Tech Talk June 2012

How to identify an AC Motor Frame Size

1.The first thing is to use a 6 inch caliper similar to one in the picture with both inch and metric scales
The 2 scales should be 1/128 inch and 1/20 mm(as shown in the blow up picture). With this caliper you will be set, whether the motor is a NEMA US Motor or an IEC European/Asian Motor.
With this caliper which reads 1/16 , 1/8 etc on the inch scale and 1 mm differences on the metric scale, measuring the motor shaft diameter, the '0' zero mark, on the moveable part of the caliper will line up dead on the inch scale or the metric scale. I cannot tell you how important this tool will be in the future with all the measurements you will want to carry out.

2. You will notice from the Baldor NEMA chart on page 2, that the motor shaft diameter is the 'U' dimension and except for the 48 Frame all the shaft sizes are in 1/8 ths up to the 5000 Frame. So this is important to remember. For NEMA motors we are looking for a shaft measuring in 1/8 th increments.

3. You will next notice that there can be several motor frames with the same shaft size,so the next measurement has to be the '2F' , center to center distance of the side mounting bolts parallel to the shaft. So with these 2 measurements, the 'U' and '2F', the motor frame size can be deduced.
These 2 above measurements correspond to the 'D' and 'B' dimensions in the IEC Frame chart.

4. It should also be noted that NEMA (National Electrical Manufacturers Association) frame size refers to mounting only and has no direct bearing on the motor body diameter.

5. Also in any Standard Frame Number Designation there are either two or three numbers. Typical examples of frame numbers are 48, 56, 145T, and 215T. The frame number relates to the "D" dimension (distance from center of shaft to center bottom of mount). For example, in the two-digit 56 frame, the "D" dimension is 3½", 56 divided by 16 = 3½". For the "D" dimension of a three-digit frame number, consider only the first two digits and use the divisor 4. In frame number 145T, for example, the first two digits divided by the constant 4 is equal to the "D" dimension, 14 divided by 4 = 3½". Similarly, the "D" dimension of a 213T frame motor is 5¼", 21 divided by 4 = 5¼".

6. In the following 3 pages you will find a NEMA ,IEC and Combination NEMA/IEC Frame chart. Using this latter chart will show just how close the NEMA and IEC frmes come and it may be helpful sometime during a breakdown to substitute a more readily available NEMA motor for a failed IEC motor.

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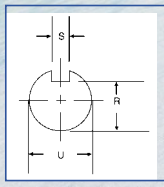
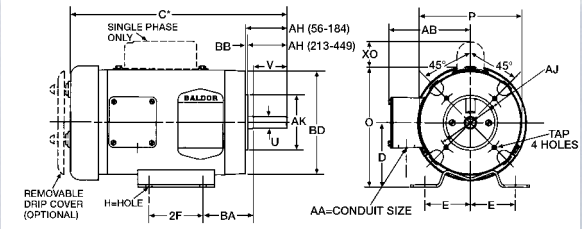
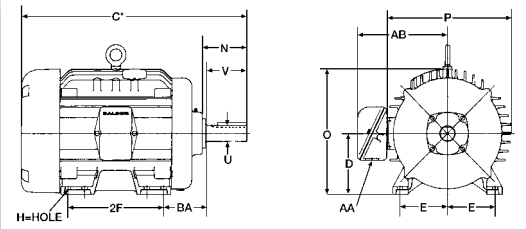
Drawings represent standard TEFC general purpose motors
Refer Data Section 502 for various models, OPEN or TEFC
*Dimensions are for reference only.



NEMA SHAFT (U)	KEYSEAT DIMENSIONS (R)	KEYSEAT DIMENSIONS (S)	NEMA SHAFT (U)	KEYSEAT DIMENSIONS (R)	KEYSEAT DIMENSIONS (S)
3/8	21/64	FLAT	1-7/8	1-19/32	1/2
1/2	29/64	FLAT	2-1/8	1-27/32	1/2
5/8	33/64	3/16	2-3/8	2-1/64	5/8
7/8	49/64	3/16	2-1/2	2-3/16	5/8
1-1/8	63/64	1/4	2-7/8	2-29/64	3/4
1-3/8	1-13/64	5/16	3-3/8	2-7/8	7/8
1-5/8	1-13/32	3/8	3-7/8	3-5/16	1





* CONTACT YOUR LOCAL BALDOR OFFICE FOR "C" DIMENSIONS

NEMA - QUICK REFERENCE CHART

DIMENSIONS - N, O, P, AB AND XO ARE SPECIFIC TO BALDOR

NEMA FRAME	D	E	2F	H	N	O	P	U	V	AA	AB	AH	AJ	AK	BA	BB	BD	XO	TAP
42	2-5/8	1-3/4	1-11/16	9/32 SLOT	1-1/2	5	4-11/16	3/8	1-1/8	3/8	4-1/32	1-5/16	3-3/4	3	2-1/16	1/8	4-5/8	1-9/16	1/4-20
48	3	2-1/8	2-3/4	11/32 SLOT	1-7/8	5-7/8	5-11/16	1/2	1-1/2	1/2	4-3/8	1-11/16	3-3/4	3	2-1/2	1/8	5-5/8	2-1/4	1/4-20
56	3-1/2	2-7/16	3	11/32	2-7/16	6-7/8	6-5/8	5/8	1-7/8	1/2	5	2-1/16	5-7/8	4-1/2	2-3/4	1/8	6-1/2	2-1/4	3/8-16
56H			5	SLOT	2-1/8														
143T	3-1/2	2-3/4	4	11/32	2-1/2	6-7/8	6-5/8	7/8	2-1/4	3/4	5-1/4	2-1/8	5-7/8	4-1/2	2-1/4	1/8	6-1/2	2-1/4	3/8-16
145T			5																
182			4-1/2		2-11/16			7/8	2-1/4			2-1/8	5-7/8	4-1/2		1/8	6-1/2		3/8-16
184	4-1/2	3-3/4	5-1/2	13/32	2-11/16	8-11/16	7-7/8	7/8	2-1/4	3/4	5-7/8	2-1/8	5-7/8	4-1/2	2-3/4	1/8	6-1/2	2-3/8	3/8-16
182T			4-1/2		3-9/16			1-1/8	2-3/4			2-5/8	7-1/4	8-1/2		1/4	9		1/2-13
184T			5-1/2		3-9/16			1-1/8	2-3/4			2-5/8	7-1/4	8-1/2		1/4	9		1/2-13
213			5-1/2		3-1/2			1-1/8	3			2-3/4							
215	5-1/4	4-1/4	7	13/32	3-1/2	10-1/4	9-9/16	1-1/8	3	3/4	7-3/8	2-3/4	7-1/4	8-1/2	3-1/2	1/4	9	2-3/4	1/2-13
213T			5-1/2		3-7/8			1-3/8	3-3/8			3-1/8							
215T			7		3-7/8			1-3/8	3-3/8			3-1/8							
254U			8-1/4		4-1/16			1-3/8	3-3/4			3-1/2							
256U	6-1/4	5	10	17/32	4-1/16	12-7/8	12-15/16	1-3/8	3-3/4	1	9-5/8	3-1/2	7-1/4	8-1/2	4-1/4	1/4	10	---	1/2-13
254T			8-1/4		4-5/16			1-5/8	4			3-3/4							
256T			10		4-5/16			1-5/8	4			3-3/4							
284U			9-1/2		5-1/8			1-5/8	4-7/8			4-5/8							
286U			11		5-1/8			1-5/8	4-7/8			4-5/8							
284T	7	5-1/2	9-1/2	17/32	4-7/8	14-5/8	14-5/8	1-7/8	4-5/8	1-1/2	13-1/8	4-3/8	9	10-1/2	4-3/4	1/4	11-1/4	---	1/2-13
286T			11		4-7/8			1-7/8	4-5/8			4-3/8							
284TS			9-1/2		3-3/8			1-5/8	3-1/4			3							
286TS			11		3-3/8			1-5/8	3-1/4			3							
324U			10-1/2		5-7/8			1-7/8	5-5/8			5-3/8							
326U			12		5-7/8			1-7/8	5-5/8			5-3/8							
324T	8	6-1/4	10-1/2	21/32	5-1/2	16-1/2	16-1/2	2-1/8	5-1/4	2	14-1/8	5	11	12-1/2	5-1/4	1/4	13-3/8	---	5/8-11
326T			12		5-1/2			2-1/8	5-1/4			5							
324TS			10-1/2		3-15/16			1-7/8	3-3/4			3-1/2							
326TS			12		3-15/16			1-7/8	3-3/4			3-1/2							
364U			11-1/4		6-3/4			2-1/8	6-3/8			6-1/8							
365U			12-1/4		6-3/4			2-1/8	6-3/8			6-1/8							
364T	9	7	11-1/4	21/32	6-1/4	18-1/2	18-1/4	2-3/8	5-7/8	2-1/2	15-1/16	5-5/8	11	12-1/2	5-7/8	1/4	13-3/8	---	5/8-11
365T			12-1/4		6-1/4			2-3/8	5-7/8			5-5/8							
364TS			11-1/4		4			1-7/8	3-3/4			3-1/2							
365TS			12-1/4		4			1-7/8	3-3/4			3-1/2							
404U			12-1/4		7-3/16			2-3/8	7-1/8			6-7/8							
405U			13-3/4		7-3/16			2-3/8	7-1/8			6-7/8							
404T	10	8	12-1/4	13/16	7-5/16	20-5/16	20-1/8	2-7/8	7-1/4	3	18	7	11	12-1/2	6-5/8	1/4	13-7/8	---	5/8-11
405T			13-3/4		7-5/16			2-7/8	7-1/4			7							
404TS			12-1/4		4-1/2			2-1/8	4-1/4			4							
405TS			13-3/4		4-1/2			2-1/8	4-1/4			4							
444U			14-1/2		8-5/8	22-7/8	22-3/8	2-7/8	8-5/8		19-9/16	8-3/8							
445U			16-1/2		8-5/8	22-7/8	22-3/8	2-7/8	8-5/8		19-9/16	8-3/8							
444T			14-1/2		8-1/2	22-7/8	22-3/8	3-3/8	8-1/2		19-9/16	8-1/4							
445T			16-1/2		8-1/2	22-7/8	22-3/8	3-3/8	8-1/2		19-9/16	8-1/4							
447T	11	9	20	13/16	8-15/16	22-15/16	23-3/4	3-3/8	8-1/2	3	21-11/16	8-1/4	14	16	7-1/2	1/4	16-3/4	---	5/8-11
449T			25		8-15/16	22-15/16	23-3/4	3-3/8	8-1/2		21-11/16	8-1/4							
444TS			14-1/2		5-3/16	22-7/8	22-3/8	2-3/8	4-3/4		19-9/16	4-1/2							
445TS			16-1/2		5-3/16	22-7/8	22-3/8	2-3/8	4-3/4		19-9/16	4-1/2							
447TS			20		4-15/16	22-15/16	23-3/4	2-3/8	4-3/4	4NPT	21-11/16	4-1/2							
449TS			25		4-15/16	22-15/16	23-3/4	2-3/8	4-3/4	4NPT	21-11/16	4-1/2							

5000 FRAME	D	E	2F	H	O	P	U	V	AA	AB	BA
5007S	12-1/2	10	22	15/16	26-27/32	30	2-1/2	6-1/2	4-NPT	26-7/8	8-1/2
5007L	12-1/2	10	22	15/16	26-27/32	30	3-7/8	11-1/8	4-NPT	26-7/8	8-1/2
5009S	12-1/2	10	28	15/16	26-27/32	30	2-1/2	6-1/2	4-NPT	26-7/8	8-1/2
5009L	12-1/2	10	28	15/16	26-27/32	30	3-7/8	11-1/8	4-NPT	26-7/8	8-1/2
5011S	12-1/2	10	36	15/16	26-27/32	30	2-1/2	6-1/2	4-NPT	26-7/8	8-1/2
5011L	12-1/2	10	36	15/16	26-27/32	30	3-7/8	11-1/8	4-NPT	26-7/8	8-1/2

NEMA C-FACE	BA DIMENSIONS
143-5TC	2-3/4
182-4TC	3-1/2
213-5TC	4-1/4
254-6TC	4-3/4

BALDOR ELECTRIC COMPANY
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72902-2400 U.S.A.

FRAME	NEMA FRAMES PRIOR TO 1953 D	E	F	N	U	V	BA
66	4-1/8	2-15/16	2-1/2	2-1/4	3/4	2-1/4	3-1/8
203	5	4	2-3/4	2-7/16	3/4	2	3-1/8
204			3-1/4				
224	5-1/2	4-1/2	3-3/8	3-1/4	1	3	3-1/2
225			3-3/4				
254	6-1/4	5	4-1/8	3-7/16	1-1/8	3-3/8	4-1/4
284	7	5-1/2	4-3/4	4-1/4	1-1/4	3-3/4	4-3/4
324	8	6-1/4	5-1/4	5-3/8	1-5/8	4-7/8	5-1/4
326			6				
364	9	7	5-5/8	5-5/8	1-78/8	5-3/8	5-7/8
365			6-1/8				
404	10	8	6-1/8	6-3/8	2-1/8	6-1/8	6-5/8
405			6-7/8				
444	11	9	7-1/4	7-1/8	2-3/8	6-7/8	7-1/2
445			8-1/4				
504	12-1/2	10	8	8-5/8	2-7/8	8-3/8	8-1/2
505			9				

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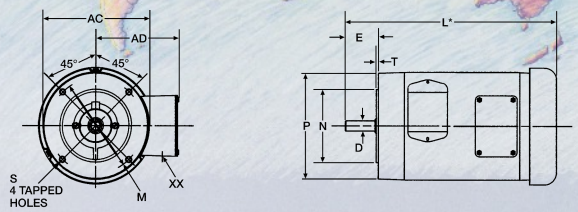
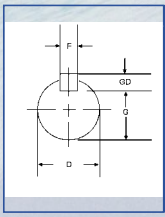
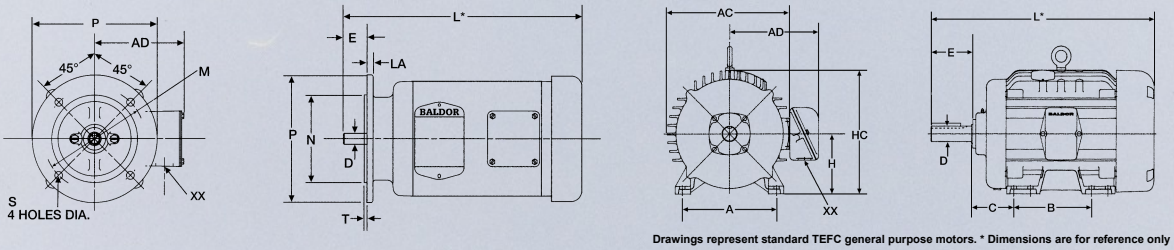




KEY AND KEYSEAT DIMENSIONS									
FRAME	D	G	F	GD	FRAME	D	G	F	GD
63	11	8.5	4	4	180	48	42.5	14	9
71	14	11	5	5	200	55	49	16	10
80	19	15.5	6	6	225	60	53	18	11
90	24	20	8	7	250	70	67.5	20	12
100	28	24	8	7	280	80	71	22	14
112	28	24	8	7	315	85	76	22	14
132	38	33	10	8	355	85	76	22	14
160	37	42	12	8					



Drawings represent standard TEFC general purpose motors. * Dimensions are for reference only

*** CONTACT YOUR LOCAL BALDOR OFFICE FOR "L" DIMENSIONS**

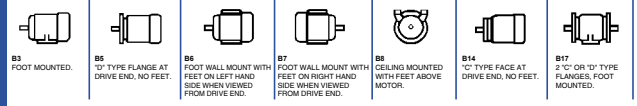
IEC - QUICK REFERENCE CHART

IEC		FOOT MOUNTING				SHAFT		B5 FLANGE						B14 FACE					GENERAL				
FRAME	TYPE	A	B	C	H	D	E	LA	M	N	P	S	T	M	N	P	S	T	L	AC	AD	HC	XX
63	300	100 3.937	80 3.150	40 1.570	63 2.480	11 .433	23 .906	8 .313	115 4.528	95 3.740	140 5.512	9 .354	3 .118	75 2.953	60 2.362	90 3.540	M5	2.5 .098	*	119 4.690	102 4 116d 4.567d	121 4.760 136d 5.375d	13 .500 22d .880d
71	300 400	112 4.409	90 3.543	45 1.770	71 2.800	14 .551	30 1.181	8 .313	130 5.118	110 4.331	160 6.299	10 .393	3.5 .138	85 3.347	70 2.756	105 4.130	M6	2.5 .098	*	119 4.690 145d 5.690d	102 4	131 5.140 149d 5.880d	18 .690 21d .844d
80	400 500	125 4.921	100 3.937	50 1.969	80 3.150	19 .748	40 1.575	13 .500	165 6.496	130 5.118	200 7.874	11 .430	3.5 .138	100 3.937	80 3.150	120 4.724	M6	3 .118	*	145 5.690 168d 6.614d	116 4.510 130 5.120	152 6 162d 6.380d	22 .880 21d .844d
90	S L	140 5.511	100 3.937 125 4.921	56 2.205	90 3.543	24 .945	50 1.969	13 .500	165 6.496	130 5.118	200 7.874	12 .472	3.5 .138	115 4.530	95 3.740	140 5.512	M8	3 .118	*	168 6.614 144d 5.687d	130 5.120 107d 4.250d	173 6.810 165d 6.531d	22 .880 21d .844d
100	S L	160 6.300	112 4.409 140 5.512	63 2.480	100 3.937	28 1.102	60 2.362	14 .562	215 8.465	180 7.087	250 9.840	14 .560	4 .160	130 5.108	110 4.331	160 6.299	M8	3.5 .138	*	200 7.875	149 5.875 153d 6.060d	180 7.906 239d 9.440d	27 1.062
112	S M	190 7.480	114 4.488 140 5.512	70 2.760	112 4.409	28 1.102	60 2.362	14 .562	215 8.465	180 7.087	250 9.840	14 .560	4 .160	130 5.108	110 4.331	160 6.299	M8	3.5 .138	*	200 7.875	149 5.875	214 8.437	27 1.062
132	S M	216 8.504	140 5.512 178 7.008	89 3.504	132 5.197	38 1.496	80 3.150	14 .562	265 10.433	230 9.055	300 11.811	14 .560	4 .160	165 6.496	130 5.118	200 7.874	M8	3.5 .138	*	243 9.562	187 7.375	256 10.062	27 1.062
160	M L	254 10	210 8.268 254 10	108 4.252	160 6.299	42 1.654	110 4.331	20 .787	300 11.811	250 9.842	350 13.780	19 .748	5 .200	215 8.465	180 7.087	250 9.840	M12	4 .160	*	329 12.940	242 9.510	329 12.940	35 1.375
180	M L	279 10.984	241 9.488 279 10.984	121 4.764	180 7.087	48 1.890	110 4.331		300 11.811	250 9.842	350 13.780	19 .748	5 .200						*	395 15.560	333 13.120	372 14.640	51 2.008
200	L M	318 12.520	267 10.512 305 12.008	133 5.236	200 7.874	55 2.165	110 4.331		350 13.780	300 11.811	400 15.748	19 .748							*	441 17.375	359 14.125	416 16.375	63 2.500
225	S M	356 14.016	286 11.260 311 12.244	149 5.866	225 8.858	60 2.362	140 5.512		400 15.748	350 13.780	450 17.716	19 .748							*	495 19.488	383 15.079	483 19.016	63 2.500
250	S M	406 15.984	311 12.244 349 13.740	168 6.614	250 9.843	70 2.756	140 5.512												*	520 20.472	457 17.992	513 20.197	63 2.500
280	S M	457 17.992	368 14.488 419 16.496	190 7.485	280 11.025	80 3.150	170 6.693												*	616 24.252	497 19.567	581 22.874	63 2.500
315	S M	508 20	406 16 457 18	216 8.500	315 12.400	85 3.346	170 6.693												*	759 29.900	683 26.880	682 26.840	102 4
355	S L	610 24	500 19.690 630 24.800	254 10	355 13.980	85 3.346	170 6.693												*	759 29.900	683 26.880	719 28.320	102 4

LEGEND

METRIC (MM) DIMENSIONS IN BLACK
INCH DIMENSIONS IN RED
d = DC MOTORS
1mm = .03937" 1" = 25.40mm

HORIZONTAL SHAFT ARRANGEMENTS



B3 FOOT MOUNTED.

B5 "D" TYPE FLANGE AT DRIVE END, NO FEET.

B6 FOOT WALL MOUNT WITH FEET ON LEFT HAND SIDE WHEN VIEWED FROM DRIVE END.

B7 FOOT WALL MOUNT WITH FEET ON RIGHT HAND SIDE WHEN VIEWED FROM DRIVE END.

B8 CEILING MOUNTED WITH FEET ABOVE MOTOR.

B14 "C" TYPE FACE AT DRIVE END, NO FEET.

B17 2 "C" OR "D" TYPE FLANGES, FOOT MOUNTED.

VERTICAL SHAFT ARRANGEMENTS

V1 "D" TYPE FLANGE AT DRIVE END, SHAFT DOWN, NO FEET.

V3 "D" TYPE FLANGE AT DRIVE END, SHAFT UP, NO FEET.

V5 VERTICAL FOOT, WALL MOUNTED, SHAFT DOWN.

V6 VERTICAL FOOT, WALL MOUNTED, SHAFT UP

V18 "C" TYPE FACE AT DRIVE END, SHAFT DOWN, NO FEET

V19 "C" TYPE FACE AT DRIVE END, SHAFT UP, NO FEET.

V22 SKIRT MOUNTING, SHAFT DOWN, NO FEET.

IP Protection - Baldor Enclosures

IP22 = Open Drip Proof AC or DC Motors.

IP54 = All standard TEFC AC and DC Motors.

IP55 = All TEFC Chemical Processing, Dirty Duty, and Washdown Duty Motors

BALDOR ELECTRIC COMPANY
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72902-2400 U.S.A.

SUMMARY OF IP PROTECTION NUMBERS

First #
Protection against Solid Objects

IP TESTS
O NO PROTECTION
1 Protection against solid objects up to 50 mm. (E.G. Accidental touch by hands.)
2 Protection against solid objects up to12 mm. (E.G. Fingers)
3 Protection against solid objects over 2.5 mm. (E.G. Tools,Wires)
4 Protection against solid objects over 1 mm. (E.G. Tools, Wires, and Small Wires)
5 Protection against dust - limited ingress (No harmful deposits)
6 Totally protected against all dust.

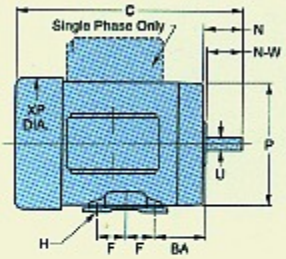
Second #
Protection against Liquids

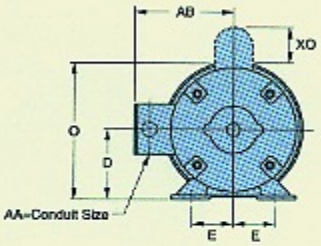
O NO PROTECTION
1 Protection against vertical drops of water. (E.G. Condensation.)
2 Protection against falling water up to 15 degrees from the vertical.
3 Protection against falling water up to 60 degrees from the vertical.
4 Protection against splashing water from all directions, limited ingress.
5 Protection against low pressure jets of water from all directions, limited ingress.
6 Protection against strong jets of water. (E.G. Use on shipdecks, limited ingress.)
7 Protection against immersion.
8 Protection against submersion.

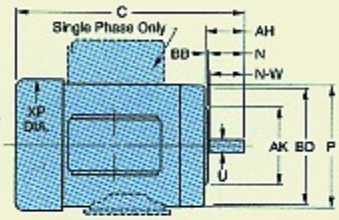
IEC / NEMA DIMENSION COMPARISON

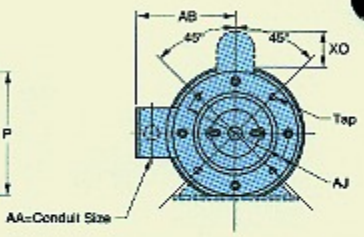
RIGID MOUNT

C FACE









IEC	NEMA	Dimensions in Millimeters							KW/HP** Frame Assignments 3 Phase - TEFC		
		D	E	F	H	U	BA	N-W	2 Pole	4 Pole	6 Pole
56		56	45	35,5	5,8	9	36	20	—	—	—
	N/A	—	—	—	—	—	—	—	—	—	—
63		63	50	40	7	11	40	23	0,25 kW	0,18 kW	—
	NA	—	—	—	—	—	—	—	1/3 HP	1/4 HP	—
71		71	56	45	7	14	45	30	0,55	0,37	—
	42	66,7	44,5	21,4	7,1	9,5	52,4	—	3/4	1/2	—
80		80	62,5	50	10	19	50	40	1,1	0,75	0,55 kW
	48	76,2	54	34,9	8,7	12,7	63,5	38,1	1 1/2	1	3/4 HP
90S		90	70	50	10	24	56	50	1,5	1,1	0,75
	56	88,9	61,9	38,1	8,7	15,9	69,9	47,6	2	1 1/2	1
90L		90	70	62,5	10	24	56	50	2,2	1,5	1,1
	56	88,9	69,8	50,8	8,7	22,2	57,2	57,2	3	2	1 1/2
100L		100	80	70	12	28	63	60	3	2,2	1,5
	145T	88,9	69,8	63,5	8,7	22,2	57,2	57,2	4	3	2
112L		112	95	57	12	28	70	60	3,7	2,2	1,5
	182T	114,3	95,2	57,2	10,7	28	70	69,9	5	3	2
112M		112	95	70	12	28	70	60	3,7	4	2,2
	184T	114,3	95,2	68,2	10,7	28	70	69,9	5	5 4/5	—
132S		132	108	70	12	38	89	80	7,5	5,5	3
	213T	133,4	108	69,8	10,7	34,9	89	85,7	10	7 1/2	—
132M		132	108	89	12	38	89	80	—	7,5	5,5
	215T	133,4	108	88,8	10,7	34,9	89	85,7	—	10	7 1/2
160M*		160	127	105	15	42	108	110	15	11	7,5
	254T	158,8	127	104,8	13,5	41,3	108	101,6	20	15	10
160L*		160	127	127	15	42	108	110	18,5	15	11
	256T	158,8	127	127	13,5	41,3	108	101,5	25	20	15
180M*		180	139,5	120,5	15	48	121	110	22	18,5	—
	284T	177,8	139,8	120,2	13,5	47,6	121	117,5	—	25	—
180L*		180	139,5	139,5	15	48	121	110	22	22	15
	286T	177,8	139,8	139,8	13,5	47,6	121	117,5	30	30	20
200M*		180	159	133,5	19	55	133	110	30	30	—
	324T	203,3	158,8	133,4	16,7	54	133	133,4	40	40	—
200L*		200	159	152,5	19	55	133	110	37	37	22
	326T	203,2	158,8	152,4	16,7	54	133	133,4	50	50	30
225S*		225	178	143	19	60	149	140	—	37	30
	364T	228,6	117,8	142,8	16,7	60,3	149	149,2	—	50/75	40
225M*		225	178	155,5	19	60	149	140	45	45	37
	365	228,6	177,8	155,6	16,7	60,3	149	149,2	60/75	60/75	50
250M*		250	203	174,5	24	65	168	140	55	55	—
	405T	254	203,2	174,6	20,6	73	168	182,2	75/100	75/100	—
280S*		280	228,5	184	24	75	190	140	—	—	45
	444T	279,4	228,6	184,2	20,6	85,7	190	215,9	—	—	60/100
280M*		280	228,5	209,5	24	75	190	140	—	—	55
	445T	279,4	228,6	209,6	20,6	85,7	190	215,9	—	—	75/125

LEESON®

LEESON ELECTRIC

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