

High Efficiency Induction Motors

MAQ - BAQ SERIES
80 - 280 FRAME SIZES



International standards for motor efficiency

The International Electrotechnical Commission (IEC), in order to harmonize the energy consumption regulations aimed to reduce the CO₂ emissions and the impact of industrial operations on the environment, has established the standard **IEC 60034-30:2008** which defines energy efficiency classes for single-speed, three-phase, 50Hz and 60Hz induction motors.

To that regard, the European Community (EC) has recently passed the regulation **EC No 640/2009** which is essentially based on the **IEC 60034-30** and requires all the EU countries to conform themselves to the new efficiency standards.

Electric motors account for about 70% of the electricity consumed by industry. The potential cost saving of high efficiency systems is estimated 20% to 30% and one of the major factors in such cost-effective improvement is the use of energy efficient motors.

The IEC 60034-30 is part of an effort to unify motor testing standards, efficiency requirements and product labelling requirements to easily recognize worldwide high-efficiency products.

To show compliance with these new efficiency standards, motors must be tested in accordance with the new testing standard IEC 60034-2-1:2007.

The motor efficiency class and nominal motor efficiency must be stated on the motor nameplate and given in product documentation and motor catalogues.

Efficiency classes

The new IEC 60034-30 defines worldwide the following efficiency classes of single-speed three-phase, cage-induction motors in the 0,75 kW - 375 kW power range.

IE1 Standard - Motors with a rated efficiency at full-load (rated output) equal to or exceeding the limits listed

IE2 High - Motors with a rated efficiency at full-load (rated output) equal to or exceeding the limits listed

IE3 Premium - Motors with a rated efficiency at full-load (rated output) equal to or exceeding the limits listed;

IE4 Super-Premium - Under consideration*.

* It is expected that technologies other than cage-induction motors will be required to meet IE4 levels.

Efficiency values (50 Hz)

Power kW	IE1 - Standard			IE2 - High			IE3 - Premium		
	2 pole	4 pole	6 pole	2 pole	4 pole	6 pole	2 pole	4 pole	6 pole
0,75	72,1	72,1	70,0	77,4	79,6	75,9	80,7	82,5	78,9
1,1	75,0	75,0	72,9	79,6	81,4	78,1	82,7	84,1	81,0
1,5	77,2	77,2	75,2	81,3	82,8	79,8	84,2	85,3	82,5
2,2	79,7	79,7	77,7	83,2	84,3	81,8	85,9	86,7	84,3
3,0	81,5	81,5	79,7	84,6	85,5	83,3	87,1	87,7	85,6
4,0	83,1	83,1	81,4	85,8	86,6	84,6	88,1	88,6	86,8
5,5	84,7	84,7	83,1	87,0	87,7	86,0	89,2	89,6	88,0
7,5	86,0	86,0	84,7	88,1	88,7	87,2	90,1	90,4	89,1
11	87,6	87,6	86,4	89,4	89,8	88,7	91,2	91,4	90,3
15	88,7	88,7	87,7	90,3	90,6	89,7	91,9	92,1	91,2
19	89,3	89,3	88,6	90,9	91,2	90,4	92,4	92,6	91,7
22	89,9	89,9	89,2	91,3	91,6	90,9	92,7	93,0	92,2
30	90,7	90,7	90,2	92,0	92,3	91,7	93,3	93,6	92,9
37	91,2	91,2	90,8	92,5	92,7	92,2	93,7	93,9	93,3
45	91,7	91,7	91,4	92,9	93,1	92,7	94,0	94,2	93,7
55	92,1	92,1	91,9	93,2	93,5	93,1	94,3	94,6	94,1
75	92,7	92,7	92,6	93,8	94,0	93,7	94,7	95,0	94,6
90	93,0	93,0	92,9	94,1	94,2	94,0	95,0	95,2	94,9
110	93,3	93,3	93,3	94,3	94,5	94,3	95,2	95,4	95,1
132	93,5	93,5	93,5	94,6	94,7	94,6	95,4	95,6	95,4
160	93,8	93,8	93,8	94,8	94,9	94,8	95,6	95,8	95,6
200	94,0	94,0	94,0	95,0	95,1	95,0	95,8	96,0	95,8
250	94,0	94,0	94,0	95,0	95,1	95,0	95,8	96,0	95,8
315	94,0	94,0	94,0	95,0	95,1	95,0	95,8	96,0	95,8
355	94,0	94,0	94,0	95,0	95,1	95,0	95,8	96,0	95,8
375	94,0	94,0	94,0	95,0	95,1	95,0	95,8	96,0	95,8

Scope

The efficiency classes specified in the IEC 60034-30 are relevant to single speed, three-phase, 50Hz and 60Hz induction motors with:

- 2, 4 or 6 pole
- rated output from 0,75 to 375kW;
- rated voltage U_N up to 1000V;
- duty type S1 (continuous duty) or S3 (intermittent periodic duty) with a rated cyclic duration factor of 80% or higher;
- direct on-line starting.

The following motors are excluded from the IEC 60034-30:

- motors made solely for converter operation;
- motors completely integrated into a machine (for example, pump, fan or compressor) that cannot be tested separately from the machine.

The following motors are excluded from regulation EC No 640/2009:

- motors designed to operate wholly immersed in a liquid;
- motors completely integrated into a product (for example gear, pump, fan or compressor) of which the energy performance cannot be tested independently from the product;
- brake motors;
- water cooled motors with inlet temperature less than 5°C or exceeding 25°C;
- motors specifically designed to operate:
 1. at altitudes exceeding 1000 m above sea-level;
 2. where ambient air temperatures exceed 40°C;
 3. in maximum operating temperature above 400°C;
 4. where ambient air temperatures are less than -15°C for any type of motor or less than 0°C for a motor with air cooling;
 5. in potentially explosive atmospheres as defined in Directive 94/9/EC

New method for determining the efficiency (IEC 60034-2-1:2007)

The method for measuring the efficiency of low-voltage three-phase asynchronous motors was revised with the IEC 60034-2-1 standard which replaced the previous IEC 60034-2:1996. The actual losses are now measured under defined laboratory conditions and no longer added as a lump sum. This new standard significantly increases the efficiency level accuracy.

Deadlines

From 16 June 2011 - motor efficiency less than IE2 level will not be allowed;

From 1 January 2015 - motor efficiency for output powers 7,5-375 kW less than IE3 level will not be allowed or if the IE2 efficiency level is met, motors will have to be equipped with variable speed drive;

From 1 January 2017 - motor efficiency for output powers 0,75-375 kW less than IE3 level will not be allowed or if the IE2 efficiency level is met, motors will have to be equipped with variable speed drive.

High efficiency motors

General specifications

Rated outputs and efficiency values are in accordance with IEC 60034-30;
 all parameters are measured in accordance with IEC 60034-2-1;
 continuous duty (S1) with sufficient thermal margins to withstand short overloads;
 IP 55 protection degree;
 F insulation class;
 +40°C maximum ambient temperature;
 1000 m a.s.l. installation.

Technical features

Terminal box can be rotated by 90°;
 drive end locked bearing from 160 mm frame size;
 PTC in main terminal box from 160 mm frame size;
 grease nipples (drive end and non drive end) as standard from 160 mm frame size;
 standard removable feet available up to 200 mm frame size.

Construction materials

Aluminium frame up to 132 mm, cast iron frame from 160 mm;
 aluminium end shields up to 132 mm, cast iron end shields from 160 mm;
 steel fan cowl;
 plastic fan;
 aluminium/cast iron terminal box.

Cable glands

Frame Size [mm]	80	90	100	112	132	160	180	200	225	250	280
Q.ty	1	2	2	2	2	2	2	2	2	2	2
Type	M20	M20	M25	M25	M25	M32	M32	M40	M50	M50	M50

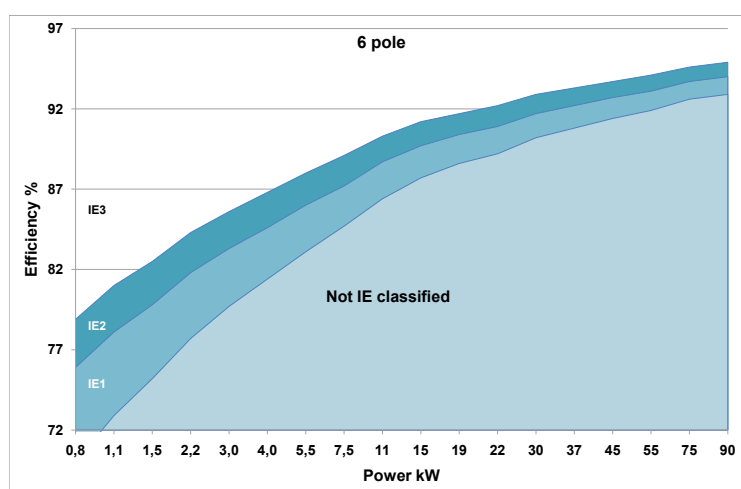
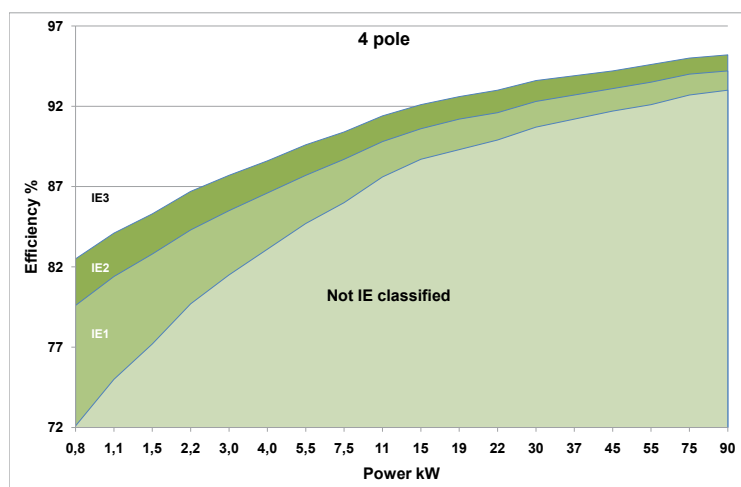
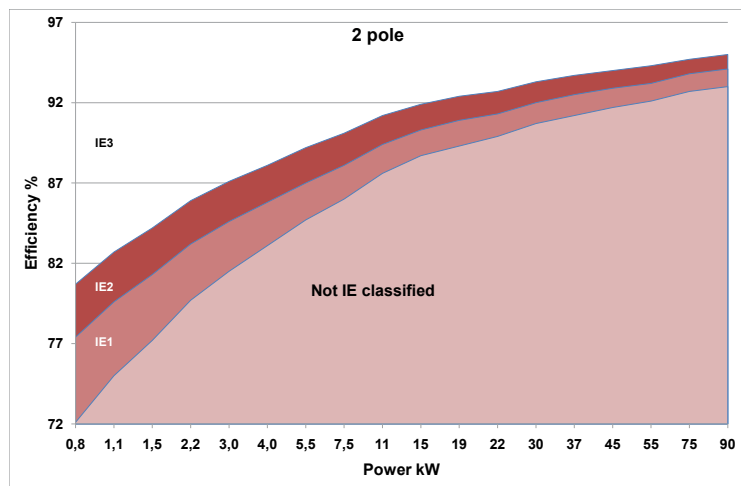
Test Facilities

The MarelliMotori test room is able to perform testing on high efficiency motors in compliance with the IEC 60034-2-1.



Bearings

Frame size	D-End	N-End
	2-4-6 pole	2-4-6 pole
80	6204	6204
90	6205	6205
100	6206	6206
112	6306	6306
132	6308	6308
160	6309	6309
180	6311	6311
200	6312	6312
225	6313	6313
250	6314	6314
280	6316	6316

Efficiency classes



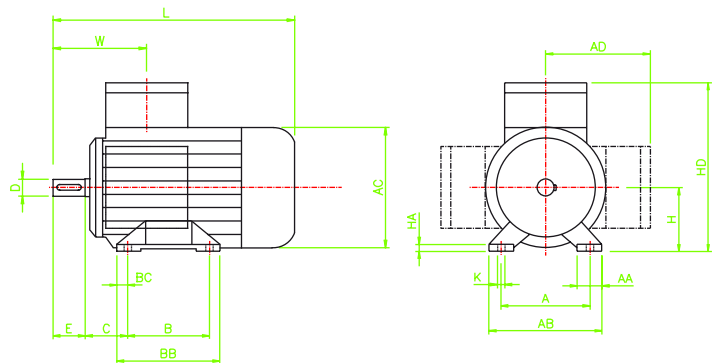
Nameplate

		MarelliMotori		EN 60034-1	IE2	
				IEC 60034-1		
MOT.3 ~ MAQ 132 SA4				COD. MAQ1302A00017		
N°	I. CL.	F	S1	kg	IP 55	
50Hz - IE2 - 88.5 % (100%) - 89.1 % (75%) - 88.0 % (50%)						
6308 - 2Z			6308 - 2Z			
Δ	V	Y	Hz	Δ	A	Y
220	380	50	19.4	11.2	5.5	1455
230	400	50	19.2	11.1	5.5	1465
240	415	50	19.17	11.1	5.5	1475
	460	60		10.6	6.1	1775
	440	60		10.8	6.1	1770
						cosφ
						0.84
						0.81
						0.78
						0.82
						0.84

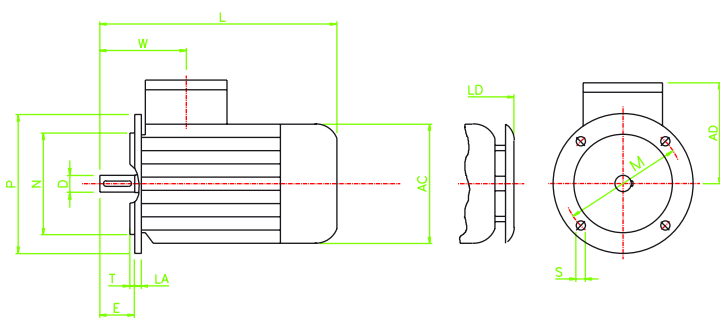
TECHNICAL DATA

RATED OUTPUT P kW	MOTOR TYPE		SPEED rpm min ⁻¹	EFFICIENCY η 100%	4/4 LOAD			3/4 LOAD	2/4 LOAD	FOR D.O.L STARTING		BREAKDOWN TORQUE Tmax/Tn	SOUND PRESSURE LEVEL LPA dB(A)	MOMENT OF INERTIA J kg m ²	WEIGHT IM1001 (IMB3) Approx. kg
					POWER FACTOR cos φ	CURRENT (400 V) In A	RATED TORQUE Tn N m	EFFICIENCY η		Is/In	Ts/Tn				
								75%	50%						
2 pole - 50 Hz - 3000 rpm															
0,75	MAQ	80 MA2	2860	77,6%	0,76	1,84	2,5	77,8%	75,5%	6,3	2,5	2,6	60	0,00083	9,5
1,1	MAQ	80 MB2	2860	79,8%	0,81	2,46	3,7	80,1%	76,5%	6,3	2,5	2,6	60	0,00097	10,0
1,5	MAQ	90 S2	2870	81,4%	0,85	3,13	5,0	81,2%	79,2%	6,8	2,8	3,0	62	0,00136	13,5
2,2	MAQ	90 L2	2885	83,3%	0,86	4,43	7,3	82,7%	81,5%	7,4	2,5	3,2	62	0,00170	15,5
3	MAQ	100 LA2	2900	84,7%	0,86	5,94	9,9	84,1%	82,2%	8,1	2,2	3,2	66	0,0036	23,4
4	MAQ	112 M2	2920	86,0%	0,88	7,63	13,1	85,6%	83,3%	8,5	2,1	3,3	67	0,0054	28,8
5,5	MAQ	132 SA2	2915	87,1%	0,90	10,1	18,0	87,2%	85,0%	7,7	2,2	2,4	70	0,0119	45,3
7,5	MAQ	132 SB2	2890	88,2%	0,90	13,6	24,8	88,3%	87,2%	7,9	2,2	2,6	70	0,0133	47,7
11	BAQ	160 MA2	2950	89,5%	0,90	19,7	35,6	89,1%	87,1%	7,9	2,2	3,0	76	0,0442	98
15	BAQ	160 MB2	2950	90,4%	0,90	26,6	48,5	89,3%	88,0%	8,0	2,2	2,5	76	0,0514	118
18,5	BAQ	160 L2	2960	91,0%	0,89	33,0	59,7	90,8%	89,0%	7,9	2,0	3,0	76	0,0615	138
22	BAQ	180 M2	2950	91,4%	0,90	38,6	71,2	91,4%	89,8%	7,7	2,1	2,8	79	0,0710	163
30	BAQ	200 LA2	2965	92,1%	0,90	52,2	96,6	91,6%	89,9%	7,9	2,2	2,8	82	0,131	235
37	BAQ	200 LB2	2960	92,6%	0,88	65,5	119,4	91,8%	90,0%	7,7	2,2	2,5	82	0,201	247
45	BAQ	225 M2	2970	93,0%	0,90	77,6	144,7	92,1%	90,1%	7,7	2,3	3,0	82	0,222	339
55	BAQ	250 M2	2970	93,3%	0,90	94,5	176,8	92,5%	90,3%	7,8	2,4	2,9	83	0,413	427
75	BAQ	280 S2	2980	94,0%	0,89	129,4	240,3	93,3%	91,5%	8,7	2,2	2,8	84	0,721	580
90	BAQ	280 M2	2980	94,2%	0,90	153,2	288,4	93,3%	92,1%	8,5	2,2	2,7	84	0,861	630
4 pole - 50 Hz - 1500 rpm															
0,75	MAQ	80 MB4	1430	79,8%	0,76	1,8	5,0	79,6%	76,3%	5,8	2,5	2,8	50	0,00150	11,4
1,1	MAQ	90 S4	1440	81,5%	0,72	2,7	7,3	79,8%	76,5%	5,5	2,2	2,8	51	0,00221	14,5
1,5	MAQ	90 L4	1440	82,9%	0,73	3,6	9,9	83,1%	81,8%	6,3	2,3	2,9	51	0,00284	17,0
2,2	MAQ	100 LA4	1445	84,4%	0,81	4,6	14,5	83,8%	82,8%	5,8	2,2	2,7	54	0,0058	23,5
3	MAQ	100 LB4	1450	85,6%	0,77	6,6	19,8	84,7%	83,4%	6,3	2,3	2,8	54	0,0073	26,5
4	MAQ	112 M4	1460	87,1%	0,82	8,1	26,2	87,2%	85,3%	7,4	2,2	2,8	55	0,0107	35,0
5,5	MAQ	132 SA4	1465	88,5%	0,81	11,1	35,8	89,1%	88,0%	6,1	2,2	2,5	61	0,0230	48,5
7,5	MAQ	132 MA4	1465	89,3%	0,82	14,8	48,9	89,6%	88,4%	6,9	2,3	2,4	61	0,0304	62
11	BAQ	160 M4	1470	90,3%	0,87	20,2	71,4	90,8%	90,1%	7,3	2,2	2,6	65	0,0760	123
15	BAQ	160 L4	1470	91,0%	0,90	26,4	97,4	91,2%	91,1%	7,2	2,2	2,6	65	0,101	141
18,5	BAQ	180 M4	1470	91,3%	0,89	32,7	119,8	91,5%	91,2%	8,7	2,2	2,3	66	0,138	163
22	BAQ	180 L4	1470	91,8%	0,89	38,9	142,9	92,2%	91,5%	7,2	2,1	2,4	66	0,151	173
30	BAQ	200 L4	1475	92,4%	0,86	54,5	194,2	92,7%	92,5%	7,2	2,2	2,4	69	0,195	231
37	BAQ	225 S4	1485	93,0%	0,87	66,0	237,9	93,3%	92,3%	6,7	2,2	2,5	71	0,356	338
45	BAQ	225 M4	1485	93,4%	0,85	81,8	289,3	93,3%	92,1%	7,0	2,1	2,6	71	0,521	381
55	BAQ	250 M4	1480	93,6%	0,89	95,3	354,8	93,6%	93,3%	6,6	2,2	2,4	73	0,692	422
75	BAQ	280 S4	1490	94,5%	0,87	131,7	480,6	94,7%	93,6%	7,8	2,3	2,4	76	1,301	620
90	BAQ	280 M4	1490	94,8%	0,87	157,5	576,7	94,4%	93,7%	7,5	2,2	2,4	76	1,471	695
6 pole - 50 Hz - 1000 rpm															
0,75	MAQ	90 S6	956	76,2%	0,71	2,00	7,5	76,3%	72,9%	4,8	1,8	2,2	48	0,00550	12,1
1,1	MAQ	90 L6	950	78,3%	0,72	2,82	11,0	78,4%	73,5%	4,8	1,8	2,1	48	0,01220	16,6
1,5	MAQ	100 LA6	955	80,0%	0,74	3,66	15,0	80,2%	78,9%	5,4	2,0	2,3	50	0,01340	21,8
2,2	MAQ	112 M6	960	81,9%	0,74	5,24	22,0	82,0%	80,4%	5,8	1,8	2,4	52	0,01430	29,5
3	MAQ	132 SA6	965	83,5%	0,77	6,73	29,7	82,6%	81,4%	6,5	1,8	2,4	53	0,02280	35,0
4	MAQ	132 MA6	965	84,8%	0,77	8,84	39,6	84,9%	83,1%	6,5	1,7	2,3	55	0,0395	49,7
5,5	MAQ	132 MB6	965	86,2%	0,79	11,7	54,4	86,8%	85,7%	6,7	1,7	2,4	55	0,0617	54,7
7,5	BAQ	160 M6	970	87,3%	0,81	15,3	73,8	87,6%	86,4%	7,1	2,0	2,7	57	0,0948	72,2
11	BAQ	160 L6	970	88,9%	0,81	22,0	108,3	89,4%	88,7%	7,2	2,0	2,3	60	0,174	87,3
15	BAQ	180 L6	972	89,8%	0,82	29,4	147,3	90,0%	89,9%	6,9	1,8	2,5	65	0,202	127
18,5	BAQ	200 LA6	975	90,6%	0,85	34,7	181,2	90,8%	90,5%	7,1	1,6	2,2	73	0,223	132
22	BAQ	200 LB6	975	91,1%	0,86	40,5	215,4	91,5%	90,8%	7,3	1,7	2,3	75	0,244	152
30	BAQ	225 M6	980	91,8%	0,86	54,8	292,3	92,1%	91,9%	6,6	2,0	2,1	69	0,602	317
37	BAQ	250 M6	980	92,4%	0,85	68,0	360,5	92,7%	91,7%	6,2	1,7	2,1	71	0,956	420
45	BAQ	280 S6	985	92,9%	0,83	84,2	436,2	93,0%	91,6%	6,0	1,8	1,9	73	1,608	500
55	BAQ	280 M6	985	93,2%	0,82	103,9	533,1	93,3%	92,9%	5,8	1,8	2,0	73	2,126	560

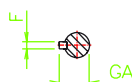
DIAGRAMS



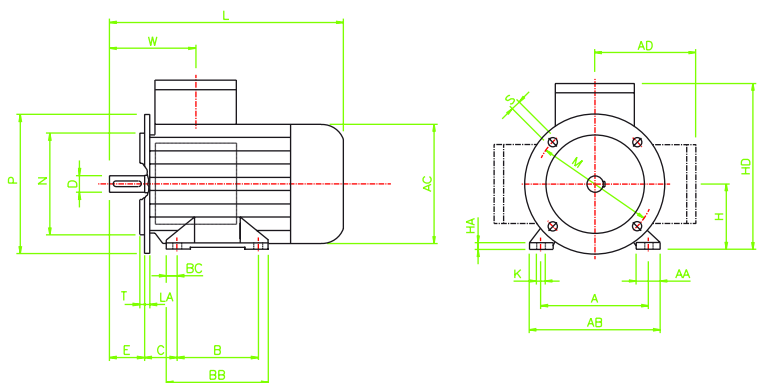
IM B3 (IM 1001)



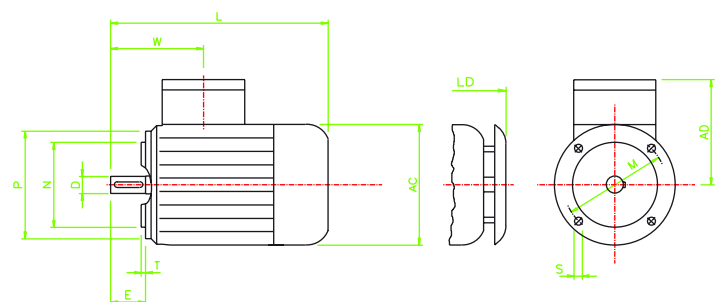
IM B5 (IM 3001) - V1 (IM 3011)



Shaft Extension



IM B35 (IM 2001)



IM B14 (IM 3601)

DIMENSIONS

Frame Size	Poles	General B3 - B5 - B35 - V1				Anti Rain B5 V1	Flange B5 - B35 - V1							Shaft Extension B3 - B5 - B35 - V1				Feet B3 - B35										Flange B14												
		AC	AD	L	W	LD	M	N	P	S	T	Z	LA	D	E	F	GA	A	AA	AB	B	BB	BC	C	H	HA	HD	K	M	N	P	S	T	Z						
80 M	2-6	158	140	290	110	320	165	130	200	12	3,5	4	10	19	40	6	21,5	125	35	160	100	125	50	80	9	220	10	100	80	120	M6	3	4							
90 S	2-6	176	150	325	121	355	165	130	200	12	3,5	4	10	24	50	8	27	140	37	175	100	130	15	56	90	12	240	10	115	95	140	M8	3	4						
90 L	2-6			350	380	125															155																			
100	2-6	199	165	388	140	430	215	180	250	15	4	4	12	28	60	8	31	160	45	200	140	180	20	63	100	14	265	12	130	110	160	M8	3,5	4						
112	2-6	220	180	405	147	445	215	180	250	15	4	4	12	28	60	8	31	190	45	230	140	180	20	70	112	14	291	12	130	110	160	M8	3,5	4						
132 S	2-6	259	200	467	166	507	265	230	300	15	4	4	13	38	80	10	41	216	44	255	140	190	25	89	132	16	332	12	165	130	200	M10	4	4						
132 M	2-6			505	547	178															228																			
160 M	2-6	314	250	610	282	660	300	250	350	18	5	4	16	42	110	12	45	254	60	315	210	262	26	108	160	19	410	15												
160 L	2-6			650	700	254															306																			
180 M	2-6	364	268	690	351	740	300	250	350	18	5	4	18	48	110	14	51,5	279	75	350	241	310	34,5	121	180	26	448	15												
180 L	4-6			730	375	780																							348	458										
200 L	2-6	400	310	772	396	822	350	300	400	18	5	4	20	55	110	16	59	318	80	398	305	370	32,5	133	200	24	510	19												
225 S	4-6	465	335	815	432	865	400	350	450	18	5	8	20	55	110	16	59	356	80	436	311	386	37,5	149	225	28	560	19												
225 M	2			445	895	64																							64											
225 M	4-6		845	895	64	64																																		
250 M	2	510	372	920	482	970	500	450	550	18	5	8	23	60	140	18	64	406	92	484	349	445	48	168	250	30	622	24												
250 M	4-6													65															69											
280 S	2	560	402	990	510	1040	500	450	550	18	5	8	23	65	140	18	69	457	100	557	368	460	46	185	280	32	682	24												
280 S	4-6													75															79,5											
280 M	2			65	69																																			
280 M	4-6			75	79,5	457	102	560	419	510	190	280	32	682	24																									



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