FELM

Electric Motors - www.felm.it

Permanent Magnet Motors

IE5

ULTRA PREMIUM EFFICIENCY

FMP5 Serie

March 2024

INTRODUCTION

FELM® FMP series high efficiency energy-saving permanent magnet synchronous motor (IE5 ULTRA PREMIUM EFFICIENCY) adopts high performance rare earth permanent magnetic material and frequency inverter technique with vector control, which has the advantages of energy saving, reliable operation and good compatible.

Main features

1. The efficiency conforms to Grade 1 of GB 30253-2013 Energy Efficiency Limit Value and IE4/IE5 efficiency of international standard IEC60034-2014.

2. The basic design is 750-3000rpm with rated power of 1.5kW-450kW, providing service factor of 1.2, which also available on request for rotation speed of 80-10000rpm and self-starting PM motor

Reliability and stability of PMSM (Permanent Magnet Synchronous Motors)

1. The motors adopts high performance NdFeB (Neodymium, Iron, Boron) permanent magnet.

2. It selects the high temperature resistant magnet material to ensure the stable use of electric motor even under the condition of service factor and higher ambient temperature (the temperature rise of the motor is B class).

3. The motor and frequency converter are both equipped with thermal protection components

Efficiency Classes of Motors and Measuring Methods

The “efficiency” describes how efficiently an electric motor transforms electrical energy into mechanical energy. Previously in Europe, low voltage three-phase motors have been graded and marketed in three efficiency classes – EFF3, EFF2 and EFF1 – based on a voluntary agreement between motor manufacturers and the European Commission.

This classification system is well proven and has now been adapted in many countries around the world. Unfortunately, other countries have also developed their own national systems, which are very different from the European system. That was the reason for the German motor manufacturers in ZVEI, with the support of their European neighbors, to develop an energy efficiency standard for the International Electrotechnical Commission (IEC).

The objective was to have a common international standard that replaces all the different national systems.

This project was successful and the objective has been met.

The new international standard, IEC 60034-30:2008, defines efficiency classes IE1, IE2 , IE3 and IE4 for three-phase motors.

This ensures a common international basis for the design and classification of motors as well as for national legislative activities. At the same time, the IEC developed improved methods for determining the efficiency of these motors.

The international standards IEC 60034-30:2008 (classification) and IEC 60034-2-1:2007 (measuring methods) have been adopted as European standards without any changes as EN 60034-30:2009 and EN 60034-2-1:2007.

For the sake of simplicity, the following sections will refer to the IEC standards only.

Scope of new IEC efficiency class system (IE-code)

The efficiency class system specified under IEC 60034-30 is valid for low voltage three-phase cage induction motors with the following specifications:

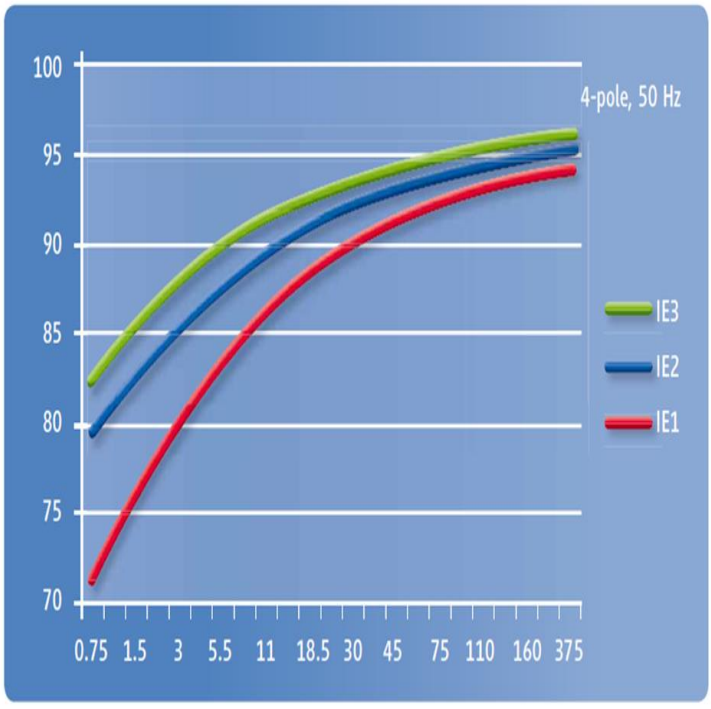
- Rated voltage up to 1.000 V
- Rated output between 0.75 kW and 1000 kW
- Either 2, 4, 6 or 8 poles
- Rated on the basis of continuous duty (S1) or intermittent periodic duty (S3) with cyclic duration factor of 80% or higher;
- Capable of operating direct on-line
- Rated for operating conditions in accordance with IEC 60034-1 (temperature, installation altitude, etc.)

Motors with flanges, feet and/or shafts with mechanical dimensions different from IEC 60072-1 are covered by this standard.

Geared motors and brake motors are covered by this standard, although special shafts and flanges may be used in such motors.

Some motors covered by this standard may be equipped with auxiliary devices. However, as long as these auxiliary devices are not an integral part of the motor construction, the determination of efficiency in all possible combinations is not practical. Determinations for efficiency of such modified standard motors shall be performed on basic motors without auxiliary devices installed. The following are exceptions to the classification system:

- Motors for short-time duty (S2) or switching operation (S3 < 80% to S10);
- Motors that were solely designed for converter operation (VSD) in accordance with IEC 60034-25 as well as
- Motors that have a highly specialized design customized for one particular application in such a way that it is not possible to measure the motor on its own (for example pump motors with wet rotors).



Asynchronous Motors vs Permanent Magnet Motors

Characteristic	Asynchronous motor	Permanent magnet motor
Efficiency	Low-High	Super High
Power factor	Low PF, and with large inactive current. PF compensator capacitor could be needed.	Highest PF, no need for PF compensator.
Control characteristics	Poor	Good
Volume	Large	Small, usually two frame sizes of reduction, light weight, equivalent to 60% of the weight of the asynchronous motor with same rating.
Start performance	Direct one line starting, large starting current, has impact to the electricity grid, and frequent starts are not allowed.	Frequency drive, constant torque start, frequent starts are allowed.
Rotator structure	Simple, squirrel cage.	Complex, in-slot or surface sticking of magnetic steel.
Total cost	Low purchase cost but with large amount of electricity consumption in the later stage, high total cost.	Relative higher purchase cost however with lower total cost from the saving on electricity during operation. The return of price difference is about 100 operation days.

Nominal speed 3000 rpm IE5 efficiency

Type Frame size	kW	Volt	Amp	Hz	Pole	rpm	Torque Nm	Efficiency %	Cosfφ	Weight Kg	Connection
FMP5 80M1-08	1.5	400	2.7	200	8	3000	4.8	88.9	0.96	17	Y
FMP5 80M2-08	2.2	400	3.9	200	8	3000	7.0	90.2	0.96	19	Y
FMP5 90L1-08	3	400	5.2	200	8	3000	9.6	91.1	0.96	21	Y
FMP5 90L2-08	4	400	6.9	200	8	3000	12.7	91.8	0.96	23	Y
FMP5 90L3-08	5.5	400	9.4	200	8	3000	17.5	92.6	0.96	26	Y
FMP5 100L1-08	3	400	5.2	200	8	3000	9.6	91.1	0.96	21	Y
FMP5 100L2-08	4	400	6.9	200	8	3000	12.7	91.8	0.96	23	Y
FMP5 100L3-08	5.5	400	9.4	200	8	3000	17.5	92.6	0.96	26	Y
FMP5 112M1-08	7.5	400	12.7	200	8	3000	23.9	93.3	0.96	36	Y
FMP5 112M2-08	11	400	18.5	200	8	3000	35.0	94.0	0.96	40	Y
FMP5 132M1-08	15	400	25.1	200	8	3000	47.8	94.5	0.96	60	Y
FMP5 132M2-08	18.5	400	30.9	200	8	3000	58.9	94.9	0.96	64	Y
FMP5 132M3-08	22	400	36.6	200	8	3000	70.0	95.1	0.96	80	Y
FMP5 160L1-06	30	400	49.7	150	6	3000	95.5	95.5	0.96	108	Y
FMP5 160L2-06	37	400	61.1	150	6	3000	117.8	95.8	0.96	124	Y
FMP5 160L3-06	45	400	74.2	150	6	3000	143.3	96.0	0.96	131	Y
FMP5 180L0-06	55	400	90.5	150	6	3000	175.1	96.2	0.96	174	Y
FMP5 200L1-06	75	400	123.0	150	6	3000	238.8	96.5	0.96	224	Y
FMP5 200L2-06	90	400	147.5	150	6	3000	286.5	96.6	0.96	245	Y
FMP5 225M0-08	110	400	179.9	200	8	3000	350.2	96.8	0.96	298	Y
FMP5 250M1-08	132	400	215.6	200	8	3000	420.2	96.9	0.96	402	Y
FMP5 250M2-08	160	400	261.1	200	8	3000	509.3	97.0	0.96	423	Y
FMP5 280M1-06	185	400	301.5	150	6	3000	588.9	97.1	0.96	552	Y
FMP5 280M2-06	200	400	325.7	150	6	3000	636.7	97.2	0.96	552	Y
FMP5 280M3-06	220	400	358.2	150	6	3000	700.3	97.2	0.96	580	Y
FMP5 280M4-06	250	400	407.1	150	6	3000	795.8	97.2	0.96	600	Y
FMP5 315L1-06	280	400	455.9	150	6	3000	891.3	97.2	0.96	802	Y
FMP5 315L2-06	315	400	512.9	150	6	3000	1002.8	97.2	0.96	854	Y
FMP5 315L3-06	355	400	578.0	150	6	3000	1130.1	97.2	0.96	946	Y
FMP5 315L4-06	400	400	651.3	150	6	3000	1273.3	97.2	0.96	988	Y
FMP5 355L1-06	450	400	695.4	150	6	3000	1432.5	97.3	0.96	1036	Y
FMP5 355L2-06	500	400	772.6	150	6	3000	1591.7	97.3	0.96	1088	Y

FELM
Electric Motors - www.felm.it

Nominal speed 1500 rpm IE5 efficiency

Type Frame size	kW	Volt	Amp	Hz	Pole	rpm	Torque Nm	Efficiency %	Cosfφ	Weight Kg	Connection
FMP5 80M1-08	1.1	400	1.9	100	8	1500	7.0	89.5	0.96	19	Y
FMP5 80M2-08	1.5	400	2.6	100	8	1500	9.6	90.4	0.96	21	Y
FMP5 90L1-08	2.2	400	3.8	100	8	1500	14.0	91.4	0.96	25	Y
FMP5 90L2-08	3	400	5.2	100	8	1500	19.1	92.1	0.96	27	Y
FMP5 90L3-08	4	400	6.8	100	8	1500	25.5	92.8	0.96	30	Y
FMP5 100L1-08	2.2	400	3.8	100	8	1500	14.0	91.4	0.96	25	Y
FMP5 100L2-08	3	400	5.2	100	8	1500	19.1	92.1	0.96	27	Y
FMP5 100L3-08	4	400	6.8	100	8	1500	25.5	92.8	0.96	30	Y
FMP5 112M1-08	5.5	400	9.3	100	8	1500	35.0	93.4	0.96	41	Y
FMP5 112M2-08	7.5	400	12.6	100	8	1500	47.8	94.0	0.96	45	Y
FMP5 132M1-08	11	400	18.4	100	8	1500	70.0	94.6	0.96	68	Y
FMP5 132M2-08	15	400	25.0	100	8	1500	95.5	95.1	0.96	76	Y
FMP5 132M3-08	18.5	400	30.7	100	8	1500	117.8	95.3	0.96	80	Y
FMP5 160L1-08	22	400	36.5	100	8	1500	140.1	95.5	0.96	124	Y
FMP5 160L2-08	30	400	49. 5	100	8	1500	191.0	95.9	0.96	150	Y
FMP5 180L1-08	37	400	60.9	100	8	1500	235.6	96.1	0.96	176	Y
FMP5 180L2-08	45	400	74.0	100	8	1500	286.5	96.3	0.96	192	Y
FMP5 200L-12	55	400	90.2	150	12	1500	350.2	96.5	0.96	245	Y
FMP5 225M-08	75	400	122.8	100	8	1500	477.5	96.7	0.96	336	Y
FMP5 250M-08	90	400	147.0	100	8	1500	573.0	96.9	0.96	430	Y
FMP5 280M1-08	110	400	179.5	100	8	1500	700.3	97.0	0.96	540	Y
FMP5 280M2-08	132	400	215.2	100	8	1500	840.4	97.1	0.96	552	Y
FMP5 280M3-08	160	400	260.5	100	8	1500	1018.7	97.2	0.96	600	Y
FMP5 315L1-08	200	400	325.0	100	8	1500	1273.3	97.4	0.96	870	Y
FMP5 315L2-08	220	400	357.5	100	8	1500	1400.7	97.4	0.96	910	Y
FMP5 315L3-08	250	400	406.2	100	8	1500	1591.7	97.4	0.96	1014	Y
FMP5 315L4-08	280	400	455.0	100	8	1500	1782.7	97.4	0.96	1045	Y
FMP5 355L1-08	315	400	511.9	100	8	1500	2005.5	97.4	0.96	1800	Y
FMP5 355L2-08	355	400	576.9	100	8	1500	2260.2	97.4	0.96	1890	Y
FMP5 355L3-08	400	400	650.0	100	8	1500	2546.7	97.4	0.96	1970	Y
FMP5 355L4-08	450	400	731.2	100	8	1500	2865.0	97.4	0.96	2010	Y
FMP5 355L5-08	500	400	812.5	100	8	1500	3183.3	97.4	0.96	2100	Y

Nominal speed 1000 rpm IE5 efficiency

Type Frame size	kW	Volt	Amp	Hz	Pole	rpm	Torque Nm	Efficiency %	Cosfφ	Weight Kg	Connection
FMP5 80M1-08	0.75	400	1.4	66.7	8	1000	7.2	85.7	0.96	18	Y
FMP5 80M2-08	1.1	400	2.0	66.7	8	1000	10.5	87.2	0.96	20	Y
FMP5 90L1-08	1.5	400	2.7	66.7	8	1000	14.3	88.4	0.96	25	Y
FMP5 90L2-08	2.2	400	3.9	66.7	8	1000	21.0	89.7	0.96	28	Y
FMP5 100L1-08	1.5	400	2.7	66.7	8	1000	14.3	88.4	0.96	25	Y
FMP5 100L2-08	2.2	400	3.9	66.7	8	1000	21.0	89.7	0.96	28	Y
FMP5 112M1-08	3	400	5.2	66.7	8	1000	28.7	90.6	0.96	32	Y
FMP5 112M2-08	4	400	6.9	66.7	8	1000	38.2	91.4	0.96	34	Y
FMP5 112M3-08	5.5	400	9.4	66.7	8	1000	52.5	92.2	0.96	37	Y
FMP5 132M1-08	7.5	400	12.8	66.7	8	1000	71.6	92.9	0.96	69	Y
FMP5 132M2-08	11	400	18.6	66.7	8	1000	105.1	93.7	0.96	78	Y
FMP5 160L1-08	15	400	25.2	66.7	8	1000	143.3	94.3	0.96	135	Y
FMP5 160L2-08	18.5	400	31.0	66.7	8	1000	176.7	94.6	0.96	149	Y
FMP5 180L1-08	22	400	36.7	66.7	8	1000	210.1	94.9	0.96	165	Y
FMP5 180L2-08	30	400	49.8	66.7	8	1000	286.5	95.3	0.96	176	Y
FMP5 200L-12	37	400	61.3	100	12	1000	353.4	95.6	0.96	206	Y
FMP5 225M1-08	45	400	74.3	66.7	8	1000	429.8	95.8	0.96	296	Y
FMP5 225M2-08	55	400	90.7	66.7	8	1000	525.3	96.0	0.96	334	Y
FMP5 250M-08	75	400	123.3	66.7	8	1000	716.3	96.3	0.96	430	Y
FMP5 280M1-12	90	400	147.6	100	12	1000	859.5	96.5	0.96	592	Y
FMP5 280M2-12	110	400	180.2	100	12	1000	1050.5	96.6	0.96	687	Y
FMP5 315L1-12	132	400	215.8	100	12	1000	1260.6	96.8	0.96	920	Y
FMP5 315L2-12	160	400	261.3	100	12	1000	1528.0	96.9	0.96	1060	Y
FMP5 315L3-12	185	400	301.9	100	12	1000	1766.8	97.0	0.96	1149	Y
FMP5 315L4-12	200	400	326.3	100	12	1000	1910.0	97.0	0.96	1149	Y
FMP5 355L1-08	220	400	359.0	66.7	8	1000	2101.0	97.0	0.96	1789	Y
FMP5 355L2-08	250	400	407.9	66.7	8	1000	2387.5	97.0	0.96	1879	Y
FMP5 355L3-08	280	400	456.9	66.7	8	1000	2674.0	97.0	0.96	1970	Y
FMP5 355L4-08	315	400	514.0	66.7	8	1000	3008.3	97.0	0.96	2040	Y
FMP5 355L5-08	355	400	579.2	66.7	8	1000	3390.3	97.0	0.96	2100	Y
FMP5 355L6-08	400	400	619.4	66.7	8	1000	3820	97,.1	0.96	2160	Y
FMP5 355L7-08	450	400	696.8	66.7	8	1000	4297.5	97.1	0.96	2240	Y
FMP5 355L8-08	500	400	773.4	66.7	8	1000	4775	97.2	0.96	2310	Y

Nominal speed 750 rpm IE5 efficiency

Type Frame size	kW	Volt	Amp	Hz	Pole	rpm	Torque Nm	Efficiency %	Cosfφ	Weight Kg	Connection
FMP5 080M1-08	0.55	400	1.1	50	8	750	7.0	80.6	0.96	17	Y
FMP5 080M2-08	0.75	400	1.4	50	8	750	9.6	82	0.96	19	Y
FMP5 090L1-08	1.1	400	2.1	50	8	750	14.0	84	0.96	25	Y
FMP5 90L2-08	1.5	400	2.8	50	8	750	19.1	85.5	0.96	27	Y
FMP5 100L1-08	1.1	400	2.1	50	8	750	14.0	84	0.96	25	Y
FMP5 100L2-08	1.5	400	2.8	50	8	750	19.1	85.5	0.96	27	Y
FMP5 112M1-08	2.2	400	4.0	50	8	750	28.0	87.2	0.96	32	Y
FMP5 112M2-08	3	400	5.4	50	8	750	38.2	88.4	0.96	35	Y
FMP5 112M3-08	4	400	7.1	50	8	750	50.9	89.4	0.96	38	Y
FMP5 132M1-08	5.5	400	9.6	50	8	750	70.0	90.4	0.96	68	Y
FMP5 132M2-08	7.5	400	13.0	50	8	750	95.5	91.3	0.96	76	Y
FMP5 160L1-08	11	400	18.9	50	8	750	140.1	92.2	0.96	125	Y
FMP5 160L2-08	15	400	25.6	50	8	750	191.0	92.9	0.96	151	Y
FMP5 180L1-12	18.5	400	31.4	75	12	750	235.6	93.3	0.96	168	Y
FMP5 180L2-12	22	400	37.2	75	12	750	280.1	93.6	0.96	176	Y
FMP5 200L-12	30	400	50.5	75	12	750	382.0	94.1	0.96	206	Y
FMP5 225M1-08	37	400	62.0	50	8	750	471.1	94.4	0.96	285	Y
FMP5 225M2-08	45	400	75.2	50	8	750	573.0	94.7	0.96	315	Y
FMP5 250M-08	55	400	91.7	50	8	750	700.3	94.9	0.96	420	Y
FMP5 280M- 12	75	400	124.6	75	12	750	955.0	95.3	0.96	553	Y
FMP5 315L1-12	90	400	149.2	75	12	750	1146.0	95.5	0.96	976	Y
FMP5 315L2-12	110	400	181.9	75	12	750	1400.7	95.7	0.96	998	Y
FMP5 315L3-12	132	400	217.8	75	12	750	1680.8	95.9	0.96	1088	Y
FMP5 315L4-12	160	400	263.5	75	12	750	2037.3	96.1	0.96	1177	Y
FMP5 355L1-12	185	400	304.7	75	12	750	2355.7	96.1	0.96	1800	Y
FMP5 355L2-12	200	400	329.0	75	12	750	2546.7	96.2	0.96	1820	Y
FMP5 355L3-12	220	400	361.6	75	12	750	2801.3	96.3	0.96	1845	Y
FMP5 355L4-12	250	400	410.9	75	12	750	3183.3	96.3	0.96	1900	Y
FMP5 355L5-12	280	400	460.2	75	12	750	3565.3	96.3	0.96	1975	Y
FMP5 355L6-12	315	400	491	75	12	750	4011.0	96.5	0.96	2045	Y
FMP5 355L7-12	355	400	553	75	12	750	4520.3	96.5	0.96	2112	Y
FMP5 355L8-12	400	400	623	75	12	750	5093.3	96.6	0.96	2186	Y
FMP5 355L9-12	450	400	700	75	12	750	5730.0	96.6	0.96	2264	Y
FMP5 355L10-12	500	400	777	75	12	750	6366.7	96.7	0.96	2352	Y

Torque Value Nm

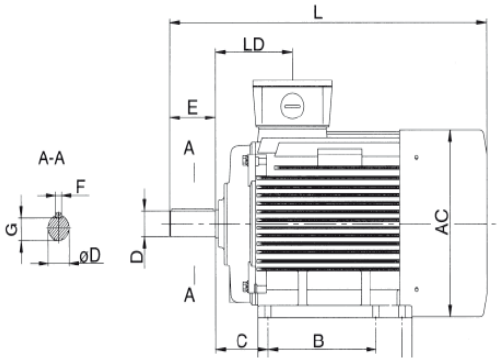
MOTOR TYPE 3000 rpm	Torque Nm motors 3000 rpm	MOTOR TYPE 1500 rpm	Torque Nm motors 1500 rpm
80M1	5	80M1	7,3
80M2	7,3	80M2	10
90S	10	90S	15
90L	13	90L	20
100L1	18	100L1	26
100L2	25	112M	36
112M	36	112M	50
132S1	61	132S1	73
132M1	73	132M1	100
132M2	100	132M2	123
160M	123	160L	146
180M	150	180M	200
180L	183	180L	245
200L	250	200L1	300
200LX	300	200L2	365
225S	365	225S	500
225M	438	225M	500
225M	530	225M	600
250M	665	250M	730
280S	730	280S	875
280M	830	280M	1060
315S	930	315S	1326
315M	1045	315M	1460
315L	1180	315L1	1658
315LX	1330	315L2	1860
355M	1500	355M1	2090
355MX	1660	355M2	2260
355L	1860	355L	2655
355L	2090	355L1	2990
355LX	2360	355L2	3320

Torque Value Nm

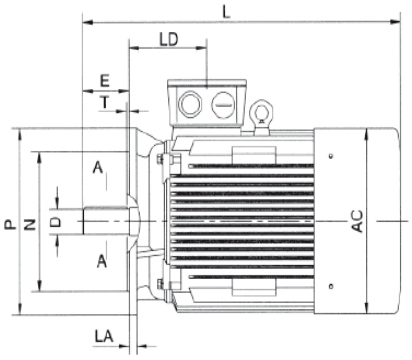
MOTOR TYPE 1000 rpm	Torque Nm motors 1000 rpm	MOTOR TYPE 750 rpm	Torque Nm motors 750 rpm
80M1	7,5	80M1	7,2
80M2	11	80M2	10
90S	15	90S	15
90L	22	90L	20
100L1	30	100L1	30
112M	40	100L2	30
132S1	55	112M	40
132S2	75	132S1	53
132M1	110	132S2	73
160L	150	132M1	100
180M	185	160L	146
180L	220	180M	200
200L	300	180L	245
200LX	370	200L1	292
225S	448	200L2	400
225M	548	225S	490
250M	746	225S	600
280S	896	250M	730
280M	1100	280M	1000
315S	1315	315S	1200
315M	1600	315M	1460
315L	1840	315L1	1750
315LX	2000	355M1	2130
355M	2200	355M2	2460
355MX	2490	355L	2655
355L	2790	355L	2920
355L	3140	355L2	3320
355LX	3540		

Mounting dimension and outline

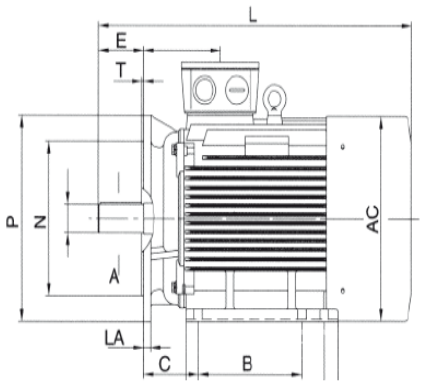
IMB3 mouting



IMB5 mouting



IMB35 mouting



Frame Size	Speed	Mounting dimensions											Outline dimension				
		A	B	C	D	E	F	G	H	M	N	P	AB	AC	AD	HD	L
80	3000~750	125	100	50	19	40	6	15.5	80	165	130	200	160	176	160	230	285
90L	3000~750	140	100/125	56	24	50	8	20	90	165	130	200	180	176	165	250	340
100L	3000~750	160	140	63	28	60		24	100	215	180	250	200	206	180	275	435
112M	3000~750	190	140	70	28				112				230	220	200	310	410
132M	3000~750	216	140/178	89	42	80	12	37	132	265	230	300	265	260	215	350	515
160L	3000~750	254	210/254	108	48	110	14	42.5	160	300	250	350	315	315	270	430	655
180L	3000~750	279	241/279	121	55		16	49	180				350	360	280	465	720
200L	3000~750	318	305	133	60		18	53	200	350	300	400	390	400	320	520	780
225M	3000~750	356	286/311	149	65	140	18	58	225	400	350	450	435	450	345	570	840
250M	3000	406	349	168	65	140	18	58	250	500	450	550	485	485	380	630	915
	1500~750				75		20	67.5									
280M	3000	457	368/419	190	65		18	58	280				545	550	410	690	1055
	1500~750				80		22	71									1065
315L	3000	508	457/508	216	80	140	22	71	315	600	550	660	630	620	550	865	1295
	1500~750				90	170	25	81									1325
355L	3000	610	500/560/630	254	80	170	22	71	355	740	680	800	730	700	605	965	1545
	1500~750				100	210	28	90									1585

The drawings listed in the tables are indicative and not binding. The guaranteed dimensions are upon request.

All data listed in the tables are indicative and not binding. The guaranteed values are upon request. Felm srl reserves the right to change the project, the technical characteristics and dimensions at any time without previous notice.

CONTACTS

Head Quarter
FELM srl
Via Morandi (Industrial Area)
20010 Inveruno (Mi) Italy
Tel. +39 02 97 289 454
Tel. +39 02 97 288 320
Fax +39 02 97 289 923
E-mail home@felm.it

FELM Office Middle East
Jebel Ali Free Zone, Warehouse no. FZS1-BM07,
PO Box 263632, Dubai, United Arab Emirates
Office Ph. +971 (04) 887 9767
mobile +971 50 550 1322
Email: ayman.abdallah@felm.it

FELM Office Germany
Heinrich-Busold-Strasse 47
D-61169 Friedberg (Hessen), Germany
Tel (Off): +49-6031-721606
Mobile: +49-172-6729011
Fax: +49-6031-721610
Email: Jayant@jk-conrep.de

FELM Office China
Add: Room 1002,Building 3#,
No 139 Rd.SongShan,
Jianye, Nanjing, Jiangsu, China
Fax:+86-25-87797622
Tel:+86-15077829999
Email: lidongming1974@vip.sina.com

FELM Office UK
The Foundry, Wadebridge
Cornwall, PL27 7JP
United Kingdom
Tel (Off): +441208 816543
Email: sales@felm.co.uk

WORLD WIDE SERVICE
Mobile +39 355 69 53 804
E-mail service@felm.it