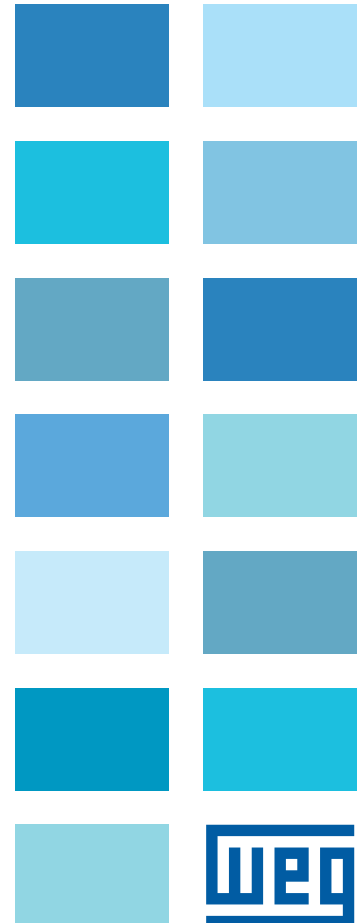
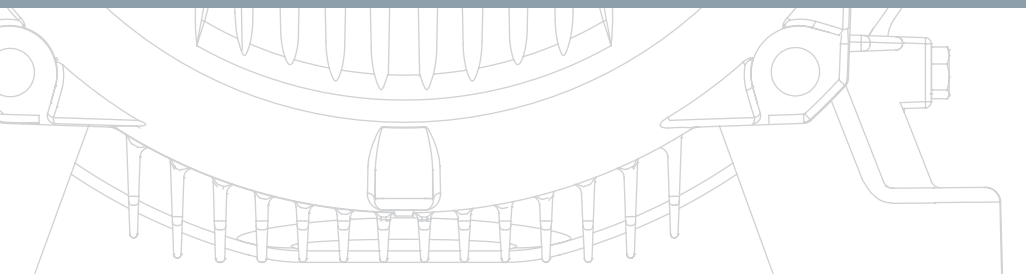
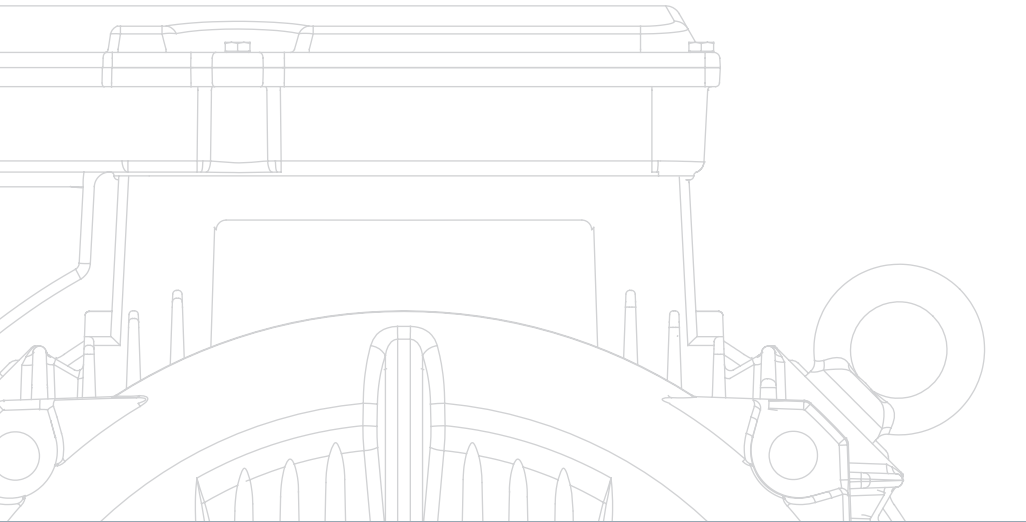


W40

Three-phase Electric
Open Drip Proof Motor
Frames NEMA 254 to 444/5T

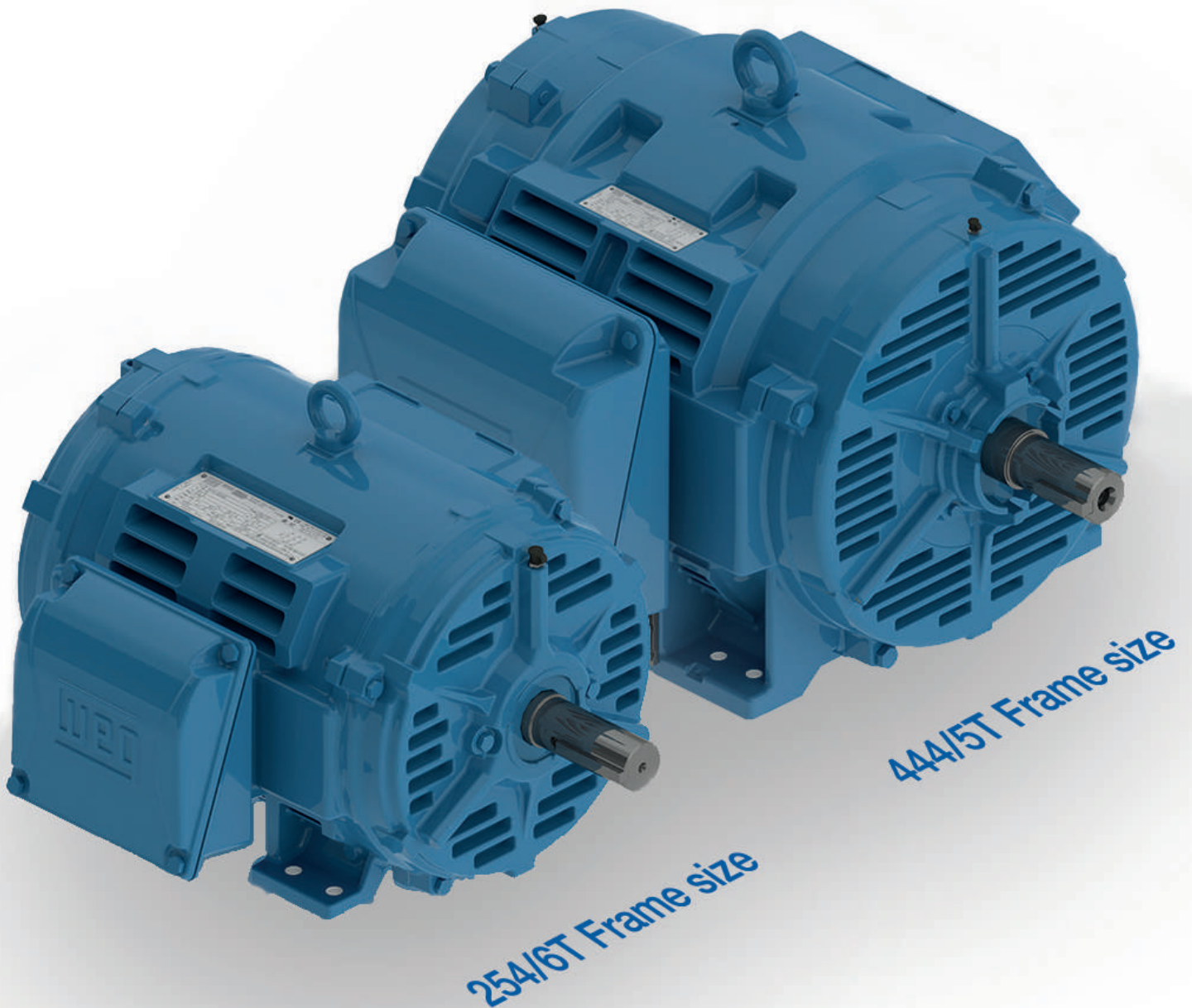
Technical Catalog
NEMA Market



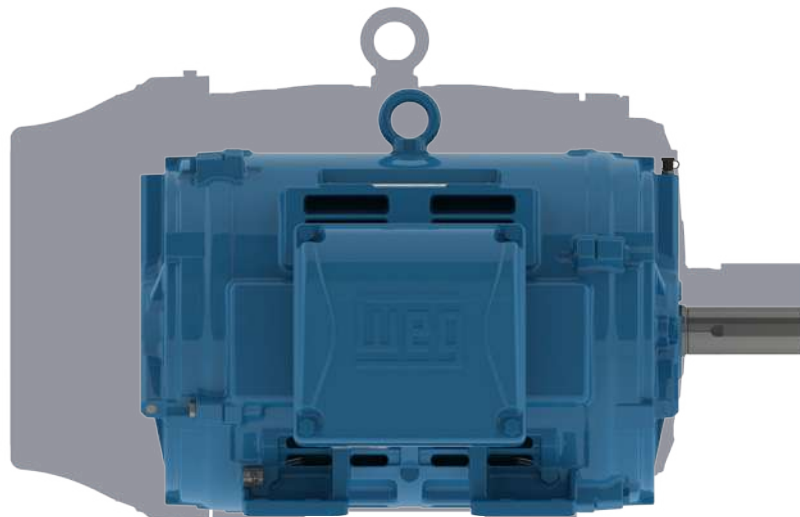
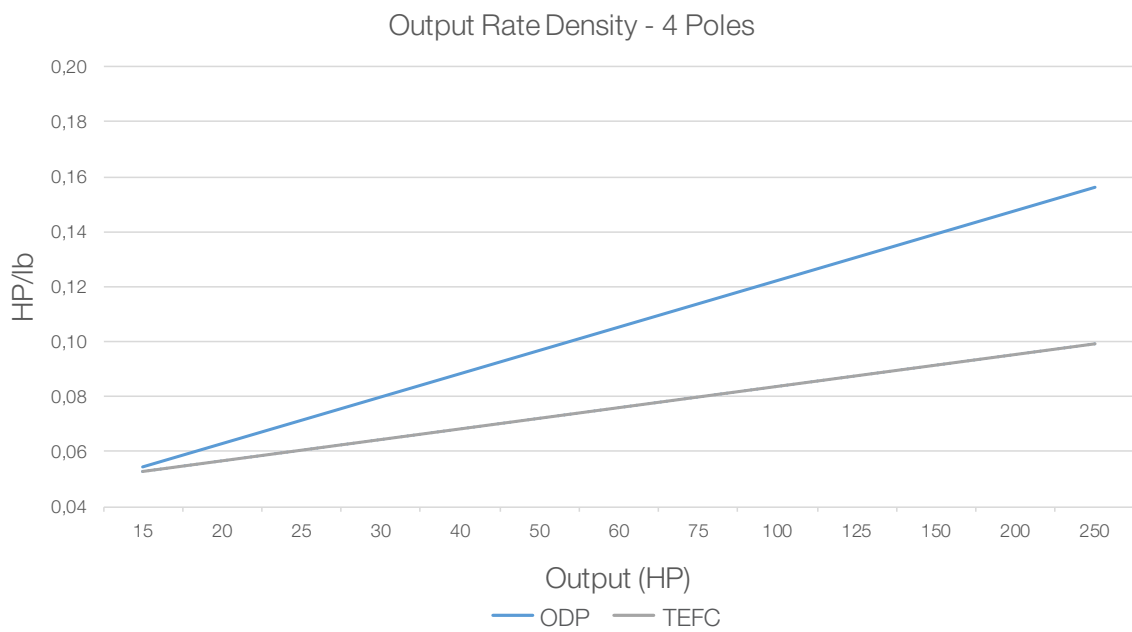
Compact and Light Solution for the Customer

W40 is a new platform of Open Drip Proof motors (ODP) designed for industrial application in order to have a compact and light solution for the customer. The platform covers NEMA frames from 254T up to 444/5T designed to meet the market requirements of optimized and rugged motors, complying with international standard dimensions, safety and performance requirements.

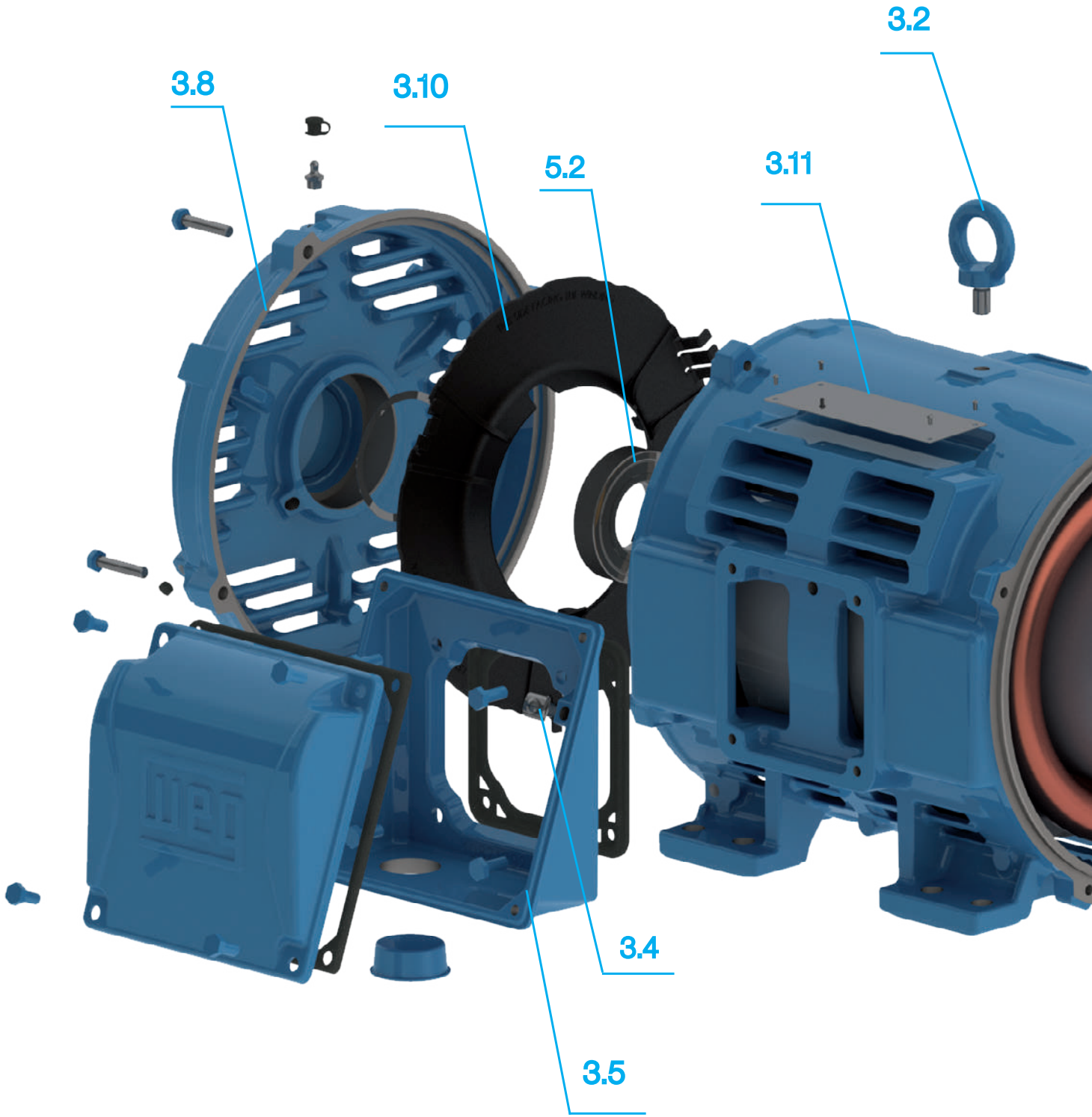
The design of W40 motors guarantees an optimized and rugged design with maximum reliability, ready for all application requirements. Below, are shown the concepts of W40 motors:



W40 motors have higher power density when compared with TEFC motors, as they deliver the same power with lighter motors at a downsized frame. Motor comparisons of TEFC vs. ODP are shown below:



Visual Index



3.1	Frame	Page 6
3.2	Eyebolts	Page 6
3.4	Grounding	Page 7
3.5	Terminal box	Page 7
3.8	Endshields	Page 8
3.10	Air baffles	Page 9
3.11	Nameplate	Page 9
5.1	Shaft	Page 11
5.2	Bearings	Page 11

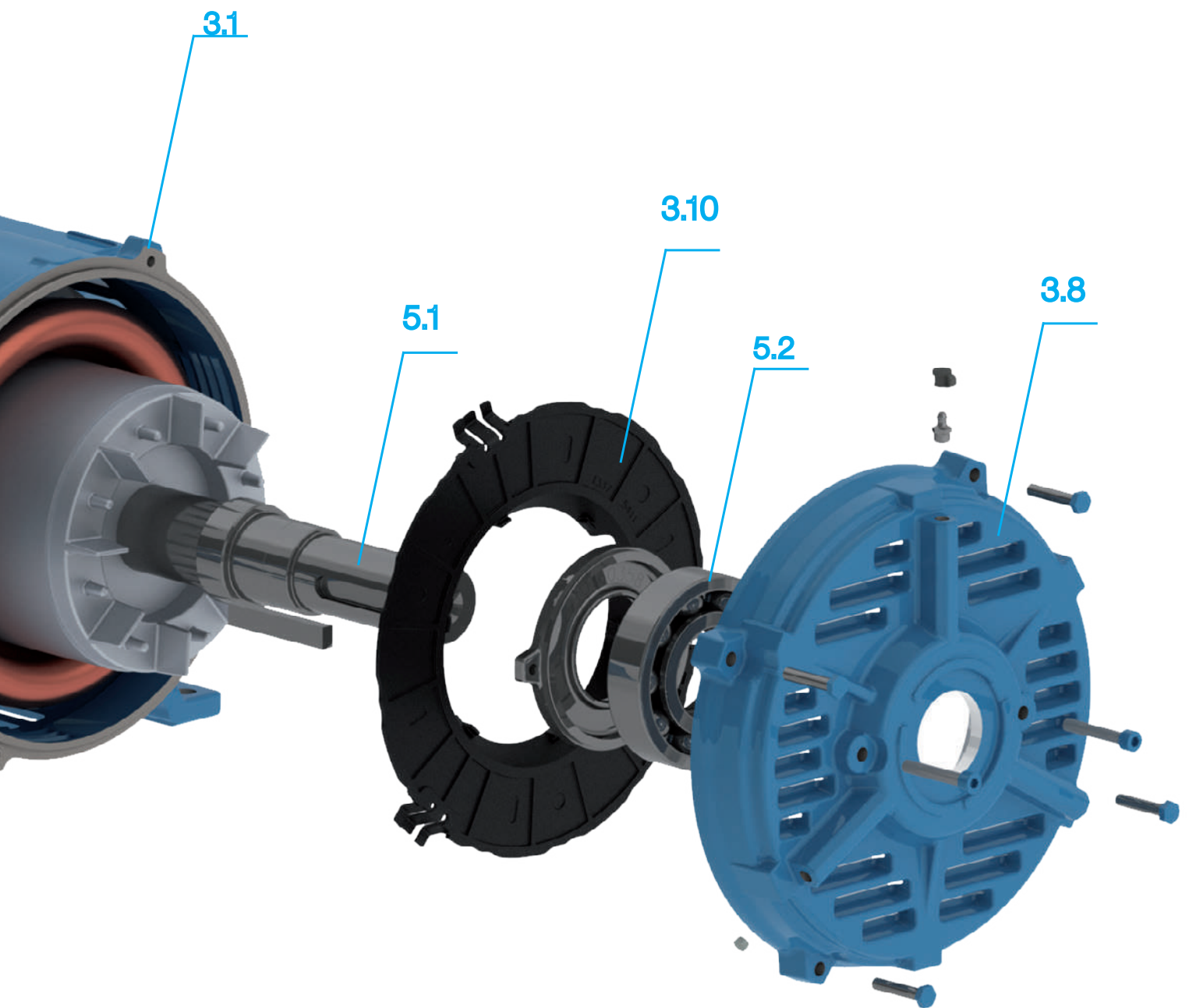
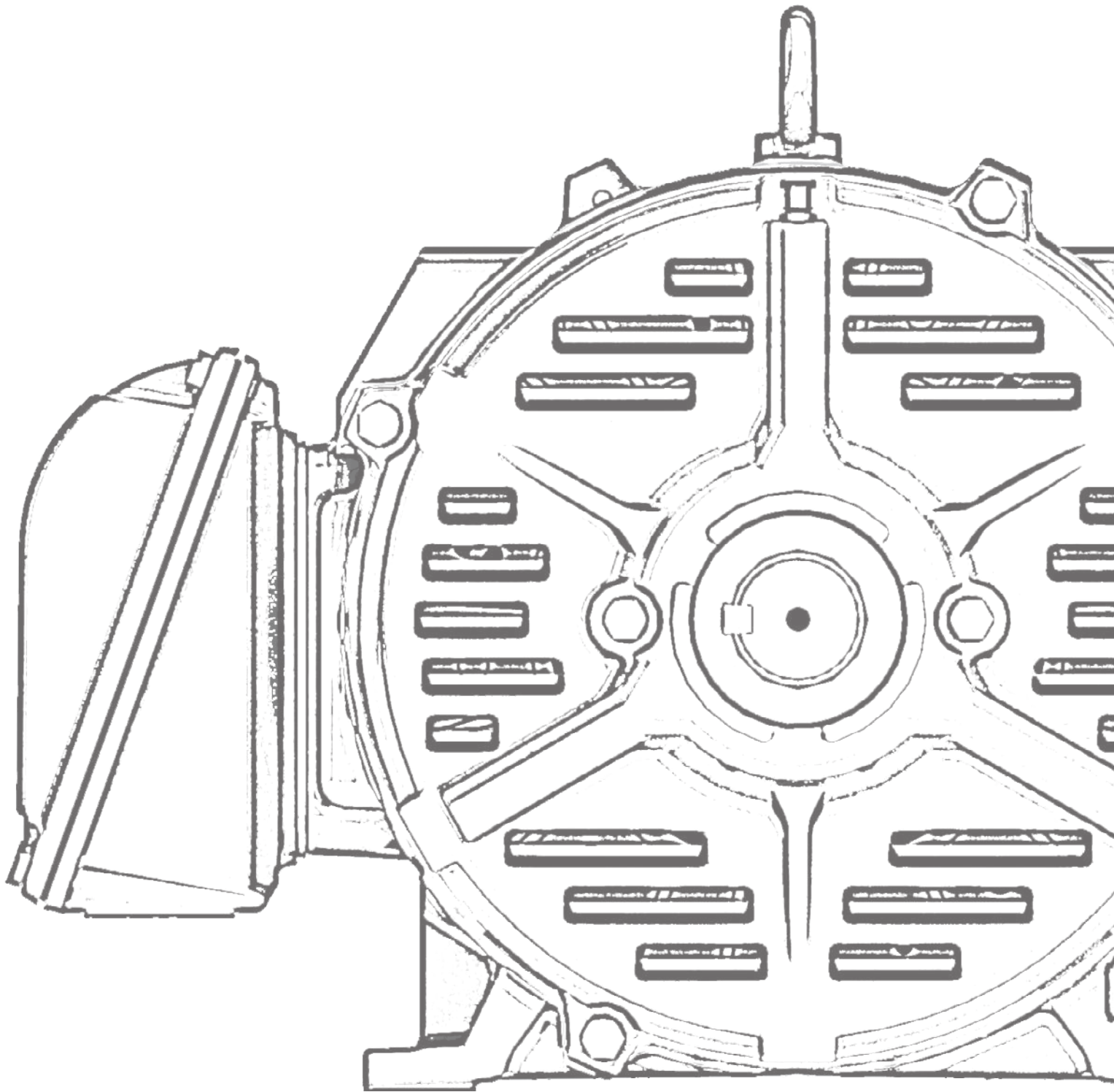


Table of Contents

1. Versions Available	08
2. Standards.....	08
3. Construction Details.....	08
3.1 Frame.....	08
3.2 Eyebolts	08
3.3 Points for Vibration Monitoring.....	09
3.4 Rodent Screen	09
3.5 Grounding	09
3.6 Terminal Box.....	09
3.7 Power Supply Connection Leads.....	09
3.8 Accessory Connection Leads	10
3.9 Endshields and Flanges	10
3.10 Nameplate	11
4. Cooling System / Noise Level / Vibration Level / Impact Resistance	12
4.1 Cooling System.....	12
4.2 Noise Level.....	12
4.3 Vibration Level.....	12
4.4 Impact Resistance	12
5. Shaft / Bearings.....	12
5.1 Shaft	12
5.2 Bearings.....	13
5.3 Permissible Loads.....	13
5.4 Bearing Monitoring	14
6. Mounting Forms	14
7. Degree of Protection and Safety Compliance / Painting	15
7.1 Degree of Protection and Safety Compliance	15
7.2 Painting.....	15
8. Voltage / Frequency.....	16
9. Ambient / Insulation	16
9.1 Space Heaters	16
10. Motor Protections.....	17
10.1 Protection Based on Operating Temperature.....	17
10.1.1 RTD.....	17
10.1.2 Thermistor (PTC)	17
10.1.3 Thermostats	17
10.2 Protection Based on Operating Current	17
11. Variable Speed Drive Application	18
11.1 Considerations Regarding Voltage Spikes and Insulation System.....	18
11.2 Torque Restrictions on Variable Speed Drive Applications	18
11.3 Considerations Regarding Bearing Currents.....	18
12. Construction Features	20
13. Optional Features.....	21
14. Electrical Data	22
15. Mechanical Data	25
16. Terminal Box Drawing	28
17. Packaging	28
18. Drip Cover Data	29
19. Distance from NDE to Wall	29
20. Spare Parts	30



1. Versions Available

W40 NEMA Motors are available in three versions: W40 High Efficiency, NEMA Premium Efficiency and NEMA Super Premium Efficiency. These versions are in accordance with the tables 12-11 and 12-12 from NEMA MG-1.

2. Standards

W40 motors meet the requirements and regulations of the latest version of the following Standards:

CSA C22.2 No. 100-04	Motor and Generators
CSA C390	Test Methods, Marking Requirements and Energy Efficiency Levels for Three-Phase Induction Motors
IEEE STD 112	IEEE Standard Test Procedure for Polyphase Induction Motors and Generators
NEMA MG-1	Motors and Generators
UL 1004-1	Rotating Electrical Machines - General Requirements

Table 1 - Standards

3. Construction Details

The information included in this document refers to standard construction features and the most common variations for W40 motors in low voltage for general applications in frame sizes from 254T up to 444/5T.

W40 motors for special and/or customized applications are available on request. For more information, please contact your WEG office or distributor.

3.1. Frame

W40 motor frame is manufactured in FC-200 gray cast iron. The frame (Figure 1) has solid feet reinforced with structural ribs linking it to the frame and internal ribs in order to guarantee high mechanical stiffness (Figure 2).

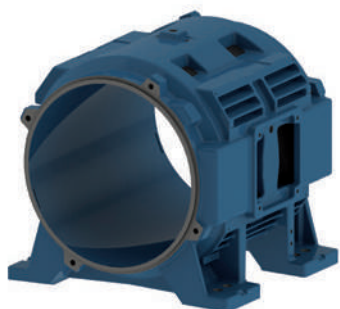


Figure 1 - W40 frame.

The frame feet were designed to facilitate the accommodation of tools and sockets during the assembly process, with a sufficient angle to apply the torque (Figure 3).

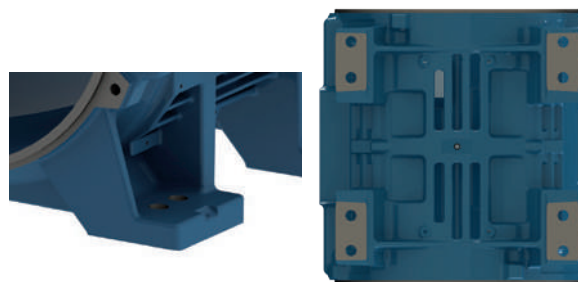


Figure 2 - Solid feet.



Figure 3 - Accommodation of tools to assembly.

The W40 frame is symmetric for easy conversion between F-1 and F-2 mountings as shown in Figure 4.

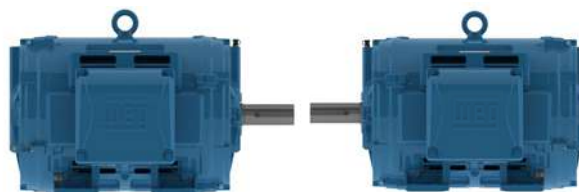


Figure 4 - F1 and F2 mountings.

The inversion process can be done by removing the endshields and swapping DE and NDE after rotating the frame. It is necessary to pay attention to the rotation direction, as they are all bidirectional motors, and the standard phase sequence is reversed when the rotor is reversed in the frame. Standard direction of rotation sequence is CW facing drive end T1-L1, T2-L2, T3-L3.

Note: For all modifications please contact WEG or your local WEG service center.

3.2. Eyebolts

The position of the eyebolts facilitates the motor moving and provides a better distribution of the motor weight. For horizontal motors, the lifting is made with one eyebolt for F-1 and F-2 mountings.



Figure 5 - Motor lifting for horizontal mountings with lateral terminal box.

3.3. Points for Vibration Monitoring

To allow easy maintenance, specifically for vibration testing, the frames are designed with flat areas for better placement of the accelerometer (Figure 6).

These areas are available both in vertical and horizontal planes. Threaded holes for nipples can be supplied under request.

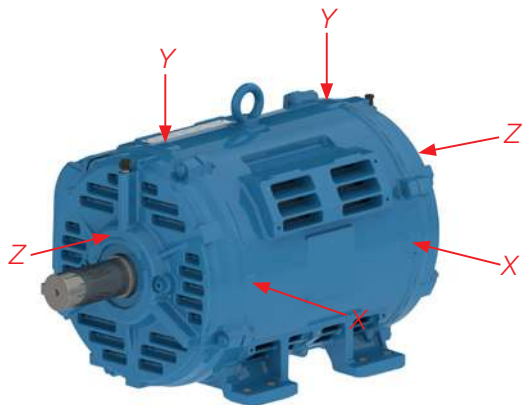


Figure 6 - Flat surfaces for vibration monitoring on the back and front side.

3.4. Rodent Screen

The motor frame is ready for rodent screens installation with areas prepared for drilling (Figure 7).



Figure 7 - Rodent screens.

3.5. Grounding

All frames from 254/6T to 324/6T are provided with earth terminals located inside the terminal box (see Figure 6).

Motors on frames 364/5T to 444/5T are fitted with one more earth terminal in the frame. It is located on the same side of the terminal box cable outlet (see Figure 8) and is responsible to equalize electrical potential and provide greater safety for operators.

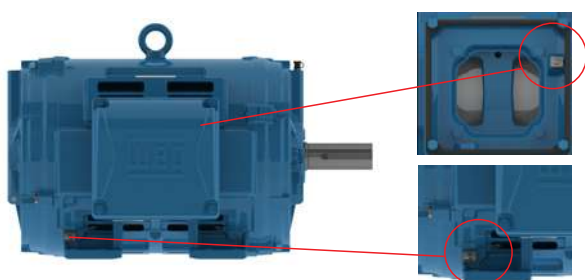


Figure 8 - Earth terminals in the terminal box and on the frame.

3.6. Terminal Box

The terminal box of W40 motors is made with FC-200 cast iron. It is diagonally split for easier handling of leads and connections.



Figure 7 - Terminal box

The W40 terminal boxes have an increased internal volume compared to the NEMA standard, as shown in Table 2.

Frame	Terminal box volume (in ³)	
	NEMA Standard	W40
254/6	36	135
284/6	77	210
324/6	140	290
364/5	252	460
404/5	450	460
444/5	840	1100

Table 2 - W40 Terminal box volume.

In addition, the terminal boxes can be easily rotated by 90°, allowing the cables to exit on the customer's desired position.

Note: for all terminal box position modifications please contact WEG or your local WEG service center.

Motors are supplied with plastic plugs in the cable entries to maintain the degree of protection during transport and storage. In order to guarantee the degree of protection, cable entries must comply with at least the same degree of protection 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.

3.7. Power Supply Connection Leads

Motor power supply leads are marked in accordance with NEMA MG-1 Part 2 - Terminal Markings and, as optional, can be fitted with a terminal block made from a polyester based resin BMC (Bulk Molding Compound), reinforced with fiberglass (see Figure 9).



Figure 9 - Six-pin terminal block.

3.8. Accessory Connection Leads

Accessory terminals are assembled on 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 10).

Whether the accessory terminals are assembled inside the main power or, as optional, in a separate terminal box, an NPT 3/4" threaded hole is provided for the fitting of cable glands for the incoming connection leads.

In the Mechanical Data section of this catalog, it is possible to check the number of connectors that may be assembled inside the main power and accessory terminal boxes.



Figure 10 - Accessory terminal box attached to power terminal box.

For frames 254T to 444/5T, there is also the option of providing a dedicated terminal box for the connection of space heaters as shown in Figure 11.



Figure 11 - Two accessory terminal boxes attached to the power terminal box.

3.9. Endshields and Flanges

3.9.1 Endshields

W40 endshields are made in gray cast iron, the external bearing caps were incorporated to the endshield (Figure 12). On W40 endshields, the mounting areas between the frame and endshield were designed to completely touch the frame, avoiding excessive deformation during its bolts tightening.

The endshields were designed to provide lower vibration, extended bearing life, more precise shaft runout and better control and distribution of the pre-loads applied to the bearings.

The grease inlet and outlet are positioned according to Figure 13.

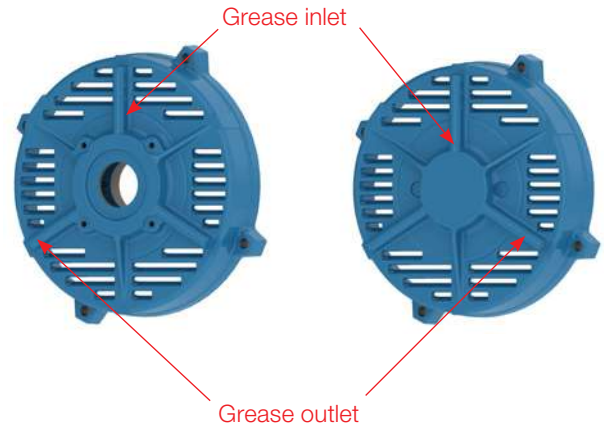


Figure 12 - Drive and non-drive end shields

3.9.2 Flanges

The bolts for flange assembling on the frame, flange coupling bolts and grease inlet are positioned in different angles to avoid assembly and access problems (Figure 13). In addition, more space is available to place tools on the bolts for mounting on the customer equipment.

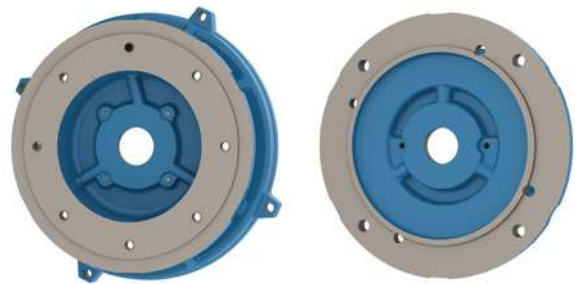


Figure 13 - C and D flanged end shields

The grease inlet and outlet are shifted from motor fixing bolts:

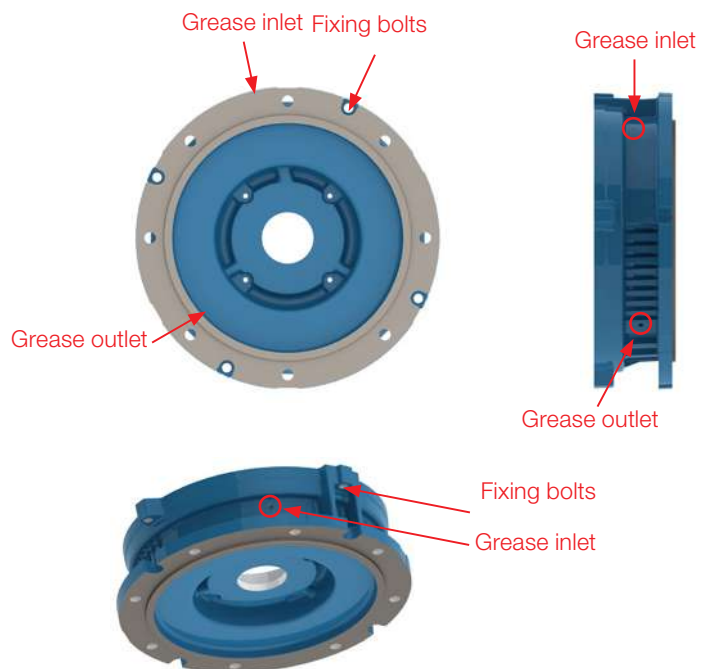


Figure 14 - Grease inlet and outlet shifted from motor fixing bolts

3.10.Nameplate

The nameplate supplies information determining motor construction and performance characteristics. The line name is given on the first line of the nameplate together with nominal efficiency levels as required by NEMA MG1.

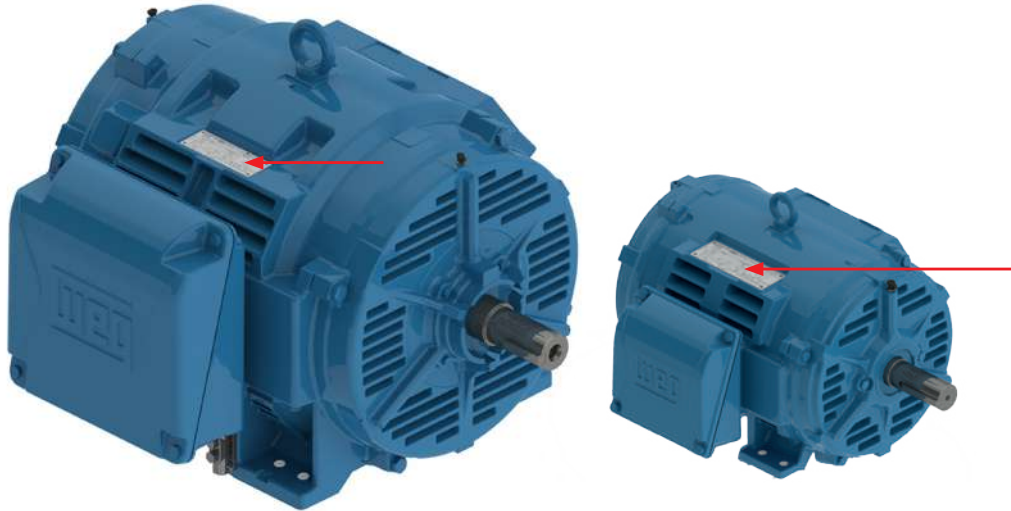


Figure 15 - Nameplate position of W40 motors.





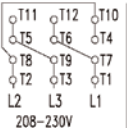
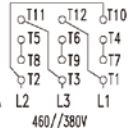

29 MODEL 100180T3E404T-W40 MADE IN BRAZIL 14011071 27 30	 W40 NEMA CC029A Inverter Duty Motor		  3PT9 US LISTED		IEC 60034-1		 25 C US Energy Verified		32 For 60Hz use on PWM, VT 1000:1, CT 2:1, 1.0SF		
	PH 3		FR 404/5T		HP(kW) 100.0(75.0)		Hz 60		  23		
	V 230/460		A 230/115		RPM 1780		DES B				
	NEMA NOM EFF 95.4		% INS. CL. F ΔT 80		IP23		 6316-C3 (34g) 6212-Z-C3 (13g)		MOBIL POLYREX EM 20000 h		
	ENCL ODP		DUTY CONT.		AMB. 40°C				20		22
	CODE G		PF 0.86		SF 1.25		SFA 288/144		21		24
USABLE @208V		254 A		SF 1.15		SFA 292		18		19	
55kW 50Hz 380V 103A 1482RPM SF1.00 EFF 94.7% (IE3)		ALT 1000 m.a.s.l.		956 Lbs							

Figure 13 - Nameplate layout for frames 254T to 444/5T.

- | | |
|--|---|
| 1 - Motor code
2 - Three-phase
3 - Rated operating voltage
4 - Service duty
5 - Efficiency
6 - Frame size
7 - Enclosure
8 - Insulation class
9 - Temperature rise at full load
10 - Design
11 - Frequency
12 - Motor rated power
13 - Full load speed (rpm)
14 - Rated operating current
15 - Power factor
16 - Ambient temperature | 17 - Service factor
18 - Altitude
19 - Motor weight
20 - Drive end bearing specification and amount of grease
21 - Non-drive end bearing specification and amount of grease
22 - Type of grease for bearings
23 - Connection diagram
24 - Relubrication intervals in hours
25 - Certification labels
26 - Service factor current
27 - NEMA code letters for locked rotor kVA/HP
28 - Current at 208 V
29 - Model
30 - Derating 50 Hz
31 - Degree of protection
32 - VFD supply |
|--|---|

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

4.1. Cooling System

On W40 platform motors, the ventilation system was designed to obtain an optimized air flow with controlled noise levels, better temperature distribution along the stator and low mechanical losses. The frame and the endshields have balanced air inlet and outlet areas that maximize the air flow, better distribute air velocity and reduce recirculation, reducing noise and losses, as shown in Figure 16.

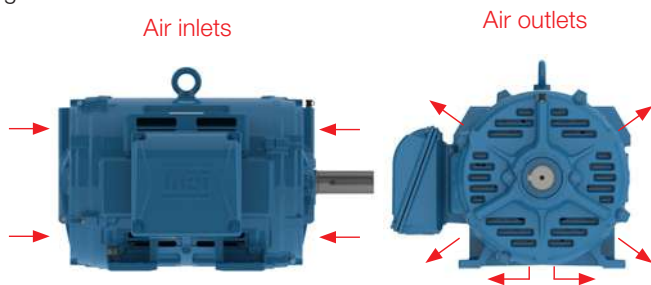


Figure 16 – Motor's air inlets and outlets.

4.2.Noise Level

W40 motors comply with NEMA MG-1 Part 9 Standard and the corresponding sound pressure levels. Table 3 shows sound pressure levels in dB(A) which is obtained upon tests at 50 and 60 Hz with tolerance +3dB(A).

Frame	Sound Pressure Level - dB(A) at 1 meter					
	2 Poles		4 Poles		6 Poles	
	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
254/6T	70	72	61	62	56	59
284/6T	70	73	61	64	56	59
324/6T	74	75	63	66	60	62
364/5T	80	82	66	67	64	65
404/5T	82	84	66	69	64	68
444/5T	81	85	75	78	65	69

Table 3 – Sound pressure levels dB(A) for motors at 50 and 60 Hz.

The noise level values shown in table 3 are taken at no load. Under load, the NEMA MG-1 Part 9 foresees an increase of the sound pressure levels as shown in Table 4.

Rated Output, HP	2 poles	4 poles	6 poles	8 poles
1.0 < HP ≤ 15	2	5	7	8
15 ≤ HP ≤ 50	2	4	6	7
50 ≤ HP ≤ 150	2	3	5	6
150 ≤ HP ≤ 500	2	3	4	5

Table 4 - Maximum increase expected in sound pressure level for loaded motors.

4.3.Vibration Level

The 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. Nevertheless, to allow evaluation of the vibration generated by the electrical machine itself in a way to allow reproducibility of the tests and to obtain 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 NEMA MG-1 Part 7. As an option, motors can be supplied with special vibration levels.

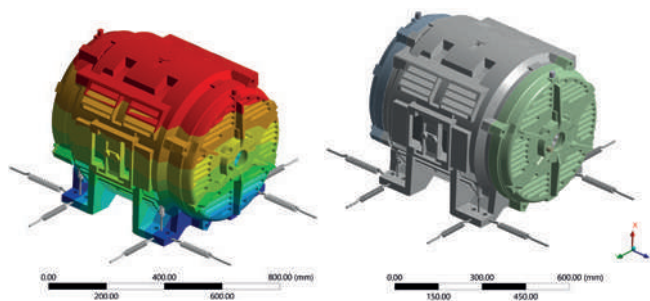


Figure 17 – Vibration levels through the frame.

4.4.Impact Resistance

The W40 motor complies with impact level IK08 - mechanical impact of 5J as per EN 62262 - Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code) ensuring superior mechanical strength for the most demanding applications.

5. Shaft / Bearings

5.1.Shaft

The shaft of W40 standard motors is made of AISI 1040/45 steel, in frames 254T to 444/5T. When supplied with roller bearings (optional above 364/5T), the shaft material must be AISI 4140. For frames 364/5T and above, the shaft is supplied with a threaded center hole and have dimensions shown in section 15 - Mechanical Data.

The maximum allowable radial load on shaft ends is in accordance with NEMA MG-1 Part 14 Table 14-1A.

As an option, W40 motors can be supplied with stainless steel shafts (AISI 304, AISI 316 and AISI 420) for highly corrosive environments.

Important: Under such circumstances, the non-drive endshield bearing cap needs to be replaced as the non-drive end bearing must be locked to prevent damage to the rotor and bearings during transportation. This locking device should only be removed right before installation and stored in a safe location for future transportation of the motor.

5.2. Bearings

W40 motors are supplied with deep groove ball bearings as standard (figure 21). Optionally, frame size 364T and above can be supplied with NU series roller bearings, where high radial loads may occur.

The rated bearing lifetime, L10h, for direct coupling of the W40 platform motors is 100,000 hours and rated bearing lifetime, L10h for overhung loads is 26,280 hours in conformance with maximum radial/axial loads as described in tables 6 and 7.

In standard configuration, with ball bearings, the drive end bearing is locked axially from frame 324T and all frames with a drive end flange. To compensate any axial movement the motors are fitted with wave washer for frames 254 to 444/5T. Pre-load springs are provided for frame 444/5T with 6314 NDE bearing.

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.

Bearings lifetime depends on the type and size of the bearing, the radial and axial mechanical loads it is submitted to, operating conditions (environment, temperature), 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 lifetime given. W40 motors are provided as standard with grease fittings in each endshield to permit the relubrication of the bearings. The lubrication interval is stamped on the nameplate. The lubrication interval is shown in tables 8 and 9, page 12.

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: L10 lifetime means that at least 90% of the bearings submitted to the maximum indicated loads will reach the number of hours indicated. For bearing lifetime in combined axial and radial loads condition contact WEG.

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 lubrication intervals to those indicated in the tables provided within this technical catalog.

2 - Roller bearings

Roller bearings require a minimum radial load to ensure correct operation. They are not recommended for direct coupling arrangements, or for use on 2 pole motors (60 Hz).

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.

5.3. Permissible Loads

Permissible loads are in accordance with NEMA MG-1 (Table 14-1A), as shown in Table 5.

Shaft loading for AC induction horizontal motors with ball bearings Maximum radial overhung load, in pounds, at center of N-W dimension			
Frame sizes	2 poles	4 poles	6 poles
254T	470	593	703
254/6T	470	589	705
284T	570	735	838
284/6T	570	735	838
324T	660	860	990
324/6T	660	850	980
364/5T	820	1080	1240
404/5T	-	1290	1480
444/5T	-	1520	1760

Table 5 - Maximum permissible radial loads for ball bearings.

- 1 - All belt loads are considered to act in a vertically downward direction.
- 2 - Overhung loads include belt tension and weight of sheave.
- 3 - For load at end of the shaft subtract 15%.
- 4 - Radial overhung load limit is based on bearing L-10 life of 26,280 hours.

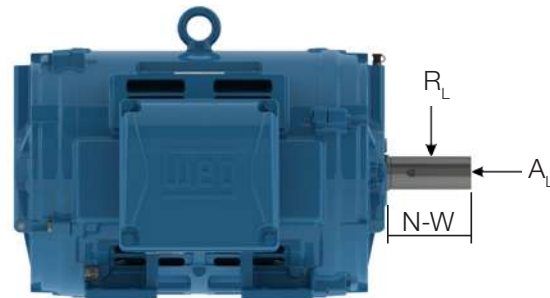


Figure 18 - Radial(R_L) and axial(A_L) loads applied to the shaft end.

Radial Loads - Roller bearings

Maximum permissible radial load in pounds - 60 Hz L10 26,280 hours				
Frame	4 poles		6 poles	
	(N-W)/2	N-W	(N-W)/2	N-W
254/6T	1400	900	1400	900
284/6T	2600	1500	2800	1500
324/6T	2900	1800	3200	1800
364/5T	3900	2400	4400	2400
404/5T	5000	2500	5600	3500
444/5T	5000	3200	5800	3700

Table 6 - Maximum permissible radial load for roller bearings.

Note: the values given for roller bearings take into consideration shaft supplied with steel AISI 4140 (Special order on frames 326T and below).

Note 2: Roller bearings require a minimum radial load (preload) to ensure proper operation. This type of bearing is not recommended for applications with direct coupling.

Axial Loads

The values shown in Table 7 indicate the maximum allowable values for the axial load on the shaft end for horizontal and vertical mounted motors fitted with ball bearing.

Maximum permissible axial load - 60 Hz - 26,280 hours - in pounds					
Frame	Poles	Horizontal		Vertical with shaft downwards*	
		Pushing	Pulling	Pushing	Pulling
254T	2	230	380	630	340
	4	320	540	810	470
	6	380	650	920	580
254/6T	2	220	380	630	340
	4	320	540	810	470
	6	380	650	920	580
284T	2	300	530	790	470
	4	420	730	1030	650
	6	510	880	1190	790
284/6T	2	300	530	390	460
	4	420	730	530	640
	6	510	880	630	760
324T	2	810	610	930	520
	4	1045	840	1190	740
	6	1210	1000	1390	890
324/6T	2	800	610	955	500
	4	1030	840	1240	700
	6	1190	1010	1420	850
364/5T	2	1150	670	1350	560
	4	1400	1030	1690	850
	6	1600	1240	1930	1030
404/5T	2	1150	670	1400	490
	4	1570	1170	1960	920
	6	1850	1440	2250	1170
444/5T	2	1110	640	1510	380
	4	1840	1390	2450	990
	6	2140	1690	2810	1260

*DE locating bearing.

Table 7 - Maximum permissible axial loads for ball bearings.

Lubrication Intervals (40 °C - Rated Speed)

Lubrication intervals (hours)				
Frame	RPM	DE Bearing	NDE Bearing	60 Hz
254/6T	3600	6309	6209	20,000
	1800			
	1200			
284/6T	3600	6311	6211	20,000
	1800			
	1200			
324/6T	3600	6312	6211	20,000
	1800			
	1200			
364/5T	3600	6314	6212	14,000
	1800			20,000
	1200			
404/5T	3600	6314	6212	14,000
	1800	6316		20,000
	1200			
444/5T	3600	6314	6212	14,000
	1800	6319	6314	20,000
	1200			

Table 8 - Lubrication intervals for ball bearings.

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

Lubrication intervals (hours)			
Frame	RPM	Bearing	60 Hz
364/5T	4-8	NU314	20,000
404/5T	4-8	NU316	20,000
444/5T	4-8	NU319	18,800

Table 9 - Lubrication intervals for roller bearings.

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

5.4. Bearing Monitoring

On request, W40 motors can be equipped with bearing temperature detectors which monitor bearing operating conditions. The most commonly used accessory is the RTD temperature detector for continuous monitoring of bearing operating temperature.

This type of monitoring is extremely important considering that it directly affects the grease and bearing lives particularly on motors equipped with regreasing facilities. See on Section 10- Motor Protection.

6. Mounting

Motors are supplied, as standard, in the F-1 configuration, with the terminal box on the left-hand side of the motor frame when looking from the drive end shaft.



Figure 19 - F-1 mounting.

All W40 frames 254T-444/5T are symmetrical and can be reversed from F-1 to F-2. The mounting configuration for the W40 motor line complies with NEMA MG-1 Part 4. Standard mountings and their variations are shown in Table 10.

Floor mountings		
Assembly F-1	Assembly F-2	Assembly F-3
Wall mountings		
Assembly W-6		

Table 10 - Mountings configurations.

7. Degree of Protection and Safety Compliance / Painting

7.1. Degree of Protection and Safety Compliance

As per NEMA MG-1 Part 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 meaning:

- a) First characteristic numeral: referred to protection of people 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 the ingress of water.

W40 motors are supplied with degrees of protection in conformance with NEMA MG-1 Part 5. As standard, they are IP23, which means:

- a) First characteristic numeral 2: machine protected against solid objects greater than 0.4724 in (12 mm) and contact with or approach to live or moving parts inside the enclosure by fingers or similar objects not exceeding 3.15 inch (80 mm) in length (Figure 20).
- b) Second characteristic numeral 3: Machine protected against water falling as a spray at an angle up to 60 degrees from the vertical (Figure 21).

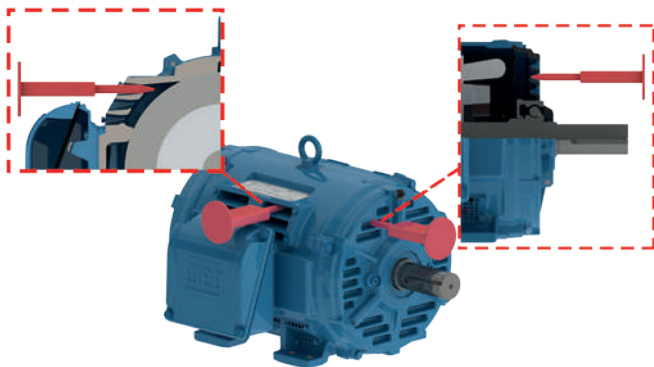


Figure 20 - IP degree of protection for the frame - first characteristic numeral.

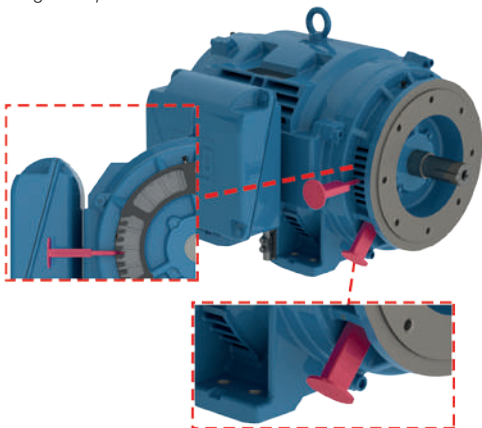


Figure 21 - IP degree of protection for the frame - first characteristic numeral - flanged.

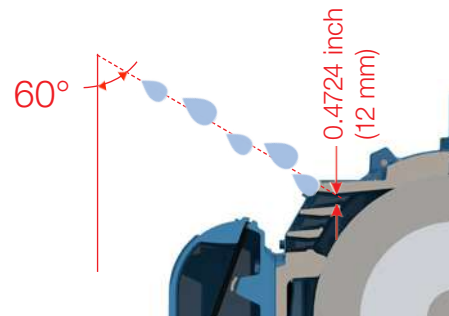


Figure 22 - IP degree of protection for the frame - second characteristic numeral.

7.2. Painting

W40 motors of frame 254T up to 444/5T are supplied as standard with WEG internal painting plan 203A.

This painting plan has a minimum resistance to the salt spray test of 240 hours in accordance with ASTM B117-03 and may be used in motors applied in normal environments, slightly severe, sheltered or non-sheltered, meeting the IP23 degree of protection, for industrial use, with low relative humidity, normal temperature variations and the presence of SO₂.

This painting plan is not recommended for direct exposure to acid steam, alkalis, solvents and salty environments.

Alternative painting plans are suitable to guarantee additional protection in aggressive environments, see Table 11.

Plan	Recommended use
202 E	Severe sheltered industrial environments. May have the presence of SO ₂ , vapors, solid contaminants and high relative humidity.
	Specific use recommendation: for application in pulp and paper, mining and chemical industries.
202 P	Severe industrial environments, sheltered or not, may have the presence of SO ₂ , vapors, solid contaminants and high relative humidity.
	Specific use recommendations: Indicated for application in food processing motors - USA.
203 A	Regular environments, not too severe, sheltered and unsheltered, for industrial purpose, with low relative humidity, normal temperature variations and SO ₂ presence. Notes: 1 - Not recommended for direct exposure to acid vapors, alkalis and solvents. 2 - Do not apply the 203 plan in motors with steel plate frames.

Table 11 - Painting plans.

8. Voltage / Frequency

NEMA MG-1 Part 12 states that the motor shall operate successfully under running conditions at rated load with a variation in the voltage or the frequency up to the following:

1. Plus or minus 10 percent of rated voltage, with rated frequency.
2. Plus or minus 5 percent of rated frequency, with rated voltage.
3. A combined variation in voltage and frequency of 10 percent (sum of absolute values) of the rated values, provided the frequency variation does not exceed plus or minus 5 percent of rated frequency.

Performance within these voltage and frequency variations will not necessarily be in accordance with the standards established for operation at rated voltage and frequency.

9. Ambient / Insulation

Unless otherwise specified, the rated power outputs present in the electrical data tables within this catalog refer to continuous duty operation S1, as per NEMA MG-1 Part 14 and under the following conditions:

- With ambient temperature range -30°C to +40°C;
- With altitudes up to 3300 feet (1000 meters) above sea level.

For operating temperatures and altitudes differing from those above, the factors indicated in table 12 must be applied to the nominal motor power rating in order to determine the derated available output (Pmax).

$$P_{max} = P_{nom} \times \text{correction factor}$$

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 12 - Correction factors for altitude and ambient temperature.

Bearing lubrication intervals will change under operating conditions other than 40°C maximum ambient temperature and 1000 meters above sea level. Contact WEG for more information. All W40 motors are wound with the WISE® insulation system which consists of enameled conductor wire meeting temperatures up to 200 °C and impregnated with solvent-free resin. The WISE® system also permits motor operation with variable speed drives (see section 11).

9.1.Space Heaters

The use of space heaters are 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 highlighted that in this situation it is strongly recommended that an epoxy paint known as internal anti-corrosive painting is applied in the internal components of the motor. More information can be obtained in Section 7.3.

For all frame sizes, W40 motors can be provided with space heaters suitable for 110-127 V, 220-240 V and 380-480 V or dual voltage heaters of 110-127 / 220-240 V.

The power rating and the number of space heaters fitted depend on the size of the motor as indicated in table 13.

Frame	Quantity	Total power rated (W)
254/6T	2	30
284 to 324/6T	2	38
364T to 404/5T	2	56
444/5T	2	140

Table 13 - Power and quantity of space heaters.

10. Motor Protections

Protections available for W40 can be classified as follows:

- Based on operating temperature.
- Based on operating current.

In section 12 - Construction Features it is possible to identify the type of protection for each W40 line.

10.1. Protection Based on Operating temperature

Continuous duty motors must be protected from overload either by a device integrated into the motor winding 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 (I_n) by the service factor.

10.1.1. RTD

These are temperature detectors (Figure 23) with operating principle based on the properties that some materials vary the electric resistance with the variation in temperature (usually platinum, nickel or copper).



Figure 23 - RTD.

They are also fitted with calibrated resistances that vary linearly with temperature, allowing a continuous reading of motor operating temperature through a monitoring display, with high precision rate and response sensitivity.

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

10.1.2. Thermistor (PTC)

These are thermal protectors consisting of semiconductor detectors with the sudden variation of the resistance when reaching a certain temperature (Figure 24).



Figure 24 - Thermistor (PTC).

PTC is considered a thermistor with the resistance increasing drastically to a well-defined temperature value. This sudden resistance variation blocks the PTC current, causing the output relay to operate, and the main circuit to switch-off.

The thermistors are of small dimensions, do not wear and have a quicker response if compared to other 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 has a product called RPW which is an electronic relay intended specifically to read the PTC signal and operate its output relay. For more information go to the website www.weg.net.

10.1.3. Thermostats

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

The thermostats 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-100, KTY and thermocouples. Contact your local WEG office closest to you for more information.

10.2. Protection Based on Operating Current

Overloads are processes that usually make the temperature increase gradually. To solve this problem, the thermal protectors described in item 10.1 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 current and it is highly effective in cases of the locked rotor.

WEG Automation supplies fuse in versions D and NH. Go to the site www.weg.net for more information.

11. Variable Speed Drive Application

11.1. Considerations Regarding Voltage Spikes and the Insulation System

The stator windings of W40 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 15.

Motor rated voltage	Voltage Spikes at motor terminals (phase-phase)	dV/dt * at motor terminals (phase-phase)	Rise time*	Minimum Time Between Successive Pulses
$V_{rated} < 460\text{ V}$	$\leq 1600\text{ V}$	$\leq 5200\text{ V}/\mu\text{s}$	$\geq 0.1\ \mu\text{s}$	$\geq 6\ \mu\text{s}$
$460\text{ V} \leq V_{rated} < 575\text{ V}$	$\leq 2000\text{ V}$	$\leq 6500\text{ V}/\mu\text{s}$		
$575\text{ V} \leq V_{rated} \leq 1000\text{ V}$	$\leq 2400\text{ V}$	$\leq 7800\text{ V}/\mu\text{s}$		

Table 15 - Supportability of random wound motors' insulation system

* dV/dt and Rise time definition according to NEMA Std. MG1 - Part 30 and Part 31.

Notes:

- In order to protect the motor insulation system, the maximum recommended switching frequency is 5 kHz.
- If one or more of the above conditions is not attended, a filter (load reactor or dV/dt filter) must be installed in the output of the VSD.
- General purpose motors with the 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.
- General purpose motors of the dual voltage type with the high voltage above 460V, for example 380/660 V, which at the time of purchase did not have any indication of operation with VSD, are able to be driven by a VSD in the higher voltage only if the limits set in the table above for rated voltage up to 460 V are fully attended in the application. Otherwise, a load reactor or a dV/dt filter must be installed in the VSD output.

11.2. Torque Restrictions on Variable Speed Drive Applications

In order to keep the temperature rise of WEG motors within acceptable levels, when under VSD supply, the speed range related loadability limits established in table 16 must be respected. **Note:** applications with motors rated for use in hazardous areas must be particularly evaluated - in such case please contact WEG.

WEG W40 Motors						
Frame size	Efficiency	Constant torque	Variable torque	Constant power	Drive	Service Factor
254 to 324/6	NEMA Premium	3:1	1000:1	60 - 120 Hz	Any	1.00
	High Efficiency					
364/5 to 444/5	NEMA Premium	2:1				
	High Efficiency					

Table 16 - Loadability limits for W40 motors operating with VSD.

Notes:

- The speed ranges stated above are related to the motor thermal capability only. Speed regulation will depend on VSD mode of operation and proper adjustment.

The relations in table 17 correspond to speed ranges of operation.

Considering 60 Hz as the base operating frequency, the following equivalence is valid:

Relation	Frequency range
2:1	30 - 60 Hz
3:1	20 - 60 Hz
1000:1	0.06 - 60 Hz

Table 17 - Operation range description.

Maximum safe operating speeds for direct-coupled motors			
Frame	Synchronous Speed at 60 Hz		
	3600 rpm	1800 rpm	1200 rpm
254/6	5300	3600	2400
284/6	4400		
324/6	4200		
364/5	3600	3200	
404/5		2300	
444/5			

Table 18 - Maximum safe operating speeds (rpm) for W40 motors driven by VSD

Notes:

- The values in the table are based on mechanical limitations. For operation above nameplate speed, the electrical limitations (motor torque capability) must be also observed.
- The limits established in table 18 are in accordance with the NEMA Std. MG 1 - Part 30.
- The permissible overspeed value is 10% above the limits given in table 18 (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.
- Operation above nameplate speed may require specially refined motor balancing. In such case, vibration and noise limits per NEMA MG1 Parts 7 and 9, respectively, are not applicable.
- Bearing life will be affected by the length of time the motor is operated at various speeds.
- For speeds and ratings not covered by the table above, please contact WEG.

11.3. Considerations Regarding Bearing Currents

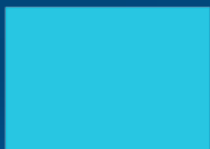
Motors up to frame size 445T generally do not require special features with respect to the bearings for variable speed drive application. Since this is a systems issue, involving the VFD characteristics, power cabling and connections issues can occur on smaller motors and the customer experience may dictate these safeguards on much smaller motors. When required, this safeguard can be accomplished by the use of an insulated bearing or an insulated hub end shield in the non-drive end and a shaft grounding brush mounted on the drive end shield.

The motors can, optionally, be supplied with an AEGIS shaft grounding ring (see Figure 25) installed on the inner bearing cap.



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).

Optimized and rugged design
with maximum reliability, ready
for all application requirements.



12. Construction Features

Frame		254T	254/6T	284T	284/6T	324T	324/6T	364/5T	404/5T	444/5T	
Mechanical features											
Nameplate markings		UL, CSA									
Mounting		F-1									
Frame material		Cast Iron FC-200									
Degree of protection (IP rating)		IP23									
Grounding		Simple grounding - one inside the terminal box						Double grounding - one inside the terminal box and one on the frame			
Cooling method (IC)		Open with self-circulation (IC01)									
Endshields material		Cast Iron FC-200									
Bearings	Shielded/clearance (DE)	Z-C3						Open / C3			
	Shielded/clearance (NDE)	Z-C3									
	Locating bearing configuration	Without bearing cap and with wave washer at NDE				With bearing cap at DE and with wave washer/pre-load spring at NDE					
	Drive end	2P	6309	6309	6311	6311	6312	6312	6314	6314	6314
		4 - 12P								6316	6319
Non-drive end	2P	6209	6209	6211	6211	6211	6211	6212	6212	6212	
	4 - 12P									6314	
Lubrication	Type of grease	Mobil Polyrex EM									
	Grease fitting	With grease relief fitting									
Terminal block		None									
Terminal box material		Cast Iron FC-200									
Leads inlet	Main T-box	Size	NPT 1 1/2"	NPT 1 1/2"	NPT 1 1/2"	NPT 1 1/2"	NPT 2"	NPT 2"	NPT 3"	NPT 3"	2xNPT 3"
	Plug		Flat plastic plug for transport and storage								
Shaft	Material	2P	SAE 1040/45								
		4 - 12P	SAE 1040/45						SAE 4140		
	DE threaded hole	2P	-						UNC 3/4"		
Vibration velocity limit		0.15 in./sec peak									
Nameplate material		Stainless Steel AISI 304									
Painting	Type	203A									
	Color	Blue RAL 5009 - High Efficiency and NEMA Premium Efficiency									
Electrical features											
Design		B									
Voltage		208-230/460 V with 12 leads								460 V with PWS	
Winding	Impregnation	Dip and Bake						Continuous Resin Flow			
	Insulation class	F (DT=80K)									
Service factor (60 Hz)		1.15 (High Efficiency motors and NEMA Premium above 150 HP) / 1.25 (NEMA Premium motors up to 150 HP and NEMA Super Premium motors)									
Rotor		Aluminum die cast									

13. Optional Features

Frame	254T	254/6T	284T	284/6T	324T	324/6T	364/5T	404/5T	444/5T
Terminal box									
Accessory terminal box	0	0	0	0	0	0	0	0	0
Terminal box with removable base	NA	NA	NA	NA	NA	NA	0	0	0
Terminal block									
BMC terminal block - six pin	0	0	0	0	0	0	0	0	0
Cable glands									
Plastic cable gland	0	0	0	0	0	0	0	0	0
Brass cable gland	0	0	0	0	0	0	0	0	0
Stainless Steel cable gland	0	0	0	0	0	0	0	0	0
Flange									
D Flange	0	0	0	0	0	0	0	0	0
C Flange	0	0	0	0	0	0	0	0	0
Bearing									
Roller bearing (DE)	NA	NA	NA	NA	NA	NA	0	0	0
Insulated non drive end bearing	NA	NA	NA	NA	NA	NA	0	0	0
Bearing cap									
Without bearing cap	S	S	S	S	NA	NA	NA	NA	NA
With bearing cap	0	0	0	0	S	S	S	S	S
Shaft									
TS shaft end (from 4 poles on)	NA	NA	0	0	0	0	0	0	0
Threaded center hole	0	0	0	0	0	0	S	S	S
Locking shaft device (standard for motors with roller bearing, 4 and 6-pole)	0	0	0	0	0	0	0	0	0
Lubrication									
Aeroshell 7 / Aeroshell 22	0	0	0	0	0	0	0	0	0
Isoflex NBU 15	0	0	0	0	0	0	0	0	0
Grease nipple									
Carbon steel grease nipple	S	S	S	S	S	S	S	S	S
Stainless steel grease nipple	0	0	0	0	0	0	0	0	0
Painting plan									
202E	0	0	0	0	0	0	0	0	0
202P	0	0	0	0	0	0	0	0	0
Painting inside of terminal box (Munsell 2.5 YR 6/14)	0	0	0	0	0	0	0	0	0
Internal Tropicalized Painting	0	0	0	0	0	0	0	0	0
Other mechanical options									
Rodent screens	0	0	0	0	0	0	0	0	0
Drip cover	0	0	0	0	0	0	0	0	0
Electrical options									
Winding thermal protection									
Alarm thermostat	0	0	0	0	0	0	0	0	0
Tripping thermostat	0	0	0	0	0	0	0	0	0
RTD two wires, one per phase	0	0	0	0	0	0	0	0	0
RTD two wires, two per phase	0	0	0	0	0	0	0	0	0
RTD three wires, one per phase	0	0	0	0	0	0	0	0	0
RTD three wires, two per phase	0	0	0	0	0	0	0	0	0
Alarm thermistor	0	0	0	0	0	0	0	0	0
Tripping thermistor	0	0	0	0	0	0	0	0	0
Bearing thermal protection									
Thermostat	0	0	0	0	0	0	0	0	0
Thermistor	0	0	0	0	0	0	0	0	0
RTD (two wires and three wires)	0	0	0	0	0	0	0	0	0
RTD three wires (calibrated)	0	0	0	0	0	0	0	0	0
Space heater									
110-127 V	0	0	0	0	0	0	0	0	0
220-240 V	0	0	0	0	0	0	0	0	0
110-127 / 220-240 V	0	0	0	0	0	0	0	0	0
380-480 V	0	0	0	0	0	0	0	0	0
Insulation class									
F	S	S	S	S	S	S	S	S	S
H	0	0	0	0	0	0	0	0	0
Protection Ring kit									
AEGIS SGR™ Bearing Protection Ring Kit	0	0	0	0	0	0	0	0	0

S (Standard) / NA (Not available) / O (Optional)

Notes: 1) Other optional features, on request.

2) Some combinations of optional features are not allowed - then contact WEG

14. Electrical Data

W40 - NEMA Super Premium Efficiency

Output		Frame	Full Load Torque (ft.lb)	Locked Rotor Current		Locked Rotor Torque Tl/Tn	Break-down Torque Tb/Tn	Inertia J (sq.ft.lb)	Allowable locked rotor time (s)		Weight (lb)	Sound dB(A)	Service Factor	460 V						Full load current In (A)	
				Code	ll/In				Hot	Cold				Rated speed (rpm)	% of full load			50	75		100
															Efficiency						

II Poles

20	15	254T	29,4	G	5,9	1,7	2,4	0,8718	16	35	238	72,0	1,15	3530	89,5	90,2	90,2	0,77	0,85	0,86	24,3
25	18,5	254/6T	36,7	G	6,1	1,9	2,6	0,9592	15	33	260	72,0	1,15	3530	89,5	91,0	91,0	0,72	0,82	0,86	29,7
30	22	284TS	43,9	G	6,2	1,7	2,6	1,59	16	35	324	73,0	1,15	3540	90,2	91,0	91,0	0,74	0,83	0,87	34,9
40	30	284/6TS	58,6	G	6,1	1,7	2,5	1,91	10	22	359	73,0	1,15	3535	91,0	91,7	91,7	0,78	0,86	0,87	47,2
50	37	324TS	72,9	F	5,8	1,7	2,0	3,01	20	44	450	75,0	1,15	3555	91,7	92,4	92,4	0,78	0,84	0,86	58,4
60	45	324/6TS	87,4	F	5,9	1,8	2,0	3,41	17	37	490	75,0	1,15	3555	92,4	93,0	93,0	0,78	0,84	0,86	70,6
75	55	364/5TS	109	F	5,8	1,6	2,1	5,60	26	57	703	82,0	1,15	3555	91,0	92,4	93,0	0,80	0,85	0,87	85,3
100	75	364/5TS	146	F	5,7	1,7	2,3	6,80	15	33	756	82,0	1,15	3550	92,4	93,0	93,0	0,80	0,85	0,88	115
125	90	404/5TS	183	G	6,6	1,8	2,3	8,03	15	33	878	84,0	1,15	3545	93,0	93,6	93,6	0,80	0,86	0,88	137
150	110	404/5TS	219	G	6,6	1,7	2,2	9,20	11	24	931	84,0	1,15	3550	93,0	93,6	93,6	0,84	0,89	0,90	164
200	150	444/5TS	291	F	5,8	1,4	2,1	21,8	27	59	1341	85,0	1,15	3565	93,0	94,1	94,5	0,82	0,87	0,89	224
250	185	444/5TS	363	G	6,4	1,3	2,2	23,8	20	44	1405	85,0	1,15	3570	93,6	94,5	94,5	0,77	0,84	0,87	282
300	220	444/5TS	437	F	5,9	1,3	2,0	28,1	16	35	1524	85,0	1,15	3560	94,1	94,5	95,0	0,85	0,89	0,89	327

IV Poles

15	11	254T	44,0	G	6,1	2,0	2,5	2,14	18	40	258	62,0	1,15	1765	89,5	91,0	91,0	0,67	0,78	0,83	18,3
20	15	254/6T	58,9	G	5,8	2,3	2,7	2,63	13	29	293	62,0	1,15	1760	90,2	91,0	91,0	0,70	0,80	0,84	24,6
25	18,5	284T	73,4	G	6,0	2,3	2,3	2,88	23	51	331	64,0	1,15	1765	91,0	91,7	91,7	0,68	0,79	0,84	30,1
30	22	284/6T	88,1	G	6,3	2,5	2,7	3,70	22	48	381	64,0	1,15	1765	91,7	92,4	92,4	0,71	0,80	0,84	35,6
40	30	324T	117	G	6,0	1,8	2,1	5,37	20	44	459	66,0	1,15	1775	92,4	93,0	93,0	0,72	0,81	0,84	48,2
50	37	324/6T	146	G	6,0	2,4	2,3	5,98	15	33	498	66,0	1,15	1775	92,4	93,0	93,0	0,67	0,78	0,83	60,2
60	45	364/5T	175	G	6,1	1,8	2,3	12,8	22	48	723	67,0	1,15	1777	93,0	93,6	93,6	0,73	0,82	0,85	71,0
75	55	364/5T	219	G	6,3	1,8	2,3	15,2	19	42	774	67,0	1,15	1775	93,6	94,1	94,1	0,75	0,83	0,86	85,3
100	75	404/5T	292	G	6,2	2,2	2,5	17,5	14	31	895	69,0	1,15	1775	93,6	94,1	94,1	0,76	0,84	0,86	116
125	90	404/5T	365	G	6,5	2,1	2,3	21,5	12	26	983	69,0	1,15	1775	94,1	94,5	94,5	0,76	0,84	0,86	139
150	110	444/5T	437	G	6,4	1,9	2,0	42,3	20	44	1365	78,0	1,15	1780	94,5	95,0	95,0	0,77	0,84	0,86	169
200	150	444/5T	582	G	6,2	1,8	2,1	42,3	20	44	1365	78,0	1,15	1780	94,5	95,0	95,0	0,77	0,83	0,86	230
250	185	444/5T	728	G	6,4	1,9	2,2	51,5	17	37	1513	78,0	1,15	1780	95,0	95,4	95,4	0,77	0,84	0,86	283

VI Poles

7,5	5,5	254T	33,0	H	6,4	2,0	2,5	2,29	25	55	240	59,0	1,15	1178	86,5	88,5	88,5	0,64	0,75	0,81	9,63
10	7,5	254/6T	44,1	H	6,3	2,3	2,6	3,12	24	53	284	59,0	1,15	1175	87,5	89,5	90,2	0,65	0,76	0,82	12,7
15	11	284T	66,1	G	6,2	2,2	2,3	4,48	23	51	326	59,0	1,15	1175	89,5	90,2	90,2	0,71	0,81	0,85	18,0
20	15	284/6T	88,2	G	5,8	2,5	2,3	5,45	17	37	366	59,0	1,15	1175	90,2	91,0	91,0	0,71	0,81	0,84	24,6
25	18,5	324T	110	G	5,9	1,8	2,2	6,66	20	44	445	62,0	1,15	1180	91,0	91,7	91,7	0,67	0,77	0,82	30,9
30	22	324/6T	132	G	6,0	1,8	2,2	7,50	16	35	485	62,0	1,15	1180	91,0	91,7	92,4	0,67	0,77	0,82	36,4
40	30	364/5T	175	G	6,1	1,5	2,0	18,5	28	62	736	65,0	1,15	1185	92,4	93,0	93,0	0,76	0,84	0,86	47,1
50	37	364/5T	219	G	6,2	2,0	2,1	20,7	20	44	770	65,0	1,15	1185	92,4	93,0	93,0	0,76	0,84	0,86	58,1
60	45	404/5T	263	G	6,1	1,9	2,0	25,0	17	37	904	68,0	1,15	1180	93,0	93,6	93,6	0,78	0,85	0,86	70,2
75	55	404/5T	329	G	6,3	1,8	2,1	27,2	14	31	939	68,0	1,15	1180	93,0	93,6	93,6	0,76	0,82	0,86	85,8
100	75	444/5T	436	G	5,8	2,0	2,2	60,6	24	53	1358	69,0	1,15	1187	93,6	94,1	94,1	0,66	0,77	0,81	124
125	90	444/5T	547	G	6,1	1,7	2,3	63,2	16	35	1387	69,0	1,15	1185	93,0	94,1	94,1	0,65	0,76	0,81	148
150	110	444/5T	656	G	6,0	1,7	2,2	76,4	15	33	1530	69,0	1,15	1185	93,6	94,5	94,5	0,67	0,77	0,81	180

W40 - NEMA Premium Efficiency

Output		Frame	Full Load Torque (ft.lb)	Locked Rotor Current		Locked Rotor Torque Tl/Tn	Break-down Torque Tb/Tn	Inertia J (sq.ft.lb)	Allowable locked rotor time (s)		Weight (lb)	Sound dB(A)	Service Factor	460 V						Full load current In (A)	
				Code	ll/In				Hot	Cold				Rated speed (rpm)	% of full load			50	75		100
															Efficiency		Power Factor				
HP	kW													50	75	100	50	75	100		
II Poles																					
20	15	254T	29,4	G	5,9	1,7	2,4	0,8718	16	35	238	72,0	1,15	3530	89,5	90,2	90,2	0,77	0,85	0,86	24,3
25	18,5	254/6T	36,7	G	6,1	1,9	2,6	0,9592	15	33	260	72,0	1,15	3530	89,5	91,0	91,0	0,72	0,82	0,86	29,7
30	22	284TS	43,9	G	6,2	1,7	2,6	1,59	16	35	324	73,0	1,15	3540	90,2	91,0	91,0	0,74	0,83	0,87	34,9
40	30	284/6TS	58,6	G	6,1	1,7	2,5	1,91	10	22	359	73,0	1,15	3535	91,0	91,7	91,7	0,78	0,86	0,87	47,2
50	37	324TS	72,9	F	5,8	1,7	2,0	3,01	20	44	450	75,0	1,15	3555	91,7	92,4	92,4	0,78	0,84	0,86	58,4
60	45	324/6TS	87,4	F	5,9	1,8	2,0	3,41	17	37	490	75,0	1,15	3555	92,4	93,0	93,0	0,78	0,84	0,86	70,6
75	55	364/5TS	109	F	5,8	1,6	2,1	5,60	26	57	703	82,0	1,15	3555	91,0	92,4	93,0	0,80	0,85	0,87	85,3
100	75	364/5TS	146	F	5,7	1,7	2,3	6,80	15	33	756	82,0	1,15	3550	92,4	93,0	93,0	0,80	0,85	0,88	115
125	90	404/5TS	183	G	6,6	1,8	2,3	8,03	15	33	878	84,0	1,15	3545	93,0	93,6	93,6	0,80	0,86	0,88	137
150	110	404/5TS	219	G	6,6	1,7	2,2	9,20	11	24	931	84,0	1,15	3550	93,0	93,6	93,6	0,84	0,89	0,90	164
200	150	444/5TS	291	F	5,8	1,4	2,1	21,8	27	59	1341	85,0	1,15	3565	93,0	94,1	94,5	0,82	0,87	0,89	224
250	185	444/5TS	363	G	6,4	1,3	2,2	23,8	20	44	1405	85,0	1,15	3570	93,6	94,5	94,5	0,77	0,84	0,87	282
300	220	444/5TS	437	F	5,9	1,3	2,0	28,1	16	35	1524	85,0	1,15	3560	94,1	94,5	95,0	0,85	0,89	0,89	327
IV Poles																					
15	11	254T	44,0	G	6,1	2,0	2,5	2,14	18	40	258	62,0	1,15	1765	89,5	91,0	91,0	0,67	0,78	0,83	18,3
20	15	254/6T	58,9	G	5,8	2,3	2,7	2,63	13	29	293	62,0	1,15	1760	90,2	91,0	91,0	0,70	0,80	0,84	24,6
25	18,5	284T	73,4	G	6,0	2,3	2,3	2,88	23	51	331	64,0	1,15	1765	91,0	91,7	91,7	0,68	0,79	0,84	30,1
30	22	284/6T	88,1	G	6,3	2,5	2,7	3,70	22	48	381	64,0	1,15	1765	91,7	92,4	92,4	0,71	0,80	0,84	35,6
40	30	324T	117	G	6,0	1,8	2,1	5,37	20	44	459	66,0	1,15	1775	92,4	93,0	93,0	0,72	0,81	0,84	48,2
50	37	324/6T	146	G	6,0	2,4	2,3	5,98	15	33	498	66,0	1,15	1775	92,4	93,0	93,0	0,67	0,78	0,83	60,2
60	45	364/5T	175	G	6,1	1,8	2,3	12,8	22	48	723	67,0	1,15	1777	93,0	93,6	93,6	0,73	0,82	0,85	71,0
75	55	364/5T	219	G	6,3	1,8	2,3	15,2	19	42	774	67,0	1,15	1775	93,6	94,1	94,1	0,75	0,83	0,86	85,3
100	75	404/5T	292	G	6,2	2,2	2,5	17,5	14	31	895	69,0	1,15	1775	93,6	94,1	94,1	0,76	0,84	0,86	116
125	90	404/5T	365	G	6,5	2,1	2,3	21,5	12	26	983	69,0	1,15	1775	94,1	94,5	94,5	0,76	0,84	0,86	139
150	110	444/5T	437	G	6,4	1,9	2,0	42,3	20	44	1365	78,0	1,15	1780	94,5	95,0	95,0	0,77	0,84	0,86	169
200	150	444/5T	582	G	6,2	1,8	2,1	42,3	20	44	1365	78,0	1,15	1780	94,5	95,0	95,0	0,77	0,83	0,86	230
250	185	444/5T	728	G	6,4	1,9	2,2	51,5	17	37	1513	78,0	1,15	1780	95,0	95,4	95,4	0,77	0,84	0,86	283
VI Poles																					
7,5	5,5	254T	33,0	H	6,4	2,0	2,5	2,29	25	55	240	59,0	1,15	1178	86,5	88,5	88,5	0,64	0,75	0,81	9,63
10	7,5	254/6T	44,1	H	6,3	2,3	2,6	3,12	24	53	284	59,0	1,15	1175	87,5	89,5	90,2	0,65	0,76	0,82	12,7
15	11	284T	66,1	G	6,2	2,2	2,3	4,48	23	51	326	59,0	1,15	1175	89,5	90,2	90,2	0,71	0,81	0,85	18,0
20	15	284/6T	88,2	G	5,8	2,5	2,3	5,45	17	37	366	59,0	1,15	1175	90,2	91,0	91,0	0,71	0,81	0,84	24,6
25	18,5	324T	110	G	5,9	1,8	2,2	6,66	20	44	445	62,0	1,15	1180	91,0	91,7	91,7	0,67	0,77	0,82	30,9
30	22	324/6T	132	G	6,0	1,8	2,2	7,50	16	35	485	62,0	1,15	1180	91,0	91,7	92,4	0,67	0,77	0,82	36,4
40	30	364/5T	175	G	6,1	1,5	2,0	18,5	28	62	736	65,0	1,15	1185	92,4	93,0	93,0	0,76	0,84	0,86	47,1
50	37	364/5T	219	G	6,2	2,0	2,1	20,7	20	44	770	65,0	1,15	1185	92,4	93,0	93,0	0,76	0,84	0,86	58,1
60	45	404/5T	263	G	6,1	1,9	2,0	25,0	17	37	904	68,0	1,15	1180	93,0	93,6	93,6	0,78	0,85	0,86	70,2
75	55	404/5T	329	G	6,3	1,8	2,1	27,2	14	31	939	68,0	1,15	1180	93,0	93,6	93,6	0,76	0,82	0,86	85,8
100	75	444/5T	436	G	5,8	2,0	2,2	60,6	24	53	1358	69,0	1,15	1187	93,6	94,1	94,1	0,66	0,77	0,81	124
125	90	444/5T	547	G	6,1	1,7	2,3	63,2	16	35	1387	69,0	1,15	1185	93,0	94,1	94,1	0,65	0,76	0,81	148
150	110	444/5T	656	G	6,0	1,7	2,2	76,4	15	33	1530	69,0	1,15	1185	93,6	94,5	94,5	0,67	0,77	0,81	180

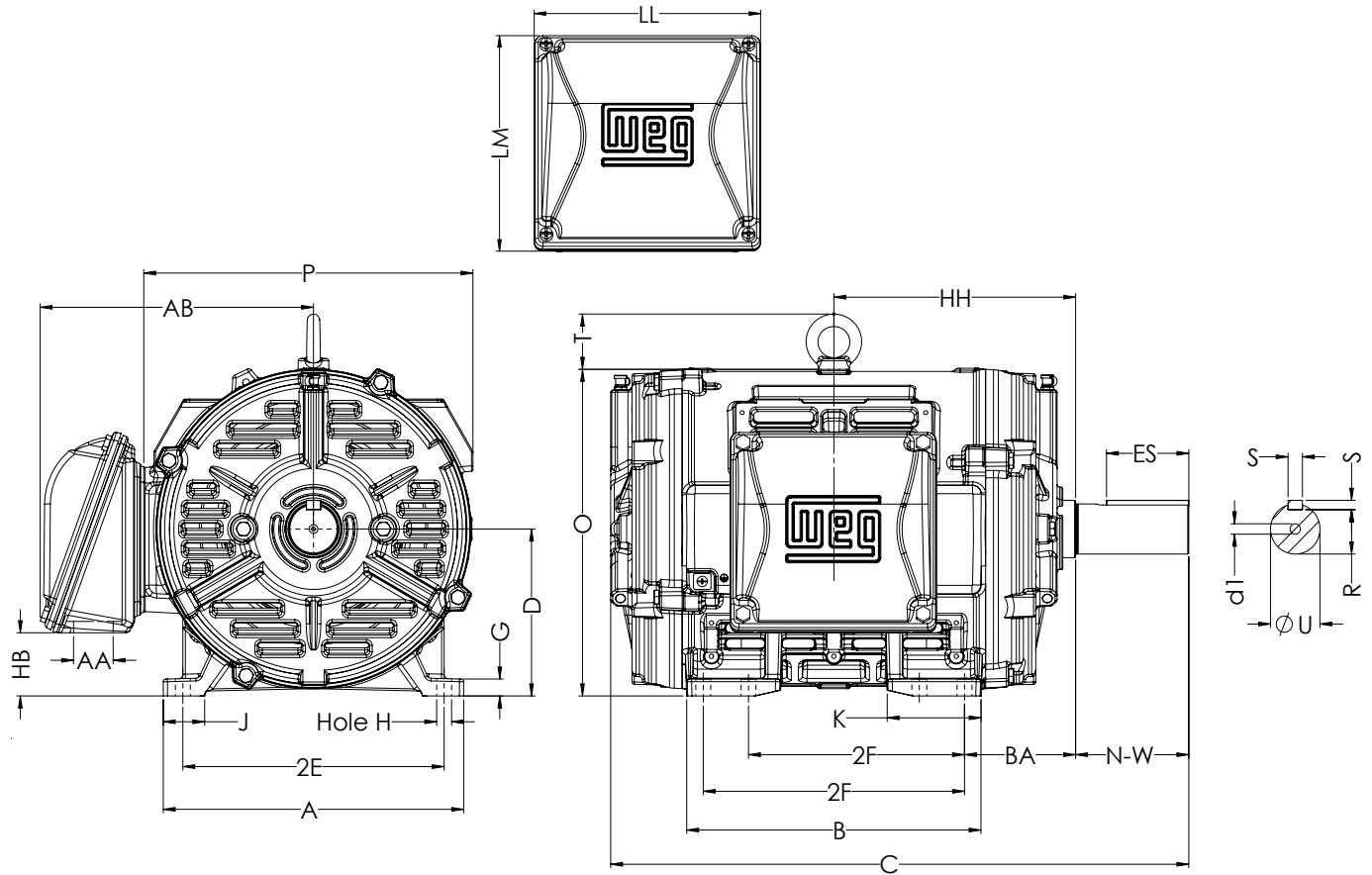


W40 - High Efficiency

Output		Frame	Full Load Torque (ft.lb)	Locked Rotor Current		Locked Rotor Torque Tl/Tn	Break-down Torque Tb/Tn	Inertia J (sq.ft.lb)	Allowable locked rotor time (s)		Weight (lb)	Sound dB(A)	Service Factor	460 V							
				Code	ll/In				Rated speed (rpm)	% of full load				Full load current In (A)							
										Efficiency					Power Factor						
HP	kW							Hot	Cold					50	75	100	50	75	100		
II Poles																					
20	15	254T	29,4	G	5,9	1,7	2,4	0,8718	16	35	238	72,0	1,15	3530	89,5	90,2	90,2	0,77	0,85	0,86	24,3
25	18,5	254/6T	36,7	G	6,1	1,9	2,6	0,9592	15	33	260	72,0	1,15	3530	89,5	91,0	91,0	0,72	0,82	0,86	29,7
30	22	284TS	43,9	G	6,2	1,7	2,6	1,59	16	35	324	73,0	1,15	3540	90,2	91,0	91,0	0,74	0,83	0,87	34,9
40	30	284/6TS	58,6	G	6,1	1,7	2,5	1,91	10	22	359	73,0	1,15	3535	91,0	91,7	91,7	0,78	0,86	0,87	47,2
50	37	324TS	72,9	F	5,8	1,7	2,0	3,01	20	44	450	75,0	1,15	3555	91,7	92,4	92,4	0,78	0,84	0,86	58,4
60	45	324/6TS	87,4	F	5,9	1,8	2,0	3,41	17	37	490	75,0	1,15	3555	92,4	93,0	93,0	0,78	0,84	0,86	70,6
75	55	364/5TS	109	F	5,8	1,6	2,1	5,60	26	57	703	82,0	1,15	3555	91,0	92,4	93,0	0,80	0,85	0,87	85,3
100	75	364/5TS	146	F	5,7	1,7	2,3	6,80	15	33	756	82,0	1,15	3550	92,4	93,0	93,0	0,80	0,85	0,88	115
125	90	404/5TS	183	G	6,6	1,8	2,3	8,03	15	33	878	84,0	1,15	3545	93,0	93,6	93,6	0,80	0,86	0,88	137
150	110	404/5TS	219	G	6,6	1,7	2,2	9,20	11	24	931	84,0	1,15	3550	93,0	93,6	93,6	0,84	0,89	0,90	164
200	150	444/5TS	291	F	5,8	1,4	2,1	21,8	27	59	1341	85,0	1,15	3565	93,0	94,1	94,5	0,82	0,87	0,89	224
250	185	444/5TS	363	G	6,4	1,3	2,2	23,8	20	44	1405	85,0	1,15	3570	93,6	94,5	94,5	0,77	0,84	0,87	282
300	220	444/5TS	437	F	5,9	1,3	2,0	28,1	16	35	1524	85,0	1,15	3560	94,1	94,5	95,0	0,85	0,89	0,89	327
IV Poles																					
15	11	254T	44,0	G	6,1	2,0	2,5	2,14	18	40	258	62,0	1,15	1765	89,5	91,0	91,0	0,67	0,78	0,83	18,3
20	15	254/6T	58,9	G	5,8	2,3	2,7	2,63	13	29	293	62,0	1,15	1760	90,2	91,0	91,0	0,70	0,80	0,84	24,6
25	18,5	284T	73,4	G	6,0	2,3	2,3	2,88	23	51	331	64,0	1,15	1765	91,0	91,7	91,7	0,68	0,79	0,84	30,1
30	22	284/6T	88,1	G	6,3	2,5	2,7	3,70	22	48	381	64,0	1,15	1765	91,7	92,4	92,4	0,71	0,80	0,84	35,6
40	30	324T	117	G	6,0	1,8	2,1	5,37	20	44	459	66,0	1,15	1775	92,4	93,0	93,0	0,72	0,81	0,84	48,2
50	37	324/6T	146	G	6,0	2,4	2,3	5,98	15	33	498	66,0	1,15	1775	92,4	93,0	93,0	0,67	0,78	0,83	60,2
60	45	364/5T	175	G	6,1	1,8	2,3	12,8	22	48	723	67,0	1,15	1777	93,0	93,6	93,6	0,73	0,82	0,85	71,0
75	55	364/5T	219	G	6,3	1,8	2,3	15,2	19	42	774	67,0	1,15	1775	93,6	94,1	94,1	0,75	0,83	0,86	85,3
100	75	404/5T	292	G	6,2	2,2	2,5	17,5	14	31	895	69,0	1,15	1775	93,6	94,1	94,1	0,76	0,84	0,86	116
125	90	404/5T	365	G	6,5	2,1	2,3	21,5	12	26	983	69,0	1,15	1775	94,1	94,5	94,5	0,76	0,84	0,86	139
150	110	444/5T	437	G	6,4	1,9	2,0	42,3	20	44	1365	78,0	1,15	1780	94,5	95,0	95,0	0,77	0,84	0,86	169
200	150	444/5T	582	G	6,2	1,8	2,1	42,3	20	44	1365	78,0	1,15	1780	94,5	95,0	95,0	0,77	0,83	0,86	230
250	185	444/5T	728	G	6,4	1,9	2,2	51,5	17	37	1513	78,0	1,15	1780	95,0	95,4	95,4	0,77	0,84	0,86	283
VI Poles																					
7,5	5,5	254T	33,0	H	6,4	2,0	2,5	2,29	25	55	240	59,0	1,15	1178	86,5	88,5	88,5	0,64	0,75	0,81	9,63
10	7,5	254/6T	44,1	H	6,3	2,3	2,6	3,12	24	53	284	59,0	1,15	1175	87,5	89,5	90,2	0,65	0,76	0,82	12,7
15	11	284T	66,1	G	6,2	2,2	2,3	4,48	23	51	326	59,0	1,15	1175	89,5	90,2	90,2	0,71	0,81	0,85	18,0
20	15	284/6T	88,2	G	5,8	2,5	2,3	5,45	17	37	366	59,0	1,15	1175	90,2	91,0	91,0	0,71	0,81	0,84	24,6
25	18,5	324T	110	G	5,9	1,8	2,2	6,66	20	44	445	62,0	1,15	1180	91,0	91,7	91,7	0,67	0,77	0,82	30,9
30	22	324/6T	132	G	6,0	1,8	2,2	7,50	16	35	485	62,0	1,15	1180	91,0	91,7	92,4	0,67	0,77	0,82	36,4
40	30	364/5T	175	G	6,1	1,5	2,0	18,5	28	62	736	65,0	1,15	1185	92,4	93,0	93,0	0,76	0,84	0,86	47,1
50	37	364/5T	219	G	6,2	2,0	2,1	20,7	20	44	770	65,0	1,15	1185	92,4	93,0	93,0	0,76	0,84	0,86	58,1
60	45	404/5T	263	G	6,1	1,9	2,0	25,0	17	37	904	68,0	1,15	1180	93,0	93,6	93,6	0,78	0,85	0,86	70,2
75	55	404/5T	329	G	6,3	1,8	2,1	27,2	14	31	939	68,0	1,15	1180	93,0	93,6	93,6	0,76	0,82	0,86	85,8
100	75	444/5T	436	G	5,8	2,0	2,2	60,6	24	53	1358	69,0	1,15	1187	93,6	94,1	94,1	0,66	0,77	0,81	124
125	90	444/5T	547	G	6,1	1,7	2,3	63,2	16	35	1387	69,0	1,15	1185	93,0	94,1	94,1	0,65	0,76	0,81	148
150	110	444/5T	656	G	6,0	1,7	2,2	76,4	15	33	1530	69,0	1,15	1185	93,6	94,5	94,5	0,67	0,77	0,81	180

15. Mechanical Data

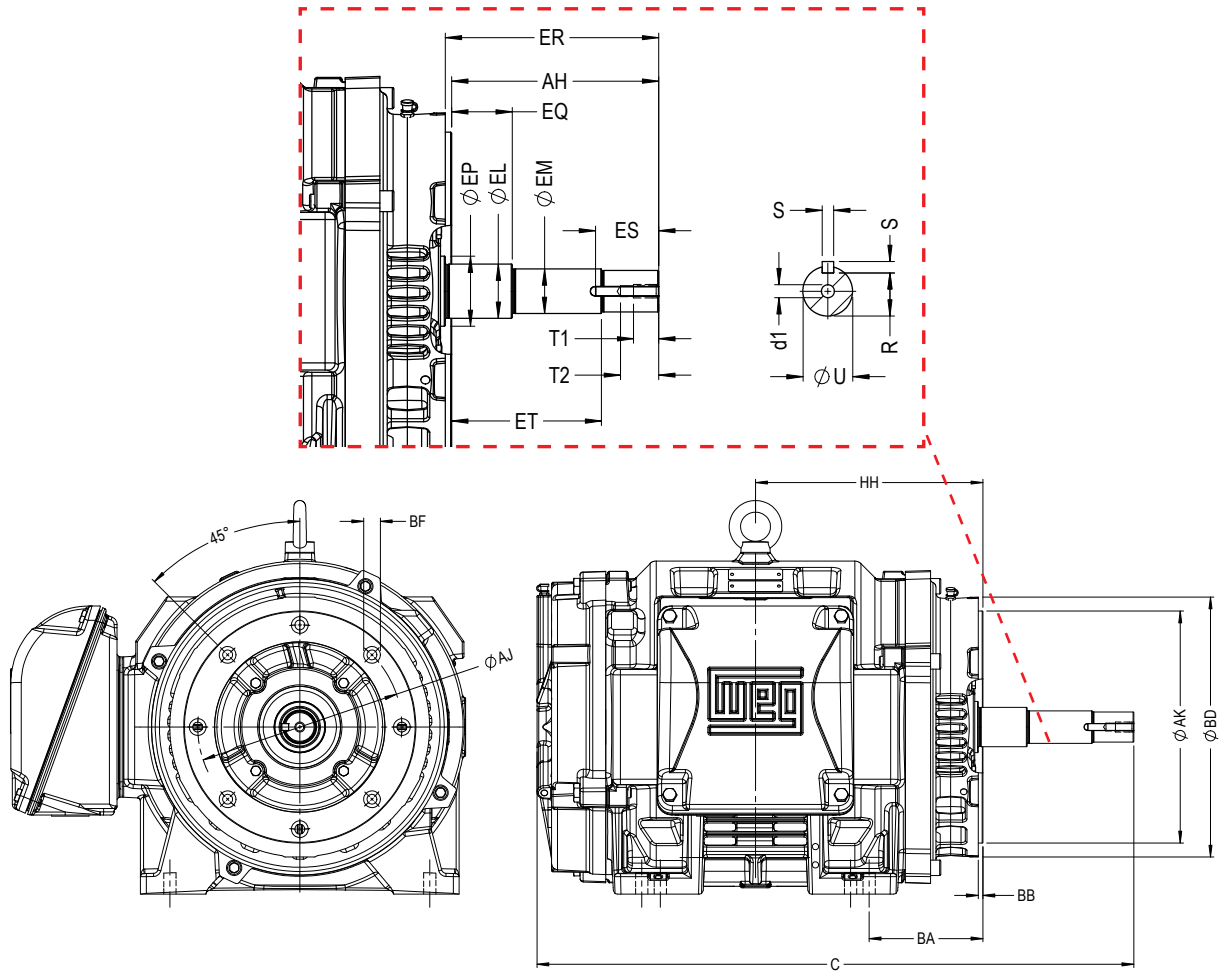
15.1. Frames 254T to 444/5TS



Frame	Mounting				A	B	C	D	G	J	K	O	P	T
	2E	2F	H	BA										
254T	10	8.25	0.530	4.250	11.496	9.507	20.537	6.250	0.630	1.526	3.012	12.336	12.598	1.994
254/6T		8.25 / 10				11.200	22.285				3.563	12.337		
284T	11	9.5		4.750	13.780	11.032	23.158	7.000	0.787	2.496	3.434	13.811	14.134	1.909
284TS		9.5 / 11				12.529	21.783				3.847			
284/6T			12.5	10.5	5.250	15.157	24.658	8.000	0.984	2.802	4.359	15.531	15.669	2.214
284/6TS		10.5 / 12					27.307							
324T	12.5	11.25 / 12.25	0.660	5.875	17.165	29.725	9.000	1.181	3.524	4.845	18.409	18.504	2.795	
324TS						12.25 / 13.75								0.810
324/6T		16	14.5 / 16.5	7.500	21.260		19.737	34.100	11.000	2.944	6.819	21.945	22.467	
324/6TS						31.100		38.108						34.358

Frame	Terminal Box				Bearing		Keyway			Shaft Extension					
	AB	HB	HH	AA	LL	LM	DE	NDE	S	R	ES	N-W	U	d1	
254T	10.462	2.360	8.376	NPT 1.1/2"	7.813	7.494	6309-Z-C3	6209-Z-C3	0.375	1.416	2.756	4.000	1.625	A4	
254/6T			9.250												
284T	11.933	2.670	9.500		8.571	8.993	6311-Z-C3	6211-Z-C3	0.500	1.591	3.150	4.625	1.875		
284TS			0.374						1.416	2.480	3.250	1.625			
284/6T			10.250	0.500	1.591	3.150	4.625		1.875						
284/6TS			0.374	1.416	2.480	3.250	1.625								
324T	13.394	3.658	10.500	NPT 2"	8.993	9.921	6312-Z-C3	6212-Z-C3	0.500	1.845	3.937	5.250	2.125		
324TS			11.250							1.591	2.756	3.750	1.875		
324/6T			0.500	1.845	3.937	5.250	2.125								
324/6TS			1.591	2.756	3.750	1.875									
364/5T	15.583	4.256	12.000	NPT 3"	10.591	11.262	6314-C3	6212-Z-C3	0.625	2.020	4.331	5.875	2.375		UNC 3/4"
364/5TS							0.500		1.591	1.969	3.750	1.875			
404/5T			5.256	13.500	2xNPT 3"	14.940	15.063	6316-C3	6314-C3	0.750	2.449	5.512	7.250	2.875	
404/5TS								6319-C3		0.500	1.845	2.756	4.250	2.125	
444/5T	18.711	4.878	15.750	2xNPT 3"	14.940	15.063	6319-C3	6314-C3	0.875	2.878	7.087	8.500	3.375		
444/5TS							6314-C3		0.625	2.021	4.331	4.750	2.375		

15.2. Frames 254 to 404/5JM/JP



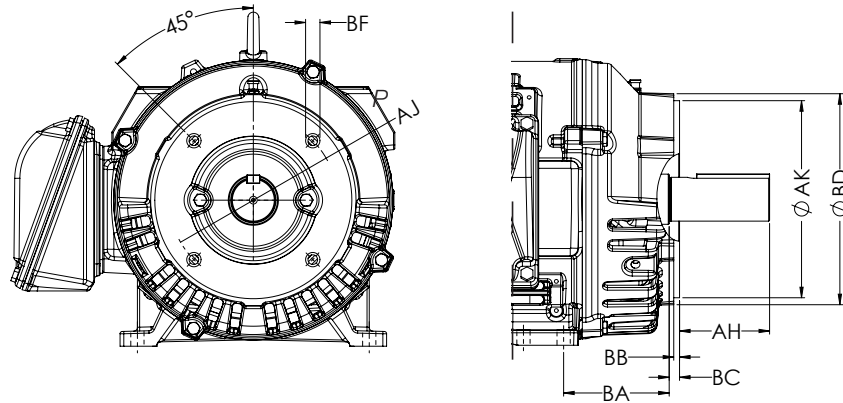
Frame	Frame JM/JP							
	Mounting		Flange					
	BA	HH	AJ	AK	BB	BD	BF Number	BF Tap size
254 JM/JP	4.980	9.106	7.250	8.500	0.250	9.000	4.000	UNC1/2"x13
254/6 JM/JP		9.980						
284 JM/JP		9.750						
284/6 JM/JP	5.000	10.500	11.000	12.500	14.000	8.000	UNC5/8"x11	
324 JM/JP		10.750						
324/6 JM/JP	5.500	11.500						
364/5 JM/JP	5.880	12.000						
404/5 JM/JP	6.620	13.500						

Frame	Shaft end - Type JM														C (JM)
	Lengths				Diameters				Keyway			Threaded Hole			
	AH	ER	EQ	ET	U	EM	EL	EP	S	R	ES	d1 (UNC)	T1	T2	
254 JM	5.229	5.250	0.610	2.985	1.250	1.375	1.750	1.764	0.250	1.110	2.480	1/2"x13-2B	1.100	1.500	22.517
254/6 JM								24.264							
284 JM								24.033							
284/6 JM	5.250	0.630	3.005	1.250	1.375	1.750	2.157	0.250	1.110	2.480	1/2"x13-2B	1.100	1.500	25.533	
324 JM							26.057								
324/6 JM	5.500	0.630	3.005	1.250	1.375	1.750	2.354	0.250	1.110	2.480	1/2"x13-2B	1.100	1.500	27.557	
364/5 JM							29.270								

Frame	Shaft end - Type JP														C (JP)
	Lengths				Diameters				Keyway			Threaded Hole			
	AH	ER	EQ	ET	U	EM	EL	EP	S	R	ES	d1 (UNC)	T1	T2	
254 JP	8.110	8.130	2.362	5.886	1.250	1.375	1.750	1.764	0.250	1.110	2.480	1/2"x13-2B	1.100	1.500	25.398
254/6 JP								27.146							
284 JP								26.913							
284/6 JP	8.130	2.382	5.886	1.250	1.375	1.750	2.157	0.250	1.110	2.480	1/2"x13-2B	1.100	1.500	28.413	
324 JP							28.937								
324/6 JP	8.130	2.382	5.886	1.250	1.375	1.750	2.354	0.250	1.110	2.480	1/2"x13-2B	1.100	1.500	30.437	
364/5 JP							32.150								
404/5 JP	8.380				1.624	1.750	2.125	2.753	0.380	1.413					35.152

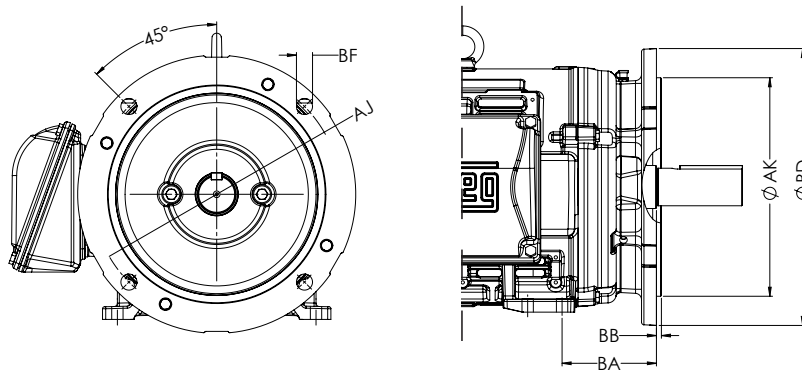
15.3. Flange Mounted Motors

“C” Flange



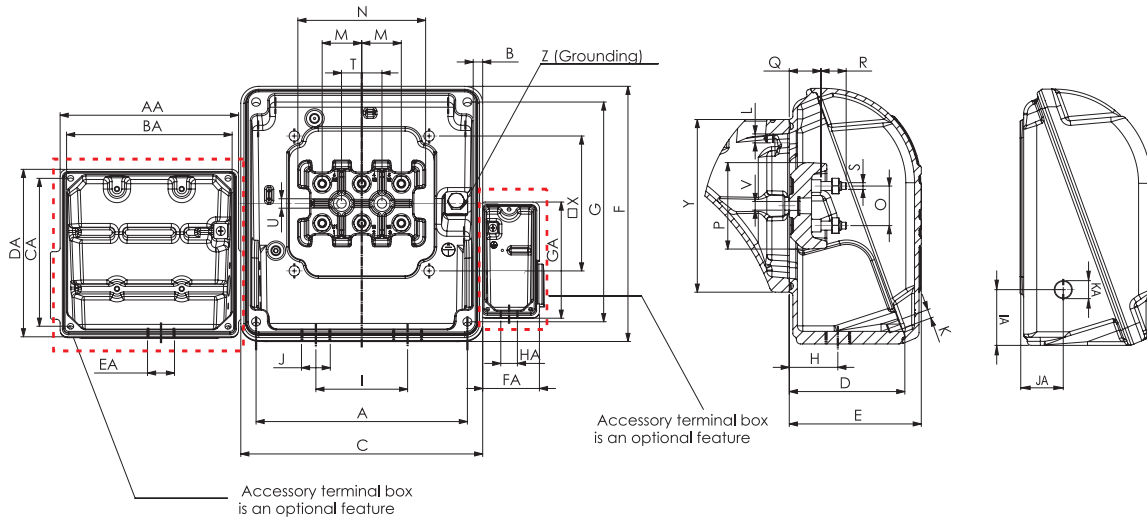
Frame	AJ	BF		AK	BD	BA	BB	BC	AH	C	HH			
		Number	Tap size											
254TC	7.252	4	UNC1/2"-13	8.500	9.019	4.750	0.250	0.250	3.750	21.037	8.876			
254/6TC										22.785				
284TC	9.000			10.500	11.295				4.750	4.375	23.158	9.500		
284TSC										3.000	21.783			
284/6TC				3.000	23.283				10.250					
284/6TSC										5.000	25.807			
324TC			11.000	UNC5/8"-11	12.500	14.023			5.250	0.250	0.250	3.500	24.307	11.250
324TSC												5.000	27.307	
324/6TC	3.500				25.807	12.000								
324/6TSC									5.625	29.725				
364/5TC	3.500				27.600	13.500								
364/5TSC									7.000	34.100				
404/5TC	4.000	31.100	15.750											
404/5TSC				8.250	38.325									
444/5TC	14.000	16.000	18.024	7.500	0.250	0.250	4.500	34.358						
444/5TSC							4.500	34.358						

“D” Flange



Frame	BA	AJ	AK	BD	BF		BB	C	HH		
					Number	Tap size					
254TD	4.750	12.500	11.000	13.934	4	0.810	0.250	21.037	8.876		
254/6TD								22.785			
284TD				13.976				9.500			
284TSD									21.783		
284/6TD				24.658				10.250			
284/6TSD									23.283		
324TD	5.250	16.000	14.000	17.717				0.810	0.250	25.807	11.250
324TSD										24.307	
324/6TD				27.307				12.000			
324/6TSD									25.807		
364/5TD				5.875				17.633	12.000		
364/5TSD										29.725	
404/5TD	6.625	20.000	18.000	21.571	8	0.810	0.250	34.100	13.500		
404/5TSD								31.100			
444/5TD	7.500	22.105	15.750								
444/5TSD				38.325							
								34.358			

16. Terminal Box Drawing



Frames	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U									
254/6T	6.890	0.328	7.813	3.487	3.828	7.494	6.890	1.811	3.307	NPT 1 1/2"	M8 x 1.25	M8 x 1.25	1.102	3.547	1.102	2.432	0.846	0.807	M6 x 1.0	1.102	0.260									
284/6T	8.031	0.348	8.571	4.134	4.456	8.993	8.031	2.205	3.701				NPT 2"	M8 x 1.25	M8 x 1.25	1.378	4.415	1.378	2.988	0.945	0.945	M8 x 1.25	1.378	0.374						
324/6T			8.993	4.808	5.141	9.921	9.449	2.323		NPT 3"	M10 x 1.5	M10 x 1.5				1.732	5.520	1.732	3.783	1.142	1.102	M10 x 1.5	1.772	0.413						
364/5T	9.252	0.502	10.591	5.177	6.016	11.262	10.236	2.677	4.331				M12 x 1.75	M12 x 1.75	1.772										6.031	1.772	4.358	1.457	1.575	M12 x 1.75
404/5T	13.386	0.561	14.940	6.363	7.176	15.063	13.583	3.346	6.299																					
444/5T																														

Frames	V	X	Y	Z	AA	BA	CA	DA	EA	FA	GA	HA	Maximum connector number			Volume (in ³)
													Main	Accessories	Space heater	
254/6T	M6 x 1.0	4.331	5.439	5.2-25 mm ²	5.450	4.606	4.606	5.130	NPT 3/4"	2.656	3.883	NPT 3/4"	12	26	4	135
284/6T		4.724	5.793	5.2-35 mm ²												210
324/6T	M8 x 1.25	5.906	7.568	25-50 mm ²							5.064		16			290
364/5T	M10 x 1.5															460
404/5T																1100
444/5T																

17. Packaging

For frames 254T to 444/5T, the motors are packaged in wooden crates (see Figure 26). Dimensions, weights and volumes are in Table 19.



Figure 26 - Wooden crates.

Frame	External height (in)	External width (in)	External length (in)	Weight (lbf)	Volume (ft ³)
254T	15.827	20.157	29.134	21.7	5.4
254/6T					
284T	17.795	22.520	32.283	29.6	7.5
284/6T					
324T	19.370	24.882	36.646	32.1	9.7
324/6T					
364/5T	30.709	33.465	45.276	109.6	26.9
404/5T					
444/5T	37.402	37.402	49.213	151.5	39.8

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

Table 19 - Wooden crates dimensions, weights and volumes for side mounting.

18. Drip Cover Data

Utilization of a rain drip cover increases the total length of the motor. The additional length can be seen in the table 20.

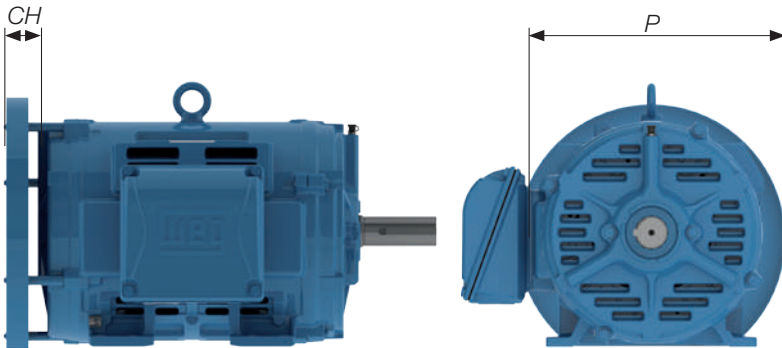


Figure 27 - Motor with drip cover.

Frame	Dimension CH (inches)	P (inches)
254/6T	1.831	14.913
284/6T	1.870	16.213
324/6T		17.669
364/5T	2.461	19.804
404/5T	2.382	19.803
444/5T	3.091	24.402

Table 20 - Increasing the total length and P dimension of the motor with drip cover.

19. Distance from NDE to the Wall

See in table 21 the distance from NDE to the wall.

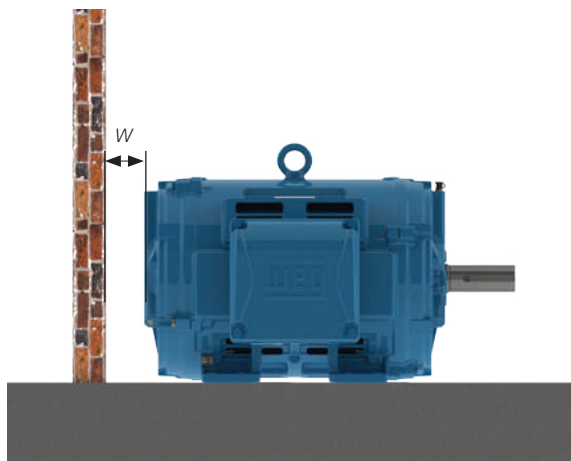


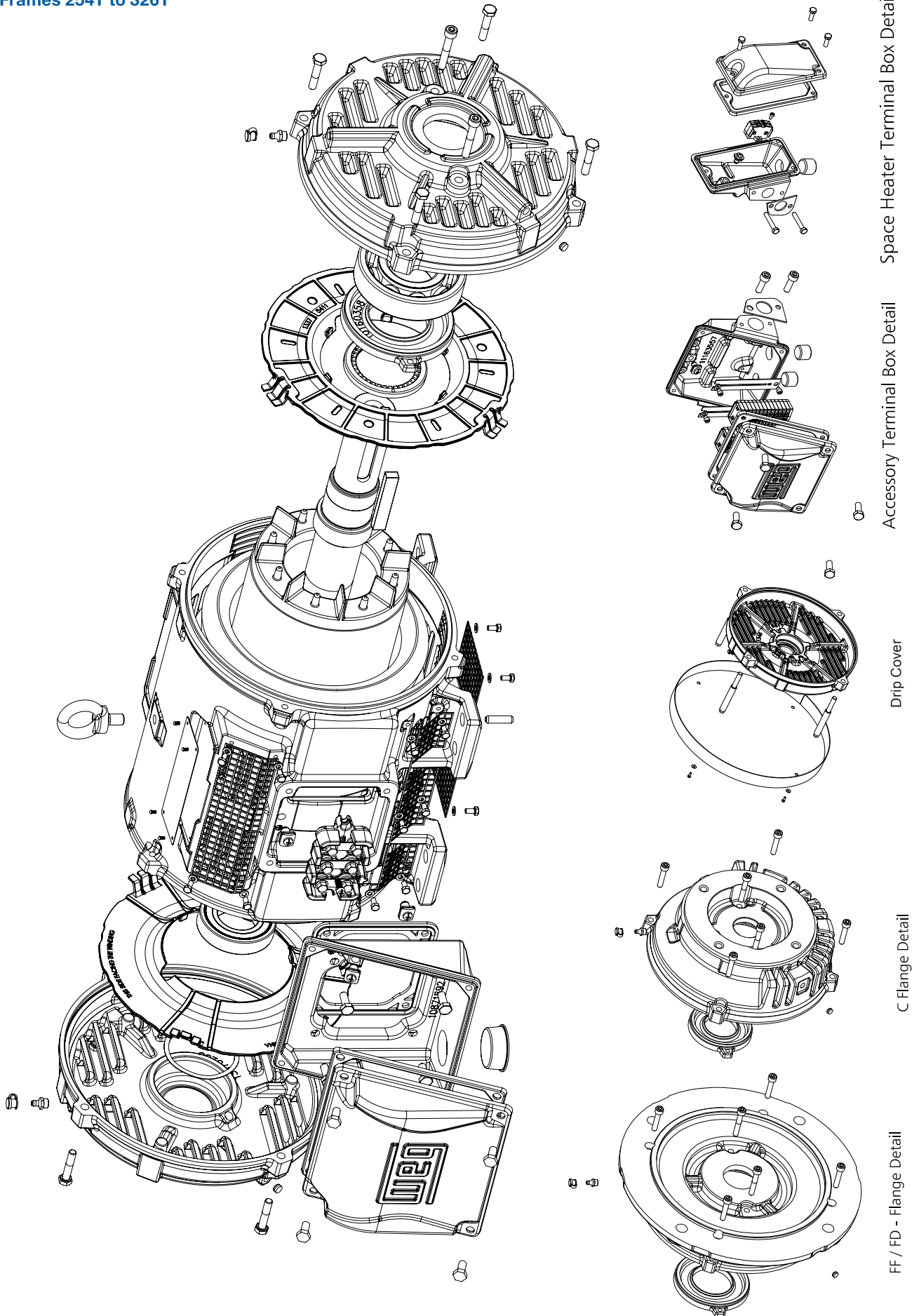
Figure 28 - Distance from NDE to the wall.

Frame	W - Distance from NDE to wall [in]
254/6T	2.755
284/6T	3.051
324/6T	3.396
364/5T	3.740
404/5T	3.740
444/5T	4.724

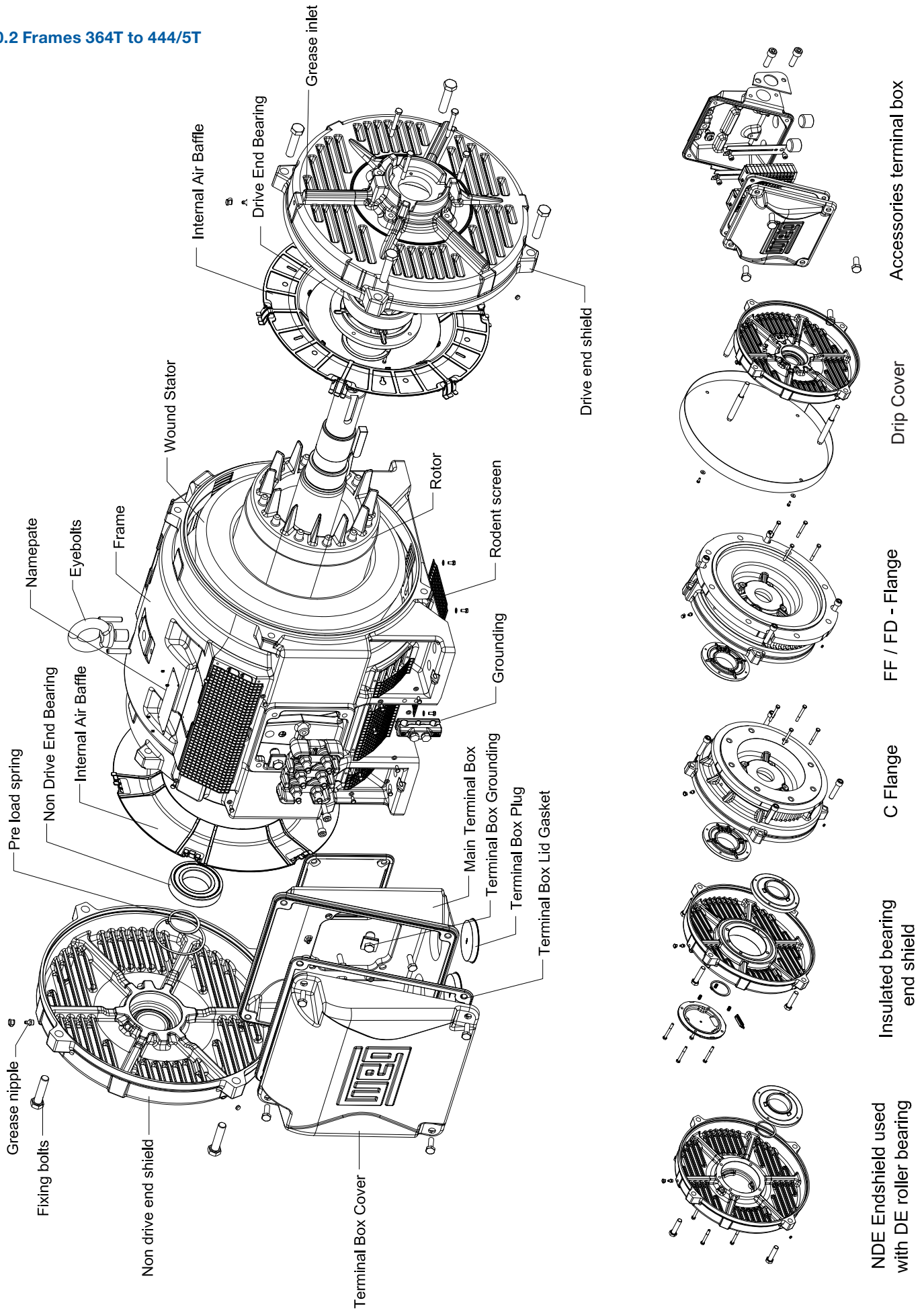
Table 21 - Distance from NDE to the wall.

20. Spare Parts

20.1 Frames 254T to 326T



20.2 Frames 364T to 444/5T



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