



NEMA

Electric Motor Frame Standards



NEMA Electric Motor Frame Standards

You need a drop-in electric motor replacement and you've got the NEMA frame size from the motor's nameplate. It's important to remember that just because the frame size matches, one cannot assume that the motor will function or fit properly in place of the old motor.

What is NEMA?

NEMA stands for National Electrical Manufacturers Association, which is the United States' largest trade association for electrical equipment manufacturers. The association provides advocacy, offers business analytics, and develops industry standards.

These standards relate to "products that have been commercially standardized and are subject to repetitive manufacture," such as electric motors. Of particular interest is the NEMA MG-1 standard for Motors and Generators.



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NEMA Frame Size

To source a replacement, you'll need to find your machine's NEMA frame number on its tag or nameplate on your motor.

AC Induction Motor					
HIGH EFFICIENT					
ORD. NO.	1LA0264SE41	E NO.			
TYPE	RGZESD	FRAME	286T		
H.P.	30.0	SERVICE FACTOR	1.15		3 PH
AMPS.	35.0	VOLTS	460		
R.P.M.	1765	HERTZ	60		
DUTY	CONT 40 C AMB	DATE CODE			
CLASS INSUL	F NEMA DESIGN B	KVA CODE G	NEMA NOM. EFF	93.0	
SH END BRG	50RU03K30	OPP END BRG	50BC03JPP3		
Made in Mexico					

In the example above, the NEMA frame size is 286T, but what does that mean? Read on to find out!

Information and key dimensions about foot- and motors equipped with a mounting flange are indicated by NEMA frame sizes. They also provide basic information about motor mounting dimensions.

It should be noted that the frame size does not have direct bearing on the diameter or overall length of the motor body.



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What can NEMA Frame Sizes Tell Us?

NEMA frame sizes include two or three numbers.

Two-digit numbers are assigned to fractional frames which generally designate a motor with a rated output of 1 hp or smaller and sometimes are followed by a letter. Three-digit numbers are followed by the letter "T" for modern NEMA frames and sometimes extra letters that define a special characteristic of the motor. Three-digit numbers are assigned to integral frames, and always have a rated output of 1 hp or greater.

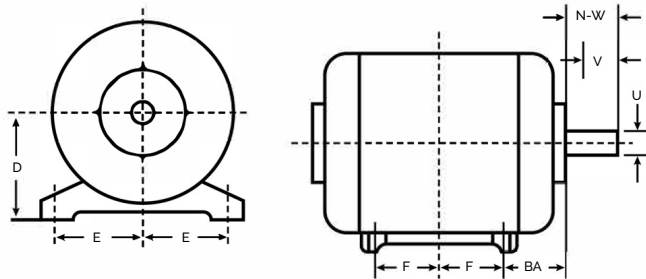
When looking at a frame chart, the D Dimension, which is the distance from the bottom of the motor mount to the centerline of the shaft, is represented by the first number in a two-digit format and the first two numbers in a three-digit format. Examples can be found on the next page.

Any letters or numbers appearing in front of a NEMA frame number are manufacturer-specific.

Once you know a frame number, you can obtain dimensions D, E, F, BA, N-W, U, and V. These dimensions are standardized across all manufacturers unless a suffix at the end of the dimensions indicates otherwise.



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Interpreting NEMA Frame Sizes

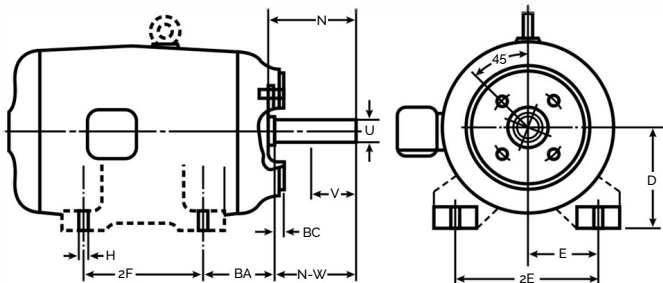
You can determine the motor's shaft height (D), the distance from the base to the centerline of the shaft, with the given NEMA frame size.

- + If there are 2 digits (X:X)
 $D = (\text{the two digits}) / 16$
- + If there are 3 digits (X:X:X)
 $D = (\text{the first two digits}) / 4$

The rest of the standardized dimensions (E, 2F, BA, N-W, V, and U) can be found in a NEMA Frame Dimensions Table such as

[The Engineering Toolbox.](#)

The various dimensions are shown below.





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Frame Number Suffixes

Letters included after a NEMA frame size are very important. The most common suffixes are summarized and explained on page 6.

Problems can come up in referencing NEMA frame size suffixes. While T means all manufacturers of a given motor use the same 2F and 2E, the motors may come in different ratings.

For example, a 256T could be a 20 HP @ 1,800 RPM, 15 HP @ 1,200 RPM, or 25HP @ 3,600 RPM.

NEMA also does not regulate the C dimension, which is the overall length of the motor from the end of the shaft to the back of the motor. As a result, this dimension varies by manufacturer. This is very important when trying to install a replacement motor in a tight space.

Finding a replacement motor with the same NEMA frame size doesn't necessarily mean it will work as a drop-in replacement. To be safe, it is imperative to check with the motor supplier to find out if the non-standardized physical dimensions will work for your application.

The Y suffix after a NEMA frame size means that the motor has special mounting dimensions and you'll have to contact the motor supplier to find out what they are. Installation will be very challenging if you don't notice the Y suffix and do your research.

The Z suffix also requires extra attention. It means that the shaft has dimensions which deviate from the standard. Finding a match without factoring in the original motor's deviations could present a challenge.



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<i>NEMA Frame Number Suffix</i>	<i>Meaning</i>
C	Type C face mounting on DE
CH	The type C face-mounting dimensions are different from those for the frame designation having just the suffix letter C
D	Type D flange mounting on DE
H	Designated 56H motors have two sets of 2F mounting holes (3" and 5")
J	Face mount for jet pumps
JM	Face-mounted, close-coupled pump motors
JP	Type C face-mounted, close-coupled pump motors
K	Has hub for sump pump mounting
LP or LPH	Type P flange-mounted, vertical solid-shaft motors
M, N	Flange mount for oil-burner motors
P or PH	Type P flange-mounted vertical hollow shaft motors
R	Drive end tapered shaft extension
S	Short shaft for direct connection
T	Included as part of a frame designation for which standard dimensions have been established
U	Previously used as part of a frame designation for which standard dimensions have been established
V	Vertical mounting only
VP	Type-P flange-mounted, vertical solid shaft motors
X	Double shaft extension
Y	Special mounting dimensions (contact manufacturer for the dimensions)
Z	All mounting dimensions are standard except the shaft extensions; can also be used to designate double shaft extensions (contact manufacturer for dimensions)



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Interpreting a NEMA Frame Size

Let's say you need to replace a 324T electric motor. There are three digits and a T suffix. Since there are three digits, then $D = 32" / 4" = 8"$.

When we look up 324T in a NEMA frame size chart, we see that $D = 8"$, $E = 6.25"$, $F = 5.25"$, $BA = 5.25"$, $N-W = 4.875"$, and $U = 2.125"$. Using a keyseat dimensions chart with $U = 2.125"$, $R = 1.844"$, and $S = 0.5"$.

The lack of a Z or Y suffix indicates that the shaft and mounting hole dimensions are the same for all motors with the same frame size. Without any physical obstructions surrounding the motor, two 324T motors will mount onto the foundation and couple up the same. The main terminal box might be in different locations on the motor and may cause issues when trying to connect the motor to incoming power.

Where do ANEMA Motors Fit In?

Unlike NEMA frames, some medium and high voltage motor frame sizes do not have standard mounting dimensions like NEMA motors. These larger frame sizes are often referred to as Above-NEMA or ANEMA motors.

For ANEMA motors, clarifying the frame dimensions with the motor manufacturer is required.



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HECO Can Help!

It's one thing to track down the right NEMA frame size, but another to make sure it fits. While the frame size might be right, you need to check with the motor supplier to make sure the non-NEMA standardized dimensions are acceptable.

If you need help finding the right replacement motor (or surplus motor) for your application, let the experts at HECO help! We carry a wide range of electric motors from manufacturers:

- | | |
|---------------------|----------------------------------|
| + ABB | + LEESON |
| + Baldor | + Marathon Electric |
| + Siemens | + Worldwide Electric Corporation |
| + Toshiba | + Hyundai |
| + TECO-Westinghouse | + Lafert Electric |
| + General Electric | + Leeson Electric |
| + WEG | + Techtop |
| + Dynamatic | + And More! |
| + Nidec U.S. Motors | |



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Contact us to learn more about HECO's expertise and let us help you find the perfect drop-in replacement motor.



Kalamazoo Service Center/Corporate Headquarters

3509 South Burdick Street
Kalamazoo, MI 49001 USA

Office: 269-381-7200
24-Hr Emergency:
800-432-2645

Metro Detroit Service Center

25575 Glendale
Redford, MI 48239 USA

Office: 313-794-1500

Kentucky Service Center

2328 Maggard Drive
Lexington, KY 40511 USA

Office: 859-254-6310





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Reference Tables

[Electric Motors - Frame Dimensions](#)

[NEMA Frame Assignments](#)

Additional Resources

Machinery's Handbook, Industrial Press Inc.

[Motors and Generators](#) (ANSI/NEMA MG 1-2016)

[Electric Motor NEMA Frame Table Chart Sizes](#)

[What Electric Motor Frame Size Tell You](#)

[NEMA T-frame Motors and Why They Are Not All the Same](#)

[Above NEMA Motors | HECO All Systems Go](#)