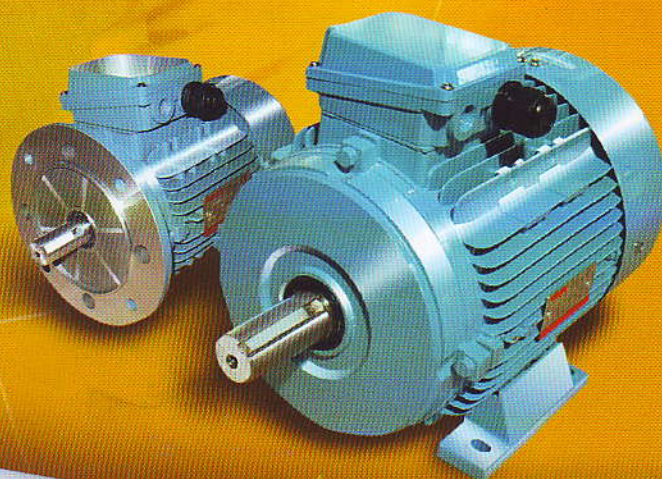


Three - Phase
Asynchronous Motors



MELCO Industrial Motors



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Technical Notes

MELCO motors correspond to various international specifications and DIN standards. Operating characteristics are in accordance with Italian C.E.I. 2-3 editions (1974), and also with German VDE 0530-1 (1972) standards.

Design in accordance with foreign standards is also possible. CSA approval exists for motors of types MMA, MMVA (with aluminium frames), MMI and MMVI (with cast iron frames). Standard mechanical protection is IP-55.

Dimensions and output are in accordance with the standards of E.E.C. countries in conformity with the I.E.C. recommendations, publication 72 (1971). Approval for "Non-Sparking design exists for motors (output data unchanged).

A. Mechanical Construction

Enclosures

Enclosure for electrical machines are quoted in accordance with DIN 40 050, Sheet 2, June 1972 Edition, with the symbol IP and two characteristic figures indicating the degree of protection.

The first figure indicates :
Protection of persons against contact with electrically live or moving parts inside the casing and protection of machines against ingress of solid foreign bodies (contact and foreign body protection).

The second figure indicates :
Protection of the machine against ingress of water (water protection).

The following table explains the types of enclosures encountered with MELCO motors.

Type of Enclosure Designation	Protection against contact and against ingress of foreign bodies	Protection against water
IP 23	Protection against contact with the fingers of electrically live parts or internal moving parts. Protection against ingress of solid foreign bodies with a diameter greater than 12 mm.	Water falling at any angle up to 60° to the vertical causes no damage.
IP 44	Protection against contact of electrically live parts or internal moving parts with tools, wires or similar items with a thickness greater than 1 mm. Protection against ingress of solid foreign bodies with a diameter greater than 1 mm; this however not covering cooling air openings (inlet and outlet of external fans) and drainage holes for condensation water.	Water splashing against the machine from any direction does not cause any damage.
IP 54	Complete protection against contact with electrically live parts or internal moving parts. Protection against harmful accumulation of dust is not totally prevented but dust does not accumulate in quantities sufficient to impair the operation of the machine.	Water splashing against the machine from any direction does not cause any damage.
IP 55		A jet of water from a nozzle directed against the machine from any direction does not cause any damage.
IP 56		No harmful amounts of water may penetrate into the machine in the case of temporary flooding, e.g. by rough sea.

Special protective measures are recommended when the motors are installed in the open or under extreme conditions of moisture or dust :

Special varnish,
Enclosure IP 55,
Protective hood (for vertical mounting with shaft-extension facing downwards),

Additional bearing seal (for vertical mounting with shaft-extension facing upwards). Extra prices on request. Please contact us for more details concerning protection.

Mounting Arrangements

Mounting arrangements for electrical machines are represented by symbols in accordance with DIN 42950. Please refer details on P.8. MELCO Motors are available with the mounting arrangements listed here for various types and sizes. It is essential to state the required form of mounting when ordering.
Drainage holes for condensation water (if present) and ventilation openings on internally cooled motors are positioned to suit the mounting arrangements.

Bearings and Lubrication

Bearings, either IBC brand of Germany or UBC brand of USA, are made of first grade materials to high precision for utmost performance and life time.
Maintenance-free life for permanently lubricated motors without relubrication facilities : at least 10,000 operating hours for 2 and 4/2-pole motors, at least 20,000 operating hours for motors with 4 or more poles, maximum of 4 years.
On motors with in-service lubricating attachments the frequency of lubrication and quantity of grease are indicated on a special instruction plate. Relubrication should be done

with similar grease only. The relubrication time should be shortened when unfavourable operating conditions prevail, e.g. high ambient temperature, dusty conditions, corrosive atmosphere. Relubrication arrangements with grease regulator for motors from size 250 onwards are normally available.

Insulations

The stator windings of squirrel-cage and slip ring motors correspond in general to insulation class F. Exceptions are marked on the table by footing.

Rated Current

The rated currents quoted for 380 V in the tables are to be multiplied
by 1.73 for 220 V,
by 0.76 for 500 V,
by 0.58 for 660 V,
assuming that the frequency and the power are the same.

Starting

Direct on-line starting :
Simple method of starting. High starting torque

with high starting current. Note regulations of the Electricity Supply Board concerned.

Star-delta starting :
Low starting current and low starting torque. The motor must have reached approximately its rated speed before it is switched over from star to delta otherwise the current at changeover will be scarcely less than the starting current with direct on-line starting.

Different Specifications

The temperature rise of MELCO motors conforms to other specifications as long as the rise does not exceed the values given in the table below. With most specifications, permitting a temperature rise of 80 K for class F (VDE 0530), the list rating is unchanged.

If the temperature rise for class F insulation is under 80 K, then a reduction in rating is necessary. As an approximation, for each 5 K reduction in permitted temperature rise below 80 K the rated output is reduced by 5%. When connected to a 60 cycle supply, the list rating can be increased by a further 15%.
An extra price may be charged for a special winding and for special mechanical features. Details on request.



Permissible temperature rise according to different specifications

Specification	Cooling air temperature °C	Permissible temperature rise in K (by resistance method) for insulation Class			
		A	E	B	F
Germany VDE 0530 Part 1/11.72	40	60	75	80	100
International IEC 34-1	40	60	75	80	100
Great Britain BS 2613/70	40	60	75	80	100
Canada CSA	40	60	-	80	105
USA Nema and ANSI	40	60	-	80	105
Italy CEI	40	60	70	80	100
Sweden SEN	40	60	70	80	100
Norway NEK	40	60	-	80	-
Belgium NBN	40	60	75	80	100
France NF	40	60	75	80	100
Switzerland SEV	40	60	75	80	100
India IS	40	60	75	80	-

Permissible mechanical load

The permissible axial and radial loads are indicated in the tables. If required, motors with 4 and more poles of frame sizes 200 L to 400 can be fitted with equally sized cylindrical roller bearings in accordance with DIN 5412 at the drive end instead of the deep groove ball bearings to DIN 625 normally used. This is recommended in case of radial loads acting on the shaft due to belt or pinion drives. (Please quote when ordering).

For high radial or axial loads the following

information must be given to permit suitable calculation of the shaft and bearing sizes :
Operational play

Point of load application

Load (magnitude, direction, constant or alternating)

Type of machine to be driven

Means of transmission (pulley, gearwheel or coupling etc.)

Vibration

The vibration of electric motors is covered by DIN 45 665, July 1968 Edition "Vibration

of rotating electrical machines in frame sizes 80-315 - Methods of measurement and limits". MELCO motors observe or keep below the values of the three vibration classes N (normal), R (reduced), S (special) as follows :

N : Normal list design

R : W 1 design

S : W 2 design

Rotors are dynamically balanced with complete shaft key fitted. Transmission parts (pulleys, pinions or motor halves of couplings) must be balanced without key on a smooth mandrel with keyway empty.

B. Electrical Design

Voltage and Frequency

Standard voltages 220V, 380V, 50Hz.

Motors wound for 50Hz may be connected to a 60-cycle supply. Speed increases 20%. If the nominal voltage of the 60-cycle supply is 20% higher than that of the 50-cycle one, the tabulated values of rated output are in general increased by about 15-20%. If the rated voltage of the 60-cycle supply is equal to that of the 50-cycle supply, no increase in output is possible. Rated torque

and values of various torque ratios are reduced to 83%, corresponding to the frequency ratio of 50:60. The absolute torque values are thus reduced by approx. 30%. No output reduction with variations of voltage up to $\pm 5\%$ of the rated value.

Output and Temperature Rise

Limits of temperature rise as per VDE 0530 part 1/11.72, with cooling air at 40° C and an installation altitude of up to 1000 m (3280 ft) above sea-level. With higher cooling air temperatures or when installed at altitudes greater than 1000 m above sea-level, the

rated output of the motor is reduced.

In the case of frequent starting and stopping, short-time duty and electrical braking, the following particulars are necessary when ordering :

1. Duty cycle and relative time during which the motor is switched on (in %), number of starts per hour and duration of operation.
2. Moment of inertia of driven machinery (in kgm^2) and speed of the same (in rpm), at maximum motor speed in case of pole-changing motors.
3. Load torque (in Nm) at starting and braking.
4. Whether mechanical braking or electrical braking by means of d. c. or a. c. current.

Output reduction with cooling air temperatures above 40° C

Temperature of cooling air	45° C	50° C	55° C	60° C
Rated output reduced to about	95%	90%	85%	80%

Installation at altitudes of more than 1000 m above sea-level

Altitude of installation	2000 m	3000 m	4000 m
With cooling air at 40° C, rated output reduced to about	92%	84%	76%
Full rated output as per lists with insulation class B and cooling air temp. of	32° C	24° C	16° C

MMA Series (Aluminium Frames)

2 POLE - 3000 RPM SYNCHRONOUS SPEED AT 380V, 50Hz

Models	Power HP kW	Current at 380V (A)	Speed (r.p.m.)	Eff (%)	Power factor	Nominal Torque (Nm)	$\frac{T_{start}}{T_n}$	$\frac{T_{max}}{T_n}$	$\frac{I_{st}}{I_n}$	Moment of inertia (kg m ²)	Weight (kg)
MMA631-2	1/4 0.18	0.53	2800	69	0.75	0.63	2.2	2.4	6	0.00013	5
MMA632-2	1/3 0.25	0.68	2800	72	0.78	0.88	2.2	2.4	6	0.00015	5.3
MMA711-2	1/2 0.37	0.95	2800	73.5	0.80	1.31	2.2	2.4	6	0.00044	6.5
MMA712-2	3/4 0.55	1.35	2800	75.5	0.82	1.93	2.2	2.4	6	0.00055	7
MMA801-2	1 0.75	1.75	2800	76.5	0.85	2.62	2.2	2.4	6	0.00068	9.5
MMA802-2	1.5 1.1	2.55	2800	77	0.85	3.83	2.2	2.4	6	0.00086	11
MMA90S-2	2 1.5	3.84	2800	77	0.85	5.28	2.2	2.4	6	0.00146	14.5
MMA90L-2	3 2.2	4.98	2800	78	0.86	7.58	2.2	2.4	6	0.00184	17
MMA100L-2	4 3.0	11.1	2870	82	0.87	9.98	2.2	2.3	7	0.00253	24.5
MMA112M-2	5.5 4.0	8.2	2890	85.5	0.87	13.22	2.2	2.3	7	0.00511	30
MMA132S1-2	7.5 5.5	11	2900	85.5	0.88	18.05	2.0	2.2	7	0.0978	42
MMA132S2-2	10 7.5	15	2900	86.2	0.88	24.70	2.0	2.2	7	0.01125	50
MMA160M1-2	15 11.0	21.3	2930	88	0.88	36.10	2.0	2.2	7	0.0377	85
MMA160M2-2	20 15.0	28.7	2930	89	0.89	49.23	2.0	2.2	7	0.0449	95
MMA160L-2	25 18.5	34.6	2930	90	0.90	60.71	2.0	2.2	7	0.055	105

4 POLE - 1500 RPM SYNCHRONOUS SPEED AT 380V, 50Hz

Models	Power HP kW	Current at 380V (A)	Speed (r.p.m.)	Eff (%)	Power factor	Nominal Torque (Nm)	$\frac{T_{start}}{T_n}$	$\frac{T_{max}}{T_n}$	$\frac{I_{st}}{I_n}$	Moment of inertia (kg m ²)	Weight (kg)
MMA632-4	1/4 0.18	0.65	1400	64	0.66	1.28	2.2	2.4	6	0.00028	5
MMA711-4	1/3 0.25	0.83	1400	67	0.68	1.72	2.2	2.4	6	0.00044	6.3
MMA712-4	1/2 0.37	1.12	1400	69.5	0.72	2.57	2.2	2.4	6	0.00054	7
MMA801-4	3/4 0.55	1.56	1400	73.5	0.73	3.83	2.2	2.4	6	0.0012	9.5
MMA802-4	1 0.75	2.01	1400	75.5	0.75	5.19	2.2	2.4	6	0.0015	11
MMA90S-4	1.5 1.1	2.75	1400	78	0.78	7.56	2.2	2.4	6	0.00177	14.5
MMA90L-4	2 1.5	3.65	1400	79	0.79	10.23	2.2	2.4	6	0.00228	16
MMA100L1-4	3 2.2	5.0	1430	81	0.82	14.69	2.2	2.3	7	0.00494	23
MMA100L2-4	4 3.0	6.8	1430	82.5	0.81	20.03	2.2	2.3	7	0.00612	27
MMA112M-4	5.5 4.0	8.8	1440	84.5	0.82	26.53	2.2	2.3	7	0.01064	33.5
MMA132S-4	7.5 5.5	12	1440	85.5	0.84	36.48	2.2	2.2	7	0.02818	49.5
MMA132M-4	10 7.5	15	1440	87	0.85	49.40	2.2	2.2	7	0.2833	57.5
MMA160M-4	15 11.0	22.3	1460	88	0.85	72.45	2.0	2.2	7	0.0747	90
MMA160L-4	20 15.0	30	1460	89	0.85	98.79	2.0	2.2	7	0.0918	100

6 POLE - 1000 RPM SYNCHRONOUS SPEED AT 380V, 50Hz

Models	Power HP kW	Current at 380V (A)	Speed (r.p.m.)	Eff (%)	Power factor	Nominal Torque (Nm)	$\frac{T_{start}}{T_n}$	$\frac{T_{max}}{T_n}$	$\frac{I_{st}}{I_n}$	Moment of inertia (kg m ²)	Weight (kg)
MMA71M-6	1/4 0.18	0.65	835	56	0.75	2.0	2.1	1.9	2.3	0.0006	6.3
MMA80M-6	1/2 0.37	1.25	920	62	0.72	3.9	1.9	2.1	3.1	0.0015	6.5
MMA90S-6	1 0.75	2.3	910	72.5	0.70	7.7	2.2	2.2	5.5	0.0026	14.5
MMA90L-6	1.5 1.1	3.2	910	73.5	0.72	11.30	2.2	2.2	5.5	0.0035	17
MMA100L-6	2 1.5	4.0	940	77.5	0.74	15.16	2.2	2.2	6	0.00563	22.5
MMA112M-6	3 2.2	5.6	940	80.5	0.74	22.23	2.2	2.2	6	0.01585	29
MMA132S-6	4 3.0	7.2	960	83	0.76	29.84	2.0	2.0	6.5	0.02586	48
MMA132M1-6	5.5 4.0	9.4	960	84	0.77	39.79	2.0	2.0	6.5	0.03088	49
MMA132M2-6	7.5 5.5	13	960	85.3	0.78	54.71	2.0	2.0	6.5	0.03611	57.5
MMA160M-6	10 7.5	16.5	970	86	0.80	74.61	2.0	2.0	6.5	0.0881	85
MMA160L-6	15 11.0	24.1	970	87.5	0.79	109.4	2.0	2.0	6.5	0.116	100

**MMI Series** (Cast Iron Frames)**2 POLE - 3000 RPM SYNCHRONOUS SPEED AT 380V, 50Hz**

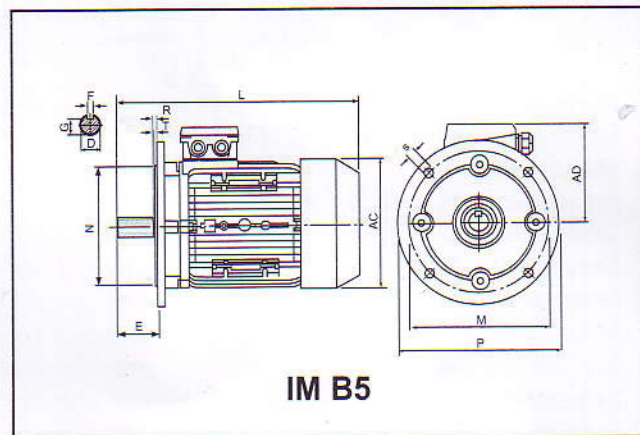
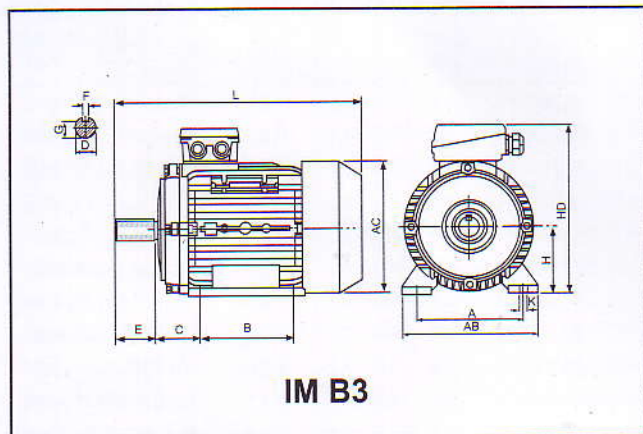
Models	Power HP	Power kW	Current at 380V (A)	Speed (r.p.m.)	Eff (%)	Power factor	Nominal Torque (Nm)	$\frac{T_{start}}{T_n}$	$\frac{T_{max}}{T_n}$	$\frac{I_{st}}{I_n}$	Moment of inertia (kg m ²)	Weight (kg)
MMI160M1-2	15	11.0	21.3	2950	88	0.88	36.10	2.0	2.2	8.0	0.0377	85
MMI160M2-2	20	15.0	28.7	2970	89	0.89	49.23	2.0	2.2	8.0	0.0449	95
MMI160L-2	25	18.5	34.6	2970	90	0.90	60.71	2.0	2.2	8.0	0.055	105
MMI180M-2	30	22.0	40.9	2970	90.5	0.90	72.20	2.0	2.2	8.0	0.075	130
MMI200L1-2	40	30.0	55.4	2970	91.2	0.90	98.45	2.0	2.2	8.0	0.124	217
MMI200L2-2	50	37.0	67.7	2980	92	0.90	121.43	2.0	2.2	8.0	0.139	245
MMI225M-2	60	45.0	82.3	2980	92.3	0.90	147.68	1.8	2.2	8.0	0.233	310
MMI250M-2	75	55	101	2980	92.5	0.90	180.50	1.8	2.2	7.0	0.312	369
MMI280S-2	100	75	134	2980	93.0	0.90	246.13	1.8	2.2	7.0	0.597	500
MMI280M-2	125	90	160	2980	93.8	0.91	295.36	1.8	2.2	7.0	0.675	557
MMI315S-2	150	110	195	2980	94.0	0.91	361.00	1.8	2.2	6.8	1.18	960
MMI315M-2	175	132	233	2980	94.5	0.91	433.20	1.8	2.2	6.8	1.82	1060
MMI315L1-2	220	160	279	2980	94.6	0.92	525.09	1.8	2.2	6.8	2.08	1140
MMI315L2-2	270	200	348	2980	94.8	0.92	656.36	1.8	2.2	6.8	2.82	1190
MMI355M-2	335	250	433	2980	95.3	0.92	820.45	1.6	2.2	7.0	3.28	1740
MMI355L-2	420	315	544	2980	95.6	0.92	1033.76	1.6	2.2	7.1	4.10	1880

4 POLE - 1500 RPM SYNCHRONOUS SPEED AT 380V, 50Hz

Models	Power HP	Power kW	Current at 380V (A)	Speed (r.p.m.)	Eff (%)	Power factor	Nominal Torque (Nm)	$\frac{T_{start}}{T_n}$	$\frac{T_{max}}{T_n}$	$\frac{I_{st}}{I_n}$	Moment of inertia (kg m ²)	Weight (kg)
MMI160M-4	15	11.0	22.3	1460	88	0.85	72.45	2.0	2.2	7.0	0.0747	90
MMI160L-4	20	15.0	30	1460	89	0.85	98.79	2.0	2.2	7.0	0.0918	100
MMI180M-4	25	18.5	36.4	1470	90.5	0.85	121.84	2.2	2.2	7.5	0.139	130
MMI180L-4	30	22.0	43.1	1470	91	0.85	144.90	2.2	2.2	7.5	0.158	140
MMI200L-4	40	30.0	57.4	1470	92	0.86	197.59	2.2	2.2	7.5	0.262	231
MMI225S-4	50	37.0	69.9	1480	92.5	0.87	243.69	2.2	2.2	7.5	0.406	290
MMI225M-4	60	45.0	84.7	1480	92.8	0.87	296.38	2.2	2.2	7.5	0.469	320
MMI250M-4	75	55	103	1480	93.0	0.89	362.24	2.2	2.2	7.0	0.66	380
MMI280S-4	100	75	140	1480	93.8	0.86	493.97	2.2	2.2	7.0	1.12	526
MMI280M-4	125	90	167	1490	94.2	0.86	592.76	2.2	2.2	7.0	1.46	600
MMI315S-4	150	110	201	1490	94.5	0.87	724.48	2.1	2.2	6.9	3.11	980
MMI315M-4	175	132	240	1490	94.8	0.87	869.38	2.1	2.2	6.9	3.62	1080
MMI315L1-4	220	160	287	1490	94.9	0.88	1053.79	2.1	2.2	6.9	4.13	1120
MMI315L2-4	270	200	359	1490	95.0	0.88	1317.24	2.3	2.2	6.9	4.82	1170
MMI355M-4	335	250	443	1485	95.3	0.88	1646.55	2.3	2.2	6.8	5.21	1780
MMI355L-4	420	315	556	1485	95.6	0.89	2074.66	2.2	2.2	6.9	5.40	1920

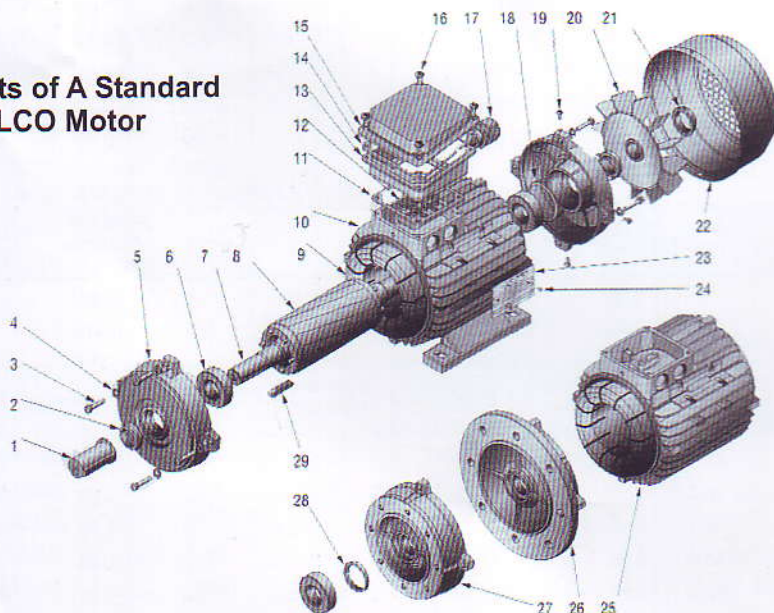
6 POLE - 1000 RPM SYNCHRONOUS SPEED AT 380V, 50Hz

Models	Power HP	Power kW	Current at 380V (A)	Speed (r.p.m.)	Eff (%)	Power factor	Nominal Torque (Nm)	$\frac{T_{start}}{T_n}$	$\frac{T_{max}}{T_n}$	$\frac{I_{st}}{I_n}$	Moment of inertia (kg m ²)	Weight (kg)
MMI160M-6	10	7.5	16.5	970	86	0.80	74.61	2.0	2.0	6.5	0.0881	85
MMI160L-6	15	11.0	24.1	970	87.5	0.79	109.43	2.0	2.0	6.5	0.116	100
MMI180L-6	20	15.0	31.5	970	89	0.81	149.22	2.0	2.0	7.0	0.207	130
MMI200L1-6	25	18.5	38.5	970	90	0.81	184.04	2.0	2.0	7.0	0.315	205
MMI200L2-6	30	22.0	44.6	970	90	0.83	218.85	2.0	2.0	7.0	0.36	225
MMI225M-6	40	30.0	59.3	980	91.5	0.84	298.44	2.0	2.1	7.0	0.547	284
MMI250M-6	50	37.0	71.0	980	92.0	0.86	368.07	2.0	2.1	7.0	0.66	370
MMI280S-6	60	45.0	86.0	980	92.5	0.86	447.66	2.0	2.0	7.0	1.39	486
MMI280M-6	75	55	105	980	92.8	0.86	547.14	2.0	2.0	7.0	1.65	533
MMI315S-6	100	75	141	990	93.5	0.86	746.09	2.0	2.0	7.0	4.11	970
MMI315M-6	125	90	169	990	93.8	0.86	895.31	2.0	2.0	7.0	4.78	1060
MMI315L1-6	150	110	206	990	94.0	0.86	1094.27	2.0	2.0	6.7	5.45	1130
MMI315L2-6	175	132	244	990	94.2	0.87	1313.13	2.0	2.0	6.7	6.12	1190
MMI355M1-6	220	160	292	990	94.5	0.88	1591.67	1.9	2.0	6.7	6.50	1600
MMI355M2-6	270	200	365	990	94.7	0.88	1989.58	1.9	2.0	6.7	8.10	1730
MMI355L-6	335	250	455	990	94.9	0.88	2486.98	1.9	2.0	6.7	8.25	1980



Frame Sizes	Mounting Dimensions (mm)																DIMENSIONS (mm)				
																	Frame Dimensions (mm)				
	IMB3								IMB5								AB	AC	AD	HD	L
	A	B	C	D	E	F	G	H	K	M	N	P	R	S	T						
56	90	71	36	9	20	3	7.2	56	5.8	98	80	120	0	7	3.0	110	120	110	155	195	
63	100	80	40	11	23	4	8.5	63	7	115	95	140	0	10	3.0	130	130	115	165	230	
71	112	90	45	14	30	5	11	71	7	130	110	160	0	10	3.5	145	145	125	185	255	
80	125	100	50	19	40	6	15.5	80	10	165	130	200	0	12	3.5	160	165	135	215	295	
90S	140	100	56	24	50	8	20	90	10	165	130	200	0	12	3.5	180	185	145	235	335	
90L	140	125	56	24	50	8	20	90	10	165	130	200	0	12	3.5	180	185	145	235	360	
100L	160	140	63	28	60	8	24	100	12	215	180	250	0	15	4.0	205	215	170	255	380	
112M	190	140	70	28	60	8	24	112	12	215	180	250	0	15	4.0	245	240	180	285	400	
132S	216	140	89	38	80	10	33	132	12	265	230	300	0	15	4.0	280	275	195	325	475	
132M	216	178	89	38	80	10	33	132	12	265	230	300	0	15	4.0	280	275	195	325	515	
160M	254	210	108	42	110	12	37	160	15	300	250	350	0	15	5.0	320	330	255	420	615	
160L	254	254	108	42	110	12	37	160	15	300	250	350	0	15	5.0	320	330	255	420	670	

Parts of A Standard MELCO Motor



No. Description

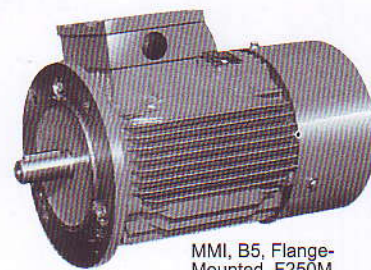
1. Shaft Cover
2. V-ring
3. Clamping screws
4. Washer
5. End shield (bracket)
6. Bearing
7. Motor shaft
8. Rotor
9. Wound stator
10. B3 motor frame
11. IP 55 gasket
12. Terminal block
13. Terminal box base
14. Gasket
15. Terminal box cover
16. Terminal box tightening screws
17. Cable inlet bush
18. Compensation spring
19. Fan cover tightening screws
20. PVC fan
21. Ring for fan tightening
22. Fan cover
23. Motor name plate
24. Name plate tightening screws
25. B5 motor frame
26. B5 flange
27. B14 flange
28. Sealing ring
29. Shaft key



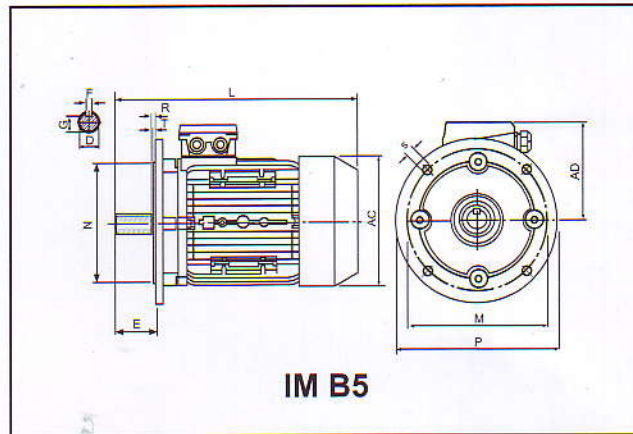
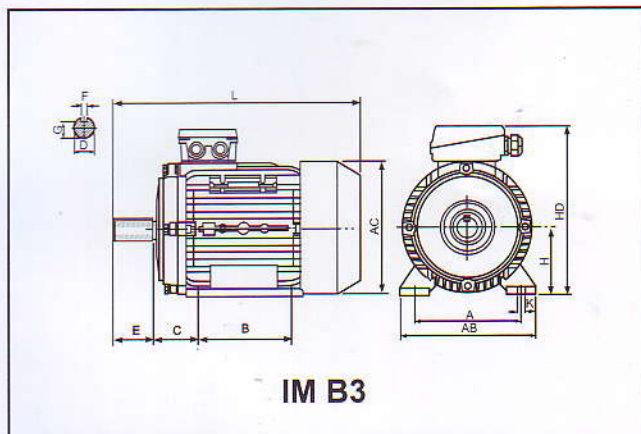
MMI Series (Cast Iron Frames)



MMI, B3, Foot-Mounted, F180L



MMI, B5, Flange-Mounted, F250M



DIMENSIONS (mm)

Frame Sizes	Mounting Dimensions (mm)												
	A	B	C	D		E		F		G		H	K
				2P	4,6,8	2P	4,6,8	2P	4,6,8	2P	4,6,8		
160M	254	210	108		42		110		12		37	160	15
160L	254	254	108		42		110		12		37	160	15
180M	279	241	121		48		110		14		42.5	180	15
180L	279	279	121		48		110		14		42.5	180	15
200L	318	305	133		55		110		16		49	200	19
225S	356	286	149	-	60	-	140	-	18	-	53	225	19
225M	356	311	149	55	60	110	140	16	18	49	53	225	19
250M	406	349	168	60	65		140		18	53	58	250	24
280S	457	368	190	65	75		140	18	20	58	67.5	280	24
280M	457	419	190	65	75		140	18	20	58	67.5	280	24
315S	508	406	216	65	80	140	170	18	22	58	71	315	28
315M	508	457	216	65	80	140	170	18	22	58	71	315	28
315L	508	508	216	65	80	140	170	18	22	58	71	315	28
355M	610	560	254	75	95	140	170	20	25	67.5	86	355	28
355L	610	630	254	75	95	140	170	20	25	67.5	86	355	28

DIMENSIONS (mm)

Frame Sizes	Mounting Dimensions (mm)						Frame Dimensions (mm)					
	M	N	P	R	S	T	AB	AC	AD	HD	L	
											2P	4,6,8
160M	300	250	350	0	19	5	320	330	255	420		615
160L	300	250	350	0	19	5	320	330	255	420		670
180M	300	250	350	0	19	5	355	380	280	455		700
180L	300	250	350	0	19	5	355	380	280	455		740
200L	350	300	400	0	19	5	395	420	305	505		770
225S	400	350	450	0	19	5	435	470	335	560	-	820
225M	400	350	450	0	19	5	435	470	335	560	815	845
250M	500	450	550	0	19	5	490	510	370	615		910
280S	500	450	550	0	19	5	550	580	410	680		985
280M	500	450	550	0	19	5	550	580	410	680		1035
315S	600	550	660	0	24	6	635	645	630	845	1185	1215
315M	600	550	660	0	24	6	635	645	630	845	1295	1325
315L	600	550	660	0	24	6	635	645	630	845	1295	1325
355M	740	680	800	0	24	6	730	710	655	1010	1500	1530
355L	740	680	800	0	24	6	730	710	655	1010	1500	1530