General Engineering Information

GEN

- NEMA Motor Information
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NEMA Motor Standards

NEMA Frame and H. P. Assignments for Open Type, Polyphase Squirrel-Cage 60 Cycle Motors

H.P.	3600 RPM			1800 RPM			1200 RPM		
	FRAME NO.			FRAME NO.			FRAME NO.		
	Old	1956	T	Old	1956	T	Old	1956	T
3/4	-	-	-	-	-	-	203	182	143T
1	-	-	-	203	182	143T	204	184	145T
1-1/2	203	182	143T	204	184	145T	224	184	182T
2	204	184	145T	224	184	145T	225	213	184T
3	224	184	145T	225	213	182T	254	215	213T
5	225	213	182T	254	215	184T	284	254U	215T
7-1/2	254	215	184T	284	254U	213T	324	256U	254T
10	284	254U	213T	324	256U	215T	326	284U	256T
15	324	256U	215T	326	284U	254T	364	324U	284T
20	326	284U	254T	364	286U	256T	365	326U	286T
25	364S	286U	256T	364	324U	284T	-	364U	324T
30	364S	324S	284TS	365	326U	286T	-	365U	326T
40	365S	326S	286TS	-	364U	324T	-	404U	364T
50	-	364US	324TS	-	365US	326T	-	405U	365T
60	-	365US	326TS	-	404US	364TS	-	444U	404T
75	-	404US	364TS	-	405US	365TS	-	445U	405T
100	-	405US	365TS	-	444US	404TS	-	-	444T
125	-	444US	404TS	-	445US	405TS	-	-	445T
150	-	445US	405TS	-	-	444TS	-	-	-
200	-	-	444TS	-	-	445TS	-	-	-
250	-	-	445TS	-	-	-	-	-	-

T Series Shaft Diameters

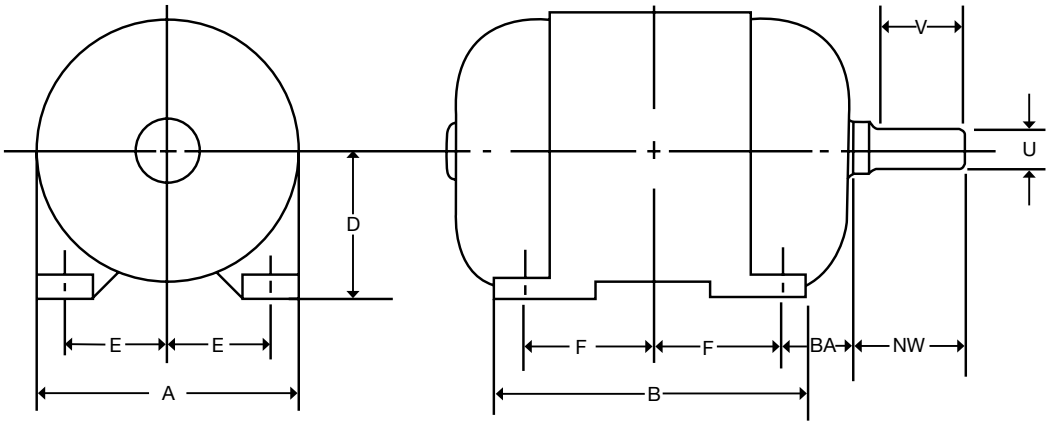
H.P.	3600 RPM		1800 RPM		1200 RPM	
	Frame No.	Shaft	Frame No.	Shaft	Frame No.	Shaft
3/4	-	-	-	-	143T	7/8
1	-	-	143T	7/8	145T	7/8
1-1/2	143T	7/8	145T	7/8	182T	1-1/8
2	145T	7/8	145T	7/8	184T	1-1/8
3	145T	7/8	182T	1-1/8	213T	1-3/8
5	182T	1-1/8	184T	1-1/8	215T	1-3/8
7-1/2	184T	1-1/8	213T	1-3/8	254T	1-5/8
10	213T	1-3/8	215T	1-3/8	256T	1-5/8
15	215T	1-3/8	254T	1-5/8	284T	1-7/8
20	254T	1-5/8	256T	1-5/8	286T	1-7/8
25	256T	1-5/8	284T	1-7/8	324T	2-1/8
30	284T	1-7/8	286T	1-7/8	326T	2-1/8
40	286T	1-7/8	324T	2-1/8	364T	2-3/8
50	324T	2-1/8	326T	2-1/8	365T	2-3/8
60	326T	2-1/8	364T	2-3/8	404T	2-7/8
75	364T	2-3/8	365T	2-3/8	405T	2-7/8
100	365T	2-3/8	404T	2-7/8	444T	3-3/8
125	404T	2-7/8	405T	2-7/8	445T	3-3/8
150	405T	2-7/8	444T	3-3/8	-	-
200	444T	3-3/8	445T	3-3/8	-	-
250	445T	3-3/8	-	-	-	-

TS Series Shaft Diameters

H.P.	3600 RPM		1800 RPM	
	Frame No.	Shaft	Frame No.	Shaft
30	284TS	1-5/8	-	-
40	286TS	1-5/8	-	-
50	324TS	1-7/8	-	-
60	326TS	1-7/8	364TS	1-7/8
75	364TS	1-7/8	365TS	1-7/8
100	365TS	1-7/8	404TS	2-1/8
125	404TS	2-1/8	405TS	2-1/8
150	405TS	2-1/8	444TS	2-3/8
200	444TS	2-3/8	445TS	2-3/8
250	445TS	2-3/8	-	-

NOTE: Suffix S denotes short shaft motor for direct coupled service. For belt drives consult motor manufacturer.

Dimensions



FRAME NO.	SHAFT		KEY			DIMENSIONS – INCHES						
	U	V	W	T	L	A	B	D	E	F	BA	NW
143T	7/8	2	3/16	3/16	1-3/8	7	6	3-1/2	2-3/4	2	2-1/4	2-1/4
145T	7/8	2	3/16	3/16	1-3/8	7	6	3-1/2	2-3/4	2-1/2	2-1/4	2-1/4
182	7/8	2	3/16	3/16	1-3/8	9	6-1/2	4-1/2	3-3/4	2-1/4	2-3/4	2-1/4
182T	1-1/8	2-1/2	1/4	1/4	1-3/4	9	6-1/2	4-1/2	3-3/4	2-1/4	2-3/4	2-3/4
184	7/8	2	3/16	3/16	1-3/8	9	7-1/2	4-1/2	3-3/4	2-3/4	2-3/4	2-1/4
184T	1-1/8	2-1/2	1/4	1/4	1-3/4	9	7-1/2	4-1/2	3-3/4	2-3/4	2-3/4	2-3/4
203	3/4	2	3/16	3/16	1-3/8	10	7-1/2	5	4	2-3/4	3-1/8	2-1/4
204	3/4	2	3/16	3/16	1-3/8	10	8-1/2	5	4	3-1/4	3-1/8	2-1/4
213	1-1/8	2-3/4	1/4	1/4	2	10-1/2	7-1/2	5-1/4	4-1/4	2-3/4	3-1/2	3
213T	1-3/8	3-1/8	5/16	5/16	2-3/8	10-1/2	7-1/2	5-1/4	4-1/4	2-3/4	3-1/2	3-3/8
215	1-1/8	2-3/4	1/4	1/4	2	10-1/2	9	5-1/4	4-1/4	3-1/2	3-1/2	3
215T	1-3/8	3-1/8	5/16	5/16	2-3/8	10-1/2	9	5-1/4	4-1/4	3-1/2	3-1/2	3-3/8
224	1	2-3/4	1/4	1/4	2	11	8-3/4	5-1/2	4-1/2	3-3/8	3-1/2	3
225	1	2-3/4	1/4	1/4	2	11	9-1/2	5-1/2	4-1/2	3-3/4	3-1/2	3
254	1-1/8	3-1/8	1/4	1/4	2-3/8	12-1/2	10-3/4	6-1/4	5	4-1/8	4-1/4	3-3/8
254U	1-3/8	3-1/2	5/16	5/16	2-3/4	12-1/2	10-3/4	6-1/4	5	4-1/8	4-1/4	3-3/4
254T	1-5/8	3-3/4	3/8	3/8	2-7/8	12-1/2	10-3/4	6-1/4	5	4-1/8	4-1/4	4
256U	1-3/8	3-1/2	5/16	5/16	2-3/4	12-1/2	12-1/2	6-1/4	5	5	4-1/4	3-3/4
256T	1-5/8	3-3/4	3/8	3/8	2-7/8	12-1/2	12-1/2	6-1/4	5	5	4-1/4	4
284	1-1/4	3-1/2	1/4	1/4	2-3/4	14	12-1/2	7	5-1/2	4-3/4	4-3/4	3-3/4
284U	1-5/8	4-5/8	3/8	3/8	3-3/4	14	12-1/2	7	5-1/2	4-3/4	4-3/4	4-7/8
284T	1-7/8	4-3/8	1/2	1/2	3-1/4	14	12-1/2	7	5-1/2	4-3/4	4-3/4	4-5/8
284TS	1-5/8	3	3/8	3/8	1-7/8	14	12-1/2	7	5-1/2	4-3/4	4-3/4	3-1/4
286U	1-5/8	4-5/8	3/8	3/8	3-3/4	14	14	7	5-1/2	5-1/2	4-3/4	4-7/8
286T	1-7/8	4-3/8	1/2	1/2	3-1/4	14	14	7	5-1/2	5-1/2	4-3/4	4-5/8
286TS	1-5/8	3	3/8	3/8	1-7/8	14	14	7	5-1/2	5-1/2	4-3/4	3-1/4
324	1-5/8	4-5/8	3/8	3/8	3-3/4	16	14	8	6-1/4	5-1/4	5-1/4	4-7/8
324U	1-7/8	5-3/8	1/2	1/2	4-1/4	16	14	8	6-1/4	5-1/4	5-1/4	5-5/8
324S	1-5/8	3	3/8	3/8	1-7/8	16	14	8	6-1/4	5-1/4	5-1/4	3-1/4
324T	2-1/8	5	1/2	1/2	3-7/8	16	14	8	6-1/4	5-1/4	5-1/4	5-1/4
324TS	1-7/8	3-1/2	1/2	1/2	2	16	14	8	6-1/4	5-1/4	5-1/4	3-3/4
326	1-5/8	4-5/8	3/8	3/8	3-3/4	16	15-1/2	8	6-1/4	6	5-1/4	4-7/8
326U	1-7/8	5-3/8	1/2	1/2	4-1/4	16	15-1/2	8	6-1/4	6	5-1/4	5-5/8
326S	1-5/8	3	3/8	3/8	1-7/8	16	15-1/2	8	6-1/4	6	5-1/4	3-1/4
326T	2-1/8	5	1/2	1/2	3-7/8	16	15-1/2	8	6-1/4	6	5-1/4	5-1/4
326TS	1-7/8	3-1/2	1/2	1/2	2	16	15-1/2	8	6-1/4	6	5-1/4	3-3/4
364	1-7/8	5-3/8	1/2	1/2	4-1/4	18	15-1/4	9	7	5-5/8	5-7/8	5-5/8
364S	1-5/8	3	3/8	3/8	1-7/8	18	15-1/4	9	7	5-5/8	5-7/8	3-1/4
364U	2-1/8	6-1/8	1/2	1/2	5	18	15-1/4	9	7	5-5/8	5-7/8	6-3/8
364US	1-7/8	3-1/2	1/2	1/2	2	18	15-1/4	9	7	5-5/8	5-7/8	3-3/4
364T	2-3/8	5-5/8	5/8	5/8	4-1/4	18	15-1/4	9	7	5-5/8	5-7/8	5-7/8
364TS	1-7/8	3-1/2	1/2	1/2	2	18	15-1/4	9	7	5-5/8	5-7/8	3-3/4
365	1-7/8	5-3/8	1/2	1/2	4-1/4	18	16-1/4	9	7	6-1/8	5-7/8	5-5/8
365S	1-5/8	3	3/8	3/8	1-7/8	18	16-1/4	9	7	6-1/8	5-7/8	3-1/4
365U	2-1/8	6-1/8	1/2	1/2	5	18	16-1/4	9	7	6-1/8	5-7/8	6-3/8
365US	1-7/8	3-1/2	1/2	1/2	2	18	16-1/4	9	7	6-1/8	5-7/8	3-3/4
365T	2-3/8	5-5/8	5/8	5/8	4-1/4	18	16-1/4	9	7	6-1/8	5-7/8	5-7/8
365TS	1-7/8	3-1/2	1/2	1/2	2	18	16-1/4	9	7	6-1/8	5-7/8	3-3/4
404	2-1/8	6-1/8	1/2	1/2	5	20	16-1/4	10	8	6-1/8	6-5/8	6-3/8
404S	1-7/8	3-1/2	1/2	1/2	2	20	16-1/4	10	8	6-1/8	6-5/8	3-3/4
404U	2-3/8	6-7/8	5/8	5/8	5-1/2	20	16-1/4	10	8	6-1/8	6-5/8	7-1/8
404US	2-1/8	4	1/2	1/2	2-3/4	20	16-1/4	10	8	6-1/8	6-5/8	4-1/4
404T	2-7/8	7	3/4	3/4	5-5/8	20	16-1/4	10	8	6-1/8	6-5/8	7-1/4
404TS	2-1/8	4	1/2	1/2	2-3/4	20	16-1/4	10	8	6-1/8	6-5/8	4-1/4
405	2-1/8	6-1/8	1/2	1/2	5	20	17-3/4	10	8	6-7/8	6-5/8	6-3/8
405S	1-7/8	3-1/2	1/2	1/2	2	20	17-3/4	10	8	6-7/8	6-5/8	3-3/4
405U	2-3/8	6-7/8	5/8	5/8	5-1/2	20	17-3/4	10	8	6-7/8	6-5/8	7-1/8
405US	2-1/8	4	1/2	1/2	2-3/4	20	17-3/4	10	8	6-7/8	6-5/8	4-1/4
405T	2-7/8	7	3/4	3/4	5-5/8	20	17-3/4	10	8	6-7/8	6-5/8	7-1/4
405TS	2-1/8	4	1/2	1/2	2-3/4	20	17-3/4	10	8	6-7/8	6-5/8	4-1/4
444	2-3/8	6-7/8	5/8	5/8	5-1/2	22	18-1/2	11	9	7-1/4	7-1/2	7-1/8
444S	2-1/8	4	1/2	1/2	2-3/4	22	18-1/2	11	9	7-1/4	7-1/2	4-1/4
444U	2-7/8	8-3/8	3/4	3/4	7	22	18-1/2	11	9	7-1/4	7-1/2	8-5/8
444US	2-1/8	4	1/2	1/2	2-3/4	22	18-1/2	11	9	7-1/4	7-1/2	4-1/4
444T	3-3/8	8-1/4	7/8	7/8	6-7/8	22	18-1/2	11	9	7-1/4	7-1/2	8-1/2
444TS	2-3/8	4-1/2	5/8	5/8	3	22	18-1/2	11	9	7-1/4	7-1/2	4-3/4
445	2-3/8	6-7/8	5/8	5/8	5-1/2	22	20-1/2	11	9	8-1/4	7-1/2	7-1/8
445S	2-1/8	4	1/2	1/2	2-3/4	22	20-1/2	11	9	8-1/4	7-1/2	4-1/4
445U	2-7/8	8-3/8	3/4	3/4	7	22	20-1/2	11	9	8-1/4	7-1/2	8-5/8
445US	2-1/8	4	1/2	1/2	2-3/4	22	20-1/2	11	9	8-1/4	7-1/2	4-1/4
445T	3-3/8	8-1/4	7/8	7/8	6-7/8	22	20-1/2	11	9	8-1/4	7-1/2	8-1/2
445TS	2-3/8	4-1/2	5/8	5/8	4	22	20-1/2	11	9	8-1/4	7-1/2	4-3/4
504U	2-7/8	8-3/8	3/4	3/4	7-1/4	25	21	12-1/2	10	8	8-1/2	8-5/8
504S	2-1/8	4	1/2	1/2	2-3/4	25	21	12-1/2	10	8	8-1/2	4-1/4
505	2-7/8	8-3/8	3/4	3/4	7-1/4	25	23	12-1/2	10	9	8-1/2	8-5/8
505S	2-1/8	4	1/2	1/2	2-3/4	25	23	12-1/2	10	9	8-1/2	4-1/4

Useful Engineering Formulas

Horsepower

Horsepower (HP) is the rate of doing work. One HP is equal to raising 33,000 lbs. one foot in one min.

$$HP = \frac{\text{Force} \times \text{FPM}}{33{,}000} \qquad HP = \frac{\text{Torque (Inch Pounds)} \times \text{RPM}}{63{,}025} \qquad HP = \frac{\text{Torque (Foot Pounds)} \times \text{RPM}}{5{,}252}$$

Torque

Torque (T) is a turning movement or twisting effort.

$$T\ (\text{Inch Pounds}) = \frac{63{,}025 \times HP}{RPM} \qquad T\ (\text{Foot Pounds}) = \frac{5{,}252 \times HP}{RPM}$$

T (Inch Pounds) = Force (Pounds) x Lever Arm (Inches)
T (Foot Pounds) = Force (Pounds) x Lever Arm (Feet)
T (Foot Pounds) = Newton – Meters x .7376

Kilowatts to HP

HP = Kilowatts x 1.341

Belt Speed

FPM = Diameter (Inches) x RPM x .262

Revolutions Per Minute

$$RPM = \frac{FPM}{.262 \times \text{Diameter (Inches)}}$$

Belt Length

To determine the belt length to use for a drive when the center distance and wheel diameters are known:
C = Center Distance D = Large Wheel Diameter d = Small Wheel Diameter

$$\text{Belt Length} = 2C + 1.57\,(D + d) + \frac{(D - d)^2}{4C}$$

Center Distance

To determine the actual center distance (C) on which a given drive will operate:
L = Belt Length D = Large Wheel Diameter d = Small Wheel Diameter

$$A = L - 1.57\,(D + d)$$

Factor h – from following chart

$\frac{D-d}{A}$	h	$\frac{D-d}{A}$	h	$\frac{D-d}{A}$	h	$\frac{D-d}{A}$	h
0.00	0.00	0.16	0.08	0.30	0.16	0.43	0.24
0.02	0.01	0.18	0.09	0.32	0.17	0.44	0.25
0.04	0.02	0.20	0.10	0.34	0.18	0.46	0.26
0.06	0.03	0.21	0.11	0.35	0.19	0.47	0.27
0.08	0.04	0.23	0.12	0.37	0.20	0.48	0.28
0.10	0.05	0.25	0.13	0.39	0.21	0.50	0.29
0.12	0.06	0.27	0.14	0.40	0.22	0.51	0.30
0.14	0.07	0.29	0.15	0.41	0.23	-	-

$$C = \frac{[A - h\,(D - d)\,]}{2}$$