132M/L					

Note: Values to be added to the net motor weight.

Table 27 - Cardboard box dimensions, weights and volumes for side mounting.

24.2 Frames 160 to 355A/B

For frames 160 to 355A/B, the motors are packaged in wooden crates (see figure 39). Dimensions, weights and volumes are in tables 28 and 29.

Figure 39 - Wooden crates

Frame	External height (m)	External width (m)	External length (m)	Weight (kg)	Volume (m³)
160	0,50	0,40	0,74	9,2	0,15
180	0,53	0,43	0,82	12,3	0,19
200	0,59	0,51	0,88	13,5	0,27
225S/M	0,90	0,85	1,15	51,9	0,88
250S/M	0,90	0,85	1,25	54,6	0,96
280S/M	1,13	0,85	1,40	67,9	1,34
315S/M	1,13	0,85	1,55	69,9	1,49
315L	1,20	0,90	1,70	111	1,84
355M/L	1,32	1,05	1,73	127	2,40
355A/B	1,32	1,05	1,90	141	2,63

Table 28 - Wooden crates dimensions, weights and volumes for top mounting.

Frame	External height (m)	External width (m)	External length (m)	Weight (kg)	Volume (m³)
160	0,40	0,51	0,74	9,85	0,15
180	0,45	0,57	0,82	13,42	0,21
200	0,49	0,63	0,88	14,58	0,27
225S/M	0,78	0,85	1,15	47,70	0,76
250S/M	0,90	0,85	1,25	52,20	0,96
280S/M	0,95	0,95	1,40	71,60	1,26
315S/M	1,13	1,10	1,75	88,40	2,18
315L	1,10	1,12	1,70	138,37	2,10
355M/L	1,20	1,19	1,72	146,00	2,46
355A/B	1,20	1,19	1,90	163,00	2,71

Note: Values to be added to the net motor weight.

Table 29 - Wooden crates dimensions, weights and volumes for side mounting.

B&P ELEKTROMOTOREN BV

Expeditieweg 21
6657 KM Boven-Leeuwen

info@bnpelektromotoren.nl
+31 (0)344 616 267

BTW nr. **NL819113918B01**
KvK nr. **30237800**
ING Bank **NL60 INGB 0675 304 792**

B&P Elektromotoren

www.bnpelektromotoren.nl