

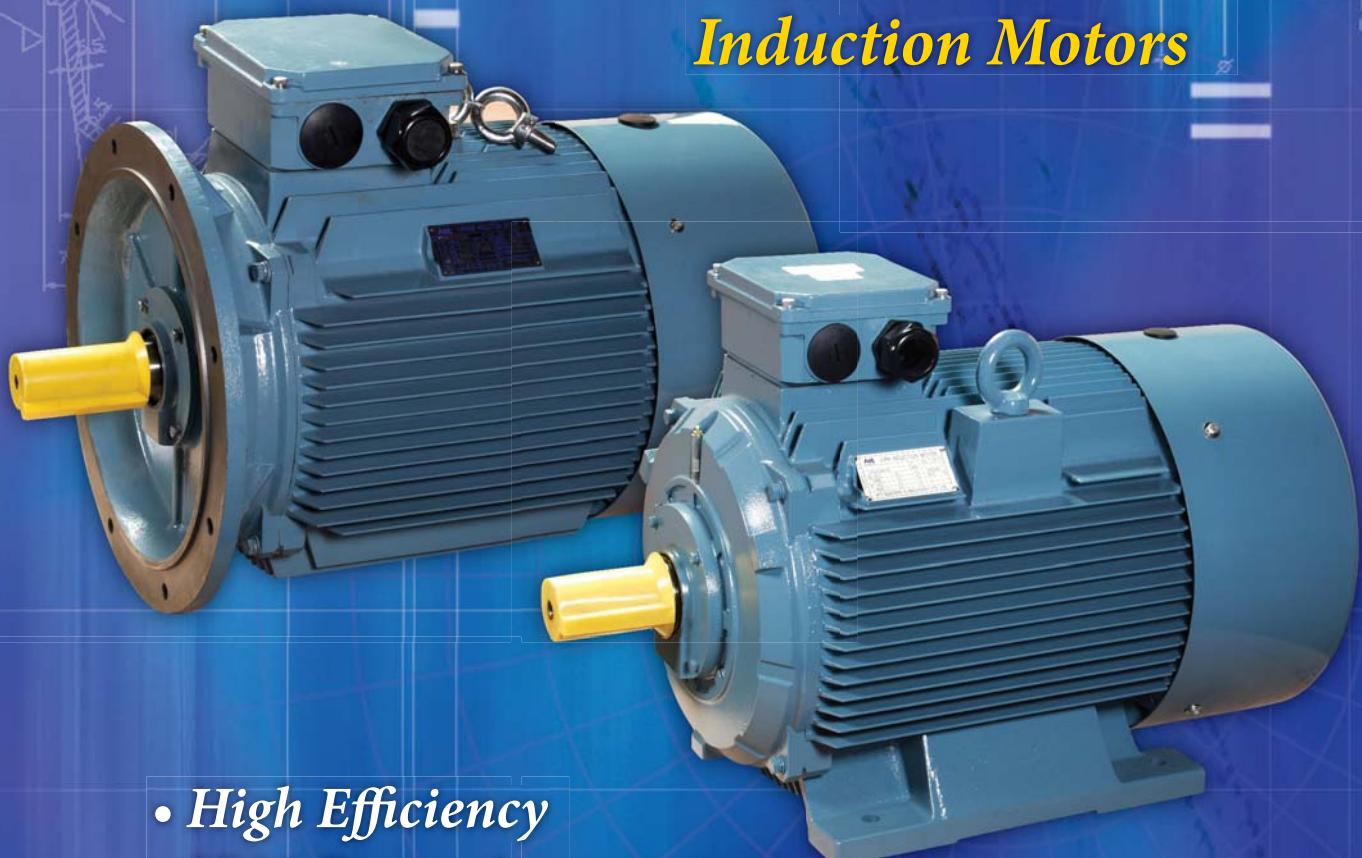


ISO9001:2000



WY SERIES

*Three-Phase TEFC
Cast-Iron
Induction Motors*



- *High Efficiency*
- *IP55 Protection*
- *IEC Dimension*
- *Low Noise*



INTRODUCTION

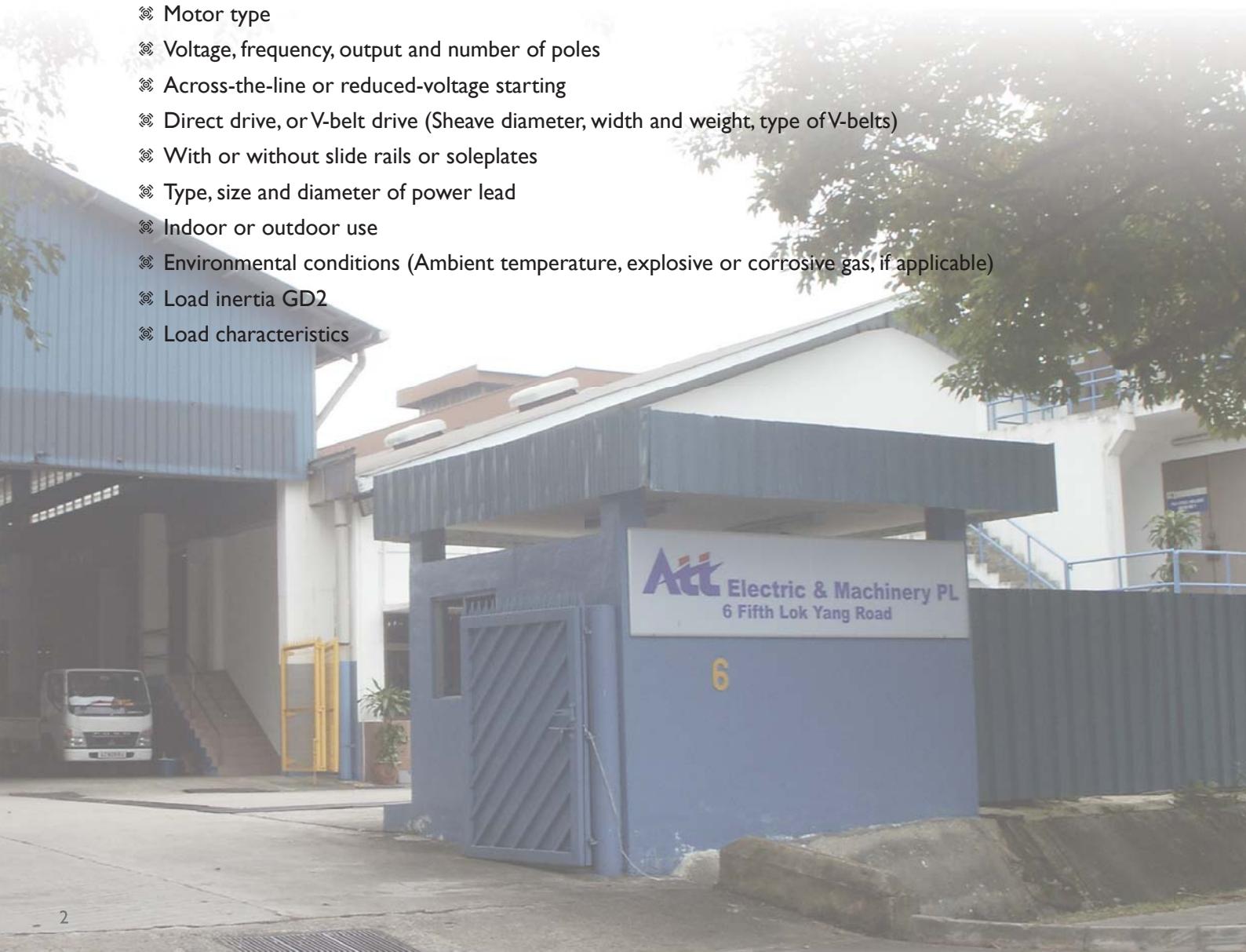
This catalogue detail the complete range of the WY series motors. Standard WY motors are three phase TEFC cast-iron induction motor with IEC frame size from 63 to 355. WY motors are supplied suitable for continuous SI duty, which means that WY motors can operate under constant load, lasting long enough to allow the machine to reach thermal equilibrium. Please contact with ATT when the motor is to operate under any other type of duty.

All WY motors are supplied with Class F insulation and checking permissible limits of temperature rise against that of class B to improve the insulation reliability. Additional protection is provided by installation of thermister in all unit from WY 160 frame upward, to continuously protect the winding.

These motors are built to comply the requirements for European "CE" marking and the International Electrotechnical Commission – IEC 60034 (included 60034-1, 60034-5, 60034-7, 60034-8, 60034-9, 60034-11, 60034-12 and 60034-14). Compliance with IEC60034 means that many standard from other countries based on IEC60034 can normally be complied with.

Ordering Information

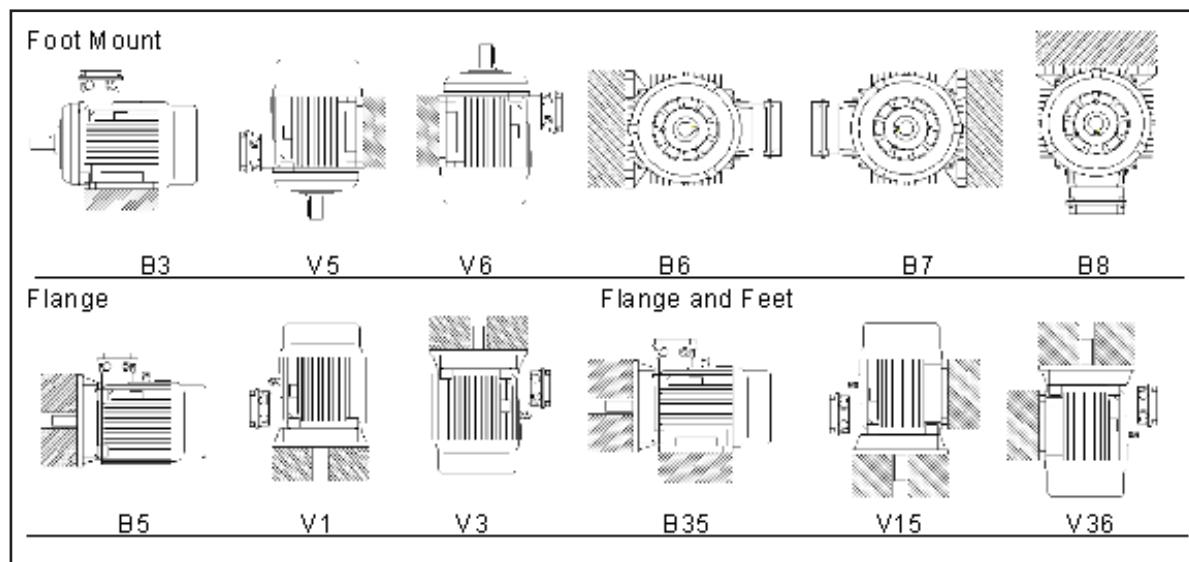
- ◎ Application
- ◎ Motor type
- ◎ Voltage, frequency, output and number of poles
- ◎ Across-the-line or reduced-voltage starting
- ◎ Direct drive, or V-belt drive (Sheave diameter, width and weight, type of V-belts)
- ◎ With or without slide rails or soleplates
- ◎ Type, size and diameter of power lead
- ◎ Indoor or outdoor use
- ◎ Environmental conditions (Ambient temperature, explosive or corrosive gas, if applicable)
- ◎ Load inertia GD₂
- ◎ Load characteristics





All motors are available in B3, B35 and V1 configuration. They can also be mounted B5, but for 315 and 355 frame motors, it is recommended to be mounted only B3, B35 or V1. Please be mentioned that motors to be mounted with the shaft vertically must be provided with a suitable cover to ensure foreign bodies are prevented from entering the motor. Table below listed the possibility mounting arrangement of ATT motors. For mounting arrangement outside the list please contact ATT.

Table 3 – Mounting arrangement



Protection Devices

In order to protect the winding of a three phase induction motor against thermal overloads, one of the following devices can be provided:

PTC temperature sensor:

Or call "thermister". Thermisters are special solid temperature sensors that behave like temperature sensitive resistor. It can be widely used at those work sites which need overheat protection. When the sensor is fixed in those facilities that need overheat protection, they are able to keep the facilities from accidents and dangerous causes by overheating. The sensor used in ATT motors are 3 cores heat variable resistor. They are small size, endurance strength, good stability and excellent sensitiveness.

Space heater:

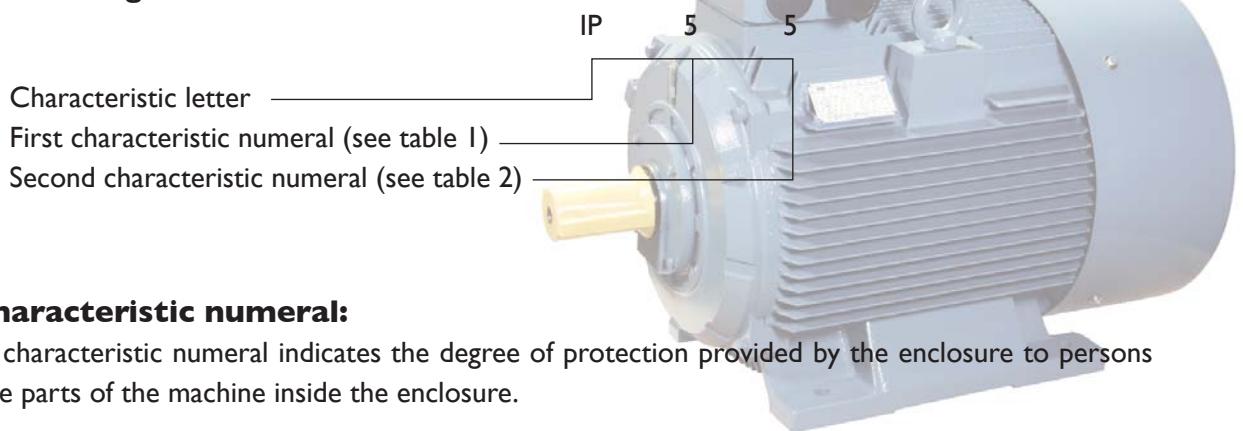
The insulating resistance of electrical facilities is liable to reduce and get electric faults due to the dampness, dew or high humidity and low temperature. The space heater are specially designed and produced according to the improvement of the above circumstances. Heat the motor against dampness before starting it in order to keep it in good working condition. Space heater can be fitted as an option to all motors and recommended for IP56 and IP66.



The standard of protection for all ATT motors are follow the international standard IEC60034-5. This standard specify the Degrees of Protection of electric equipment, commonly known as the "IP" code.

Please refer to the guide below to selected the most suitable protection:

Example of designation:



First characteristic numeral:

The first characteristic numeral indicates the degree of protection provided by the enclosure to persons and to the parts of the machine inside the enclosure.

Table 1 - Degrees of protection indicates by the first characteristic numeral

First characteristic numeral	Degree of protection	
	Brief description	Definition
5	Dust-protection machine	part inside the enclosure. Ingress of dust is not totally prevented but dust does not enter in sufficient quantity to interfere with satisfactory operation of the machine.
6	Dust-tight machine	Ingress of dust totally prevent

Second characteristic numeral:

The second characteristic numeral indicates the degree of protection provided by the enclosure with respect to harmful effects due to ingress of water.

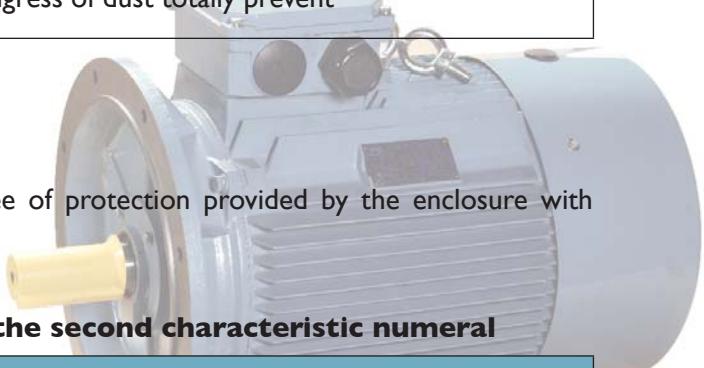


Table 2 - Degrees of protection indicates by the second characteristic numeral

Second characteristic numeral	Degree of protection	
	Brief description	Definition
5	Machine protected against water jet	Water projected by a nozzle against the machine from any direction shall have no harmful effect
6	Machine protected against heavy seas	Water from heavy seas or water projected in powerful jets shall not enter the machine in harmful quantities

Standard level of enclosure protection for all ATT motor is IP55 as a minimum.

Higher levels of protection are available as request.

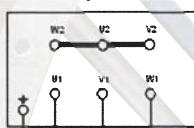


Standard terminal connection for 2.2kW and below is 220-240 volt delta / 380-415 volt star. These motors are normally connected in star connection, thus they are designed for 415 volt Direct On Line (D.O.L) starting. They are also suitable for operation with 240 volt three phase variable frequency drives, when connected in the delta connection.

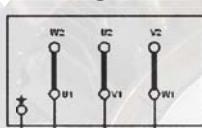
For motors 3.0kW and above, their standard terminal connection is 380-415 volt delta / 660-720 volt star. These motors are designed for 415 volt Direct On Line (D.O.L) starting. They are also suitable for operation with 415V three phase variable frequency drives. These motors are also can be operated for 720V Direct On line starting, when connected in the star configuration.

CONNECTION DIAGRAMS

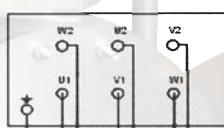
Three phase motors with cage rotor



Star connection

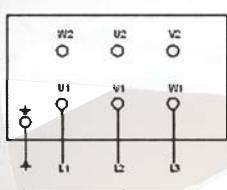


Delta connection

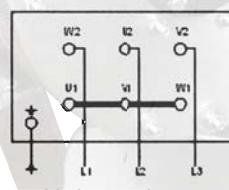


Connection to star-delta starter

Multi-speed motors in Dahlander connection (Tapped Winding)

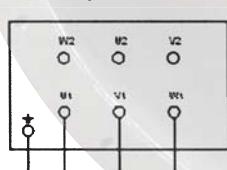


Low speed

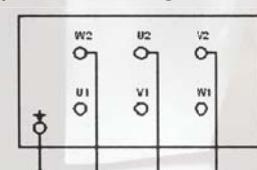


High speed

Multi-speed motors with 2 separate windings.



Low speed



High speed

Vibration

ATT WY motors' rotor have been dynamically balanced and fall within the limit of maximum vibration magnitude set out in IEC 60034-14. Care must be taken to ensure that pulleys or couplings used with motors must also be appropriately balanced with haft feather key.

Limit of maximum vibration magnitude in displacement, velocity and acceleration(r.m.s.) for shaft height:

Vibration grade	Shaft height, mm	56 ≤ H ≤ 132			132 ≤ H ≤ 280			H > 280		
		Mounting	Disp. µm	mm/s	Acc. m/s ²	Disp. µm	Vel. mm/s	Acc. m/s ²	Disp.µm	Vel.mm/s
A	Free suspension	25	1.6	2.5	35	2.2	3.5	45	2.8	4.4
	Rigid mounting	21	1.3	2	29	1.8	2.8	37	2.3	3.8
B	Free suspension	11	0.7	1.1	18	1.1	1.7	29	1.8	2.8
	Rigid mounting				14	0.9	1.4	24	1.5	2.4



Voltage/Frequency

Standard voltage and frequency for WY motor are 220-240V / 380-415V at 50Hz for 2.2kW and below, 380-415V / 660-720V at 50Hz for 3kW and above, and other voltages such as 220-380V, 440-480V at 60Hz. Voltage tolerance is $\pm 5\%$, and frequency tolerance is 1%. Voltage beyond these limits will cause a high winding temperature rise.

Insulation

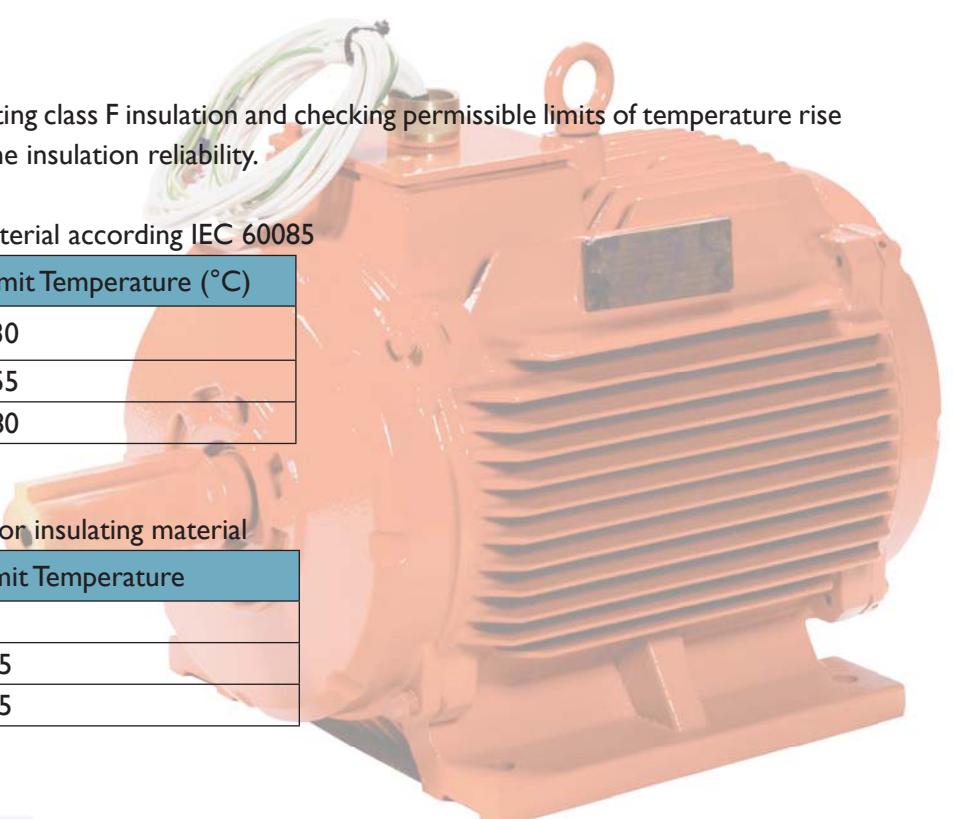
Standard MS series motor are adopting class F insulation and checking permissible limits of temperature rise against that of class B to improve the insulation reliability.

Limit temperature for insulating material according IEC 60085

Insulation Class	Limit Temperature (°C)
B	130
F	155
H	180

Max. permissible temperature rise for insulating material

Insulation Class	Limit Temperature
B	80
F	105
H	125



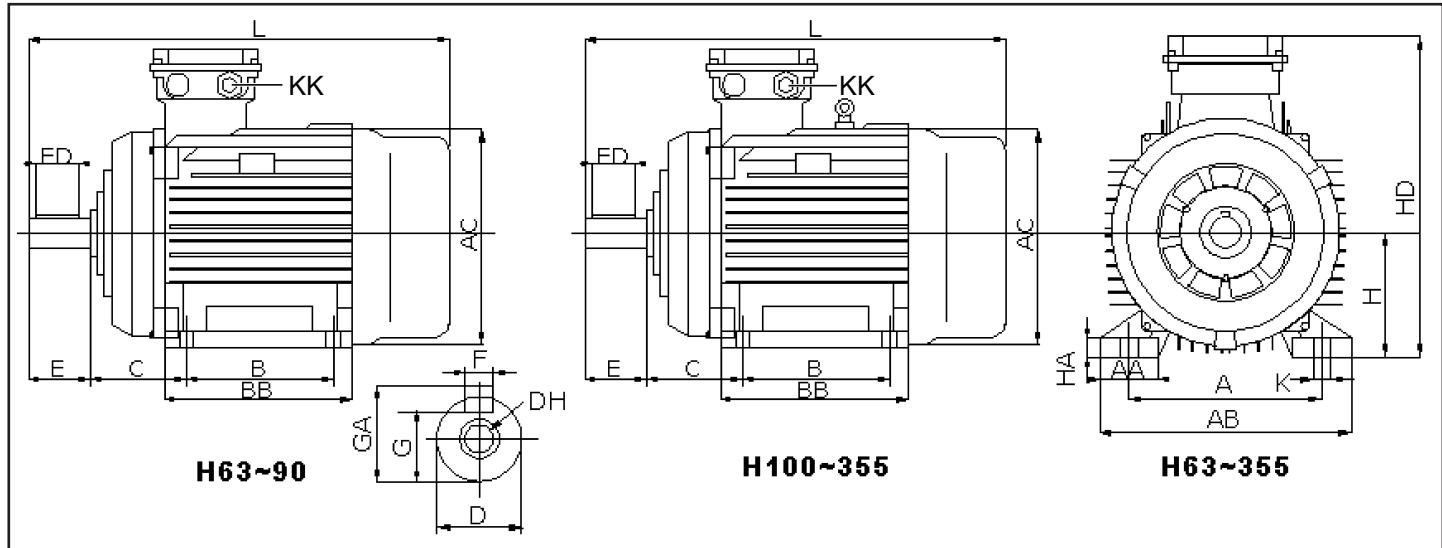
Direction of Rotation

The motors can operate in both direction of rotation. For clockwise rotation, viewed from the drive end, standard WY motor terminal marking coincide with the sequence of the phase line conductors. The direction of rotation can be reversed by interchanging any two phase conductors.

Terminal box location (viewed from drive end)"	Sequential connection of L1,L2 and L3"	Direction of rotation
Right	U1 V1 W1	Clockwise
	V1 U1 W1	Counter-clockwise
Left	V1 U1 W1	Clockwise
	U1 V1 W1	Counter-clockwise

WY B3 FOOT MOUNTING DIMENSIONS

F#63~90 without lifting bolt

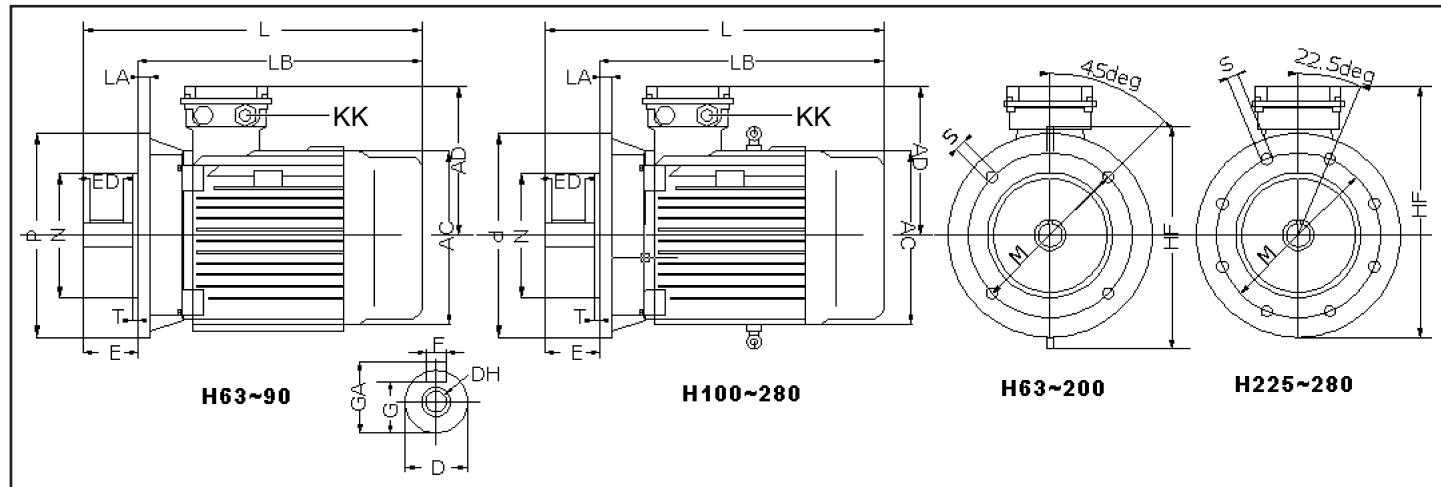


Frame Size	Poles	Mounting Dimensions (mm)									Overall Dimensions (mm)											
		A	B	C	D	E	F	G	H	K	AA	AB	AC	AD	BB	KK	ED	DH	GA	HA	HD	L
63	2,4	100	80	40	11j6	23	4	8.5	63	7	28.5	135	130	70	101	M16X1.5	15	M4X10	12.5	11	180	225
71	2,4,6	112	90	45	14j6	30	5	11	71	7	24	150	150	124	108	M16X1.5	20	M5X13	16	10.5	195	255
80	2,4,6,8	125	100	50	19j6	40	6	15.5	80	10	34	165	175	145	135	M25X1.5	32	M6X16	21.5	12	220	295
90S	2,4,6,8	140	100	56	24j6	50	8	20	90	10	36	180	195	155	140	M25X1.5	32	M8X20	27	12	250	315
90L	2,4,6,8	140	125	56	24j6	50	8	20	90	10	36	180	195	155	165	M25X1.5	32	M8X20	27	12	250	340
100L	2,4,6,8	160	140	63	28j6	60	8	24	100	12	40	205	215	180	185	M25X1.5	40	M10X25	31	14	270	385
112M	2,4,6,8	190	140	70	28j6	60	8	24	112	12	45	230	240	190	185	M32X1.5	40	M10X25	31	15	300	400
132S	2,4,6,8	216	140	89	38k6	80	10	33	132	12	55	270	275	210	190	M32X1.5	56	M12X30	41	18	345	470
132M	2,4,6,8	216	178	89	38k6	80	10	33	132	12	55	270	275	210	230	M32X1.5	56	M12X30	41	18	345	510
160M	2,4,6,8	254	210	108	42k6	110	12	37	160	15	65	320	330	255	274	M40X1.5	85	M16X36	45	20	420	615
160L	2,4,6,8	254	254	108	42k6	110	12	37	160	15	65	320	330	255	318	M40X1.5	85	M16X36	45	20	420	670
180M	2,4,6,8	279	241	121	48k6	110	14	42.5	180	15	70	355	380	280	315	M40X1.5	80	M16X36	51.5	22	455	700
180L	2,4,6,8	279	279	121	48k6	110	14	42.5	180	15	70	355	380	280	355	M40X1.5	80	M16X36	51.5	22	455	740
200L	2,4,6,8	318	305	133	55m6	110	16	49	200	19	70	395	420	305	375	M50X1.5	100	M20X42	59	25	505	770
225S	4,8	356	286	149	60m6	140	18	53	225	19	75	435	470	335	375	M50X1.5	125	M20X40	64	28	560	845
225M	2	356	311	149	55m6	110	16	49	225	19	75	435	470	335	400	M50X1.5	100	M20X40	59	28	560	820
225M	4,6,8	356	311	149	60m6	140	18	53	225	19	75	435	470	335	400	M50X1.5	125	M20X40	64	28	560	850
250M	2	406	349	168	60m6	140	18	53	250	24	80	490	510	370	450	M63X1.5	125	M20X42	64	30	615	910
250M	4,6,8	406	349	168	65m6	140	18	58	250	24	80	490	510	370	450	M63X1.5	125	M20X42	69	30	615	910
280S	2	457	368	190	65m6	140	18	58	280	24	85	550	580	410	490	M63X1.5	100	M20X42	69	45	680	985
280S	4,6,8	457	368	190	75m6	140	20	67.5	280	24	85	550	580	410	535	M63X1.5	100	M20X42	79.5	35	680	985
280M	2	457	419	190	65m6	140	18	58	280	24	85	550	580	410	540	M63X1.5	100	M20X42	69	35	680	1035
280M	4,6,8	457	419	190	75m6	140	20	67.5	280	24	85	550	580	410	535	M63X1.5	100	M20X42	79.5	35	680	1035
315S	2	508	406	216	65m6	140	18	58	315	28	116	635	645	530	680	M63X1.5	110	M20X46	69	45	845	1190
315S	4,6,8,10	508	406	216	80m6	170	22	71	315	28	116	635	645	530	675	M63X1.5	140	M20X46	85	45	845	1220
315M	2	508	457	216	65m6	140	18	58	315	28	116	635	645	530	680	M63X1.5	110	M20X46	69	45	845	1300
315M	4,6,8,10	508	457	216	80m6	170	22	71	315	28	116	635	645	530	675	M63X1.5	140	M20X46	85	45	845	1330
315L	2	508	508	216	65m6	140	18	58	315	28	116	635	645	530	675	M63X1.5	140	M20X46	69	45	845	1300
315L	4,6,8,10	508	508	216	80m6	170	22	71	315	28	116	635	645	530	675	M63X1.5	140	M20X46	85	45	845	1330
355M	2	610	560	254	75m6	140	20	67.5	355	28	120	730	720	655	710	M63X1.5	160	M20X46	79.5	52	1010	1500
355M	4,6,8,10	610	560	254	95m6	170	25	86	355	28	120	730	720	655	775	M63X1.5	140	M24X46	100	49	1010	1530
355L	2	610	630	254	75m6	170	25	86	355	28	120	730	720	655	775	M63X1.5	140	M24X46	100	49	1010	1500
355L	4,6,8,10	610	630	254	95m6	170	25	86	355	28	120	730	720	655	840	M63X1.5	160	M20X46	79.5	52	1010	1500

Data are subjected to revisions without any prior notice.

WY B5 FLANGE MOUNTING DIMENSIONS

F#63~90 without lifting bolt

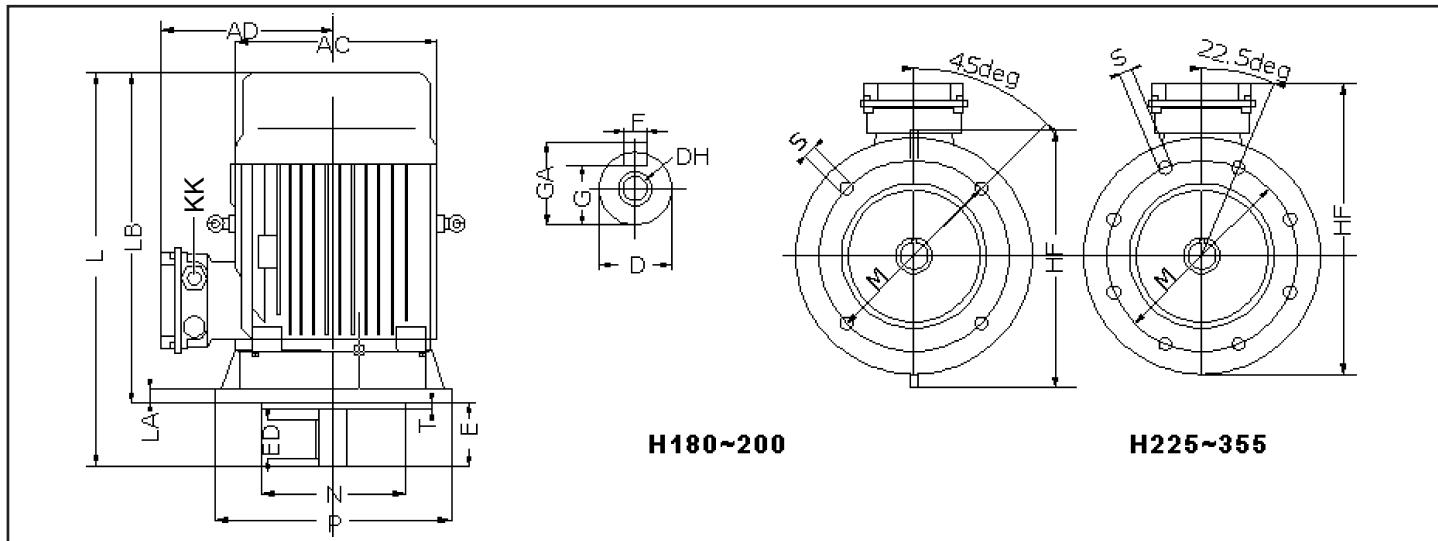


Frame Size	Poles	Mounting Dimensions (mm)										Overall Dimensions (mm)									
		D	E	F	G	M	N	P	S	T	AC	AD	ED	KK	DH	GA	HF	LA	LB	L	
63	2,4	11j6	23	4	8.5	115	95	140	4-ø10	3	130	105	15	M16X1.5	M4X10	12.5	185	-	199	225	
71	2,4,6	14j6	30	5	11	130	110	160	4-ø10	3.5	150	124	20	M16X1.5	M5X13	16	200	10.2	221.5	255	
80	2,4,6,8	19j6	40	6	15.5	165	130	200	4-ø12	3.5	175	135	32	M25X1.5	M6X16	21.5	235	12	251.5	295	
90S	2,4,6,8	24j6	50	8	20	165	130	200	4-ø12	3.5	195	150	32	M25X1.5	M8X20	27	250	12	261.5	315	
90L	2,4,6,8	24j6	50	8	20	165	130	200	4-ø12	3.5	195	170	32	M25X1.5	M8X20	27	270	12	286.5	340	
100L	2,4,6,8	28j6	60	8	24	215	180	250	4-ø15	4	215	155	40	M25X1.5	M10X25	31	280	13	321	385	
112M	2,4,6,8	28j6	60	8	24	215	180	250	4-ø15	4	240	235	40	M32X1.5	M10X25	31	360	14	336	400	
132S	2,4,6,8	38k6	80	10	33	265	230	300	4-ø15	4	275	210	56	M32X1.5	M12X30	45	360	14	386	470	
132M	2,4,6,8	38k6	80	10	33	265	230	300	4-ø15	4	275	210	56	M32X1.5	M12X30	45	360	14	426	510	
160M	2,4,6,8	42k6	110	12	37	300	250	350	4-ø19	5	330	255	85	M40X1.5	M16X36	46	430	15	500	615	
160L	2,4,6,8	42k6	110	12	37	300	250	350	4-ø19	5	330	255	85	M40X1.5	M16X36	46	430	15	555	670	
180M	2,4,6,8	48k6	110	14	42.5	300	250	350	4-ø19	5	380	255	80	M40X1.5	M16X36	51.5	430	15	585	700	
180L	2,4,6,8	48k6	110	14	42.5	300	250	350	4-ø19	5	380	275	80	M40X1.5	M16X36	51.5	450	15	625	740	
200L	2,4,6,8	55m6	110	16	49	350	300	400	4-ø19	5	420	345	100	M50X1.5	M20X42	59	545	17	655	770	
225S	4,8	60m6	140	18	53	400	350	450	8-ø19	5	470	330	125	M50X1.5	M20X40	64	555	20	700	845	
225M	2	55m6	110	16	49	400	350	450	8-ø19	5	470	330	125	M50X1.5	M20X40	60	555	20	705	820	
225M	4,6,8	60m6	140	18	53	400	350	450	8-ø19	5	470	330	125	M50X1.5	M20X40	59	555	20	705	850	
250M	2	60m6	140	18	53	500	450	550	8-ø19	5	510	365	125	M63X1.5	M20X42	64	640	22	765	910	
250M	4,6,8	65m6	140	18	58	500	450	550	8-ø19	5	510	365	125	M63X1.5	M20X42	69	640	22	765	910	
280S	2	65m6	140	18	58	500	450	550	8-ø19	5	580	400	100	M63X1.5	M20X42	69	675	22	840	985	
280S	4,6,8	75m6	140	20	67.5	500	450	550	8-ø19	5	580	405	110	M63X1.5	M20X42	79.5	675	22	840	985	
280M	2	65m6	140	18	58	500	450	550	8-ø19	5	580	400	100	M63X1.5	M20X42	69	675	22	890	1035	
280M	4,6,8	75m6	140	20	67.5	500	450	550	8-ø19	5	580	405	110	M63X1.5	M20X42	79.5	675	22	890	1035	

Data are subjected to revisions without any prior notice.



WY VI FLANGE MOUNTING DIMENSIONS

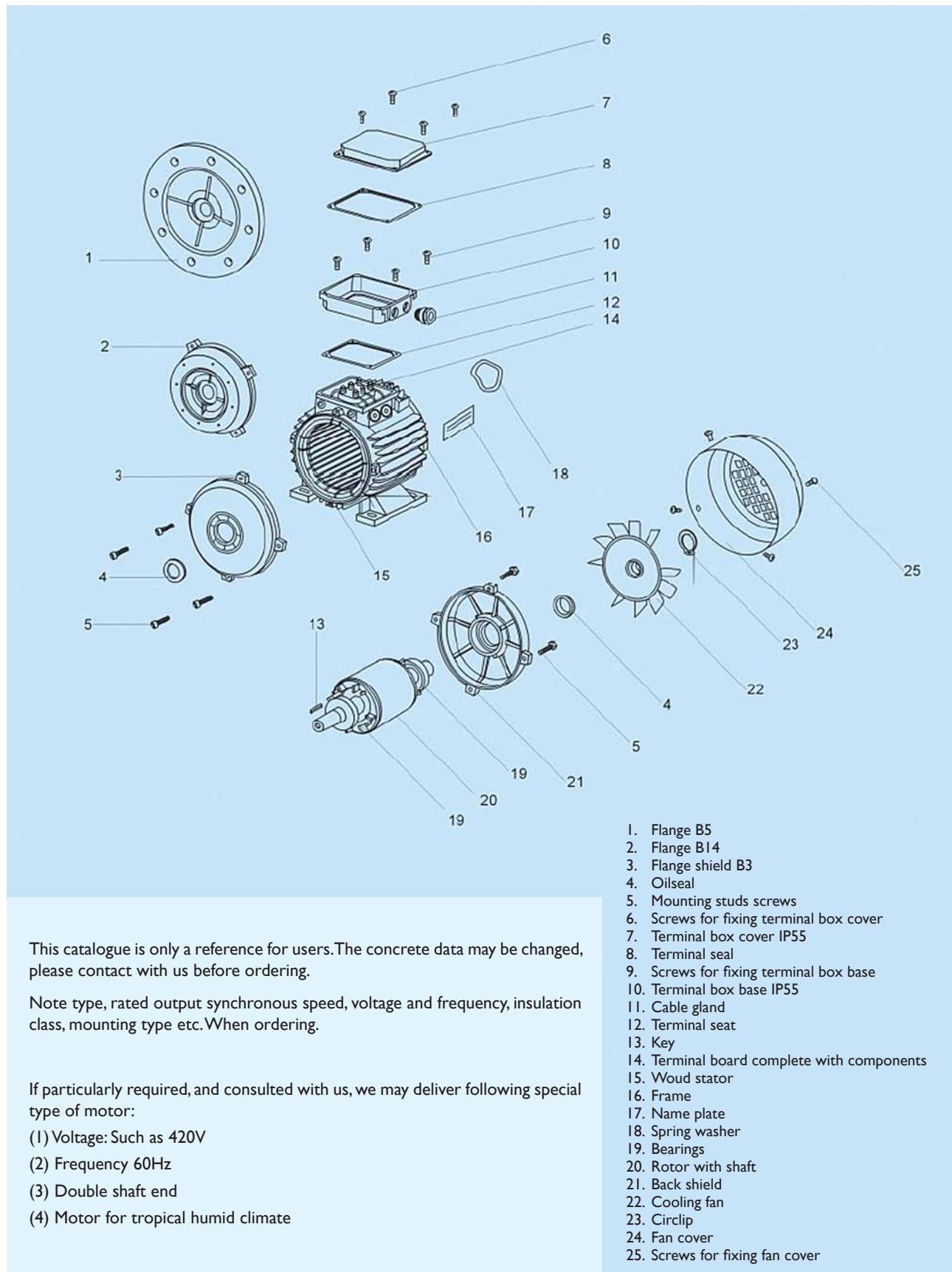


Frame Size	Poles	Mounting Dimensions (mm)										Overall Dimensions (mm)									
		D	E	F	G	M	N	P	S	T	AC	AD	ED	KK	DH	GA	HF	LA	LB	L	
180M	2,4,6,8	48k6	110	14	42.5	300	250	350	4-ø19	5	380	280	80	M40X1.5	M16X36	51.5	500	15	585	760	
180L	2,4,6,8	48k6	110	14	42.5	300	250	350	4-ø19	5	380	280	80	M40X1.5	M16X36	51.5	500	15	625	800	
200L	2,4,6,8	55m6	110	16	49	350	300	400	4-ø19	5	420	305	100	M50X1.5	M20X42	59	550	17	655	840	
225S	4,8	60m6	140	18	53	400	350	450	8-ø19	5	470	335	125	M50X1.5	M20X40	64	610	20	700	905	
225M	2	55m6	110	16	49	400	350	450	8-ø19	5	470	335	100	M50X1.5	M20X40	59	610	20	705	910	
225M	4,6,8	60m6	140	18	53	400	350	450	8-ø19	5	470	335	125	M50X1.5	M20X40	64	610	20	700	935	
250M	2	60m6	140	18	53	500	450	550	8-ø19	5	510	370	125	M63X1.5	M20X42	64	650	22	765	1015	
250M	4,6,8	65m6	140	18	58	500	450	550	8-ø19	5	510	370	125	M63X1.5	M20X42	69	650	22	765	1015	
280S	2	65m6	140	18	58	500	450	550	8-ø19	5	580	410	100	M63X1.5	M20X42	69	685	22	840	1110	
280S	4,6,8	75m6	140	20	67.5	500	450	550	8-ø19	5	580	410	110	M63X1.5	M20X42	79.5	685	22	840	1110	
280M	2	65m6	140	18	58	500	450	550	8-ø19	5	580	410	100	M63X1.5	M20X42	69	685	22	890	1150	
280M	4,6,8	75m6	140	20	67.5	500	450	550	8-ø19	5	580	410	110	M63X1.5	M20X42	79.5	685	22	890	1150	
315S	2	65m6	140	18	58	600	550	660	8-ø24	6	645	530	110	M63X1.5	M20X46	69	830	22	1014	1320	
315S	4,6,8,10	80m6	170	22	71	600	550	660	8-ø24	6	645	530	140	M63X1.5	M20X46	85	830	24	1094	1350	
315M	2	65m6	140	18	58	600	550	660	8-ø24	6	645	530	110	M63X1.5	M20X46	69	830	22	1044	1430	
315M	4,6,8,10	80m6	170	22	71	600	550	660	8-ø24	6	645	530	140	M63X1.5	M20X46	85	830	24	1124	1460	
315L	2	65m6	140	18	58	600	550	660	8-ø24	6	645	530	110	M63X1.5	M20X46	69	830	22	1044	1430	
315L	4,6,8,10	80m6	170	22	71	600	550	660	8-ø24	6	645	530	140	M63X1.5	M20X46	85	830	24	1124	1460	
355M	2	75m6	140	20	67.5	740	680	800	8-ø24	6	720	655	160	M63X1.5	M20X46	79.5	990	25	1500	1640	
355M	4,6,8,10	95m6	170	25	86	740	680	800	8-ø24	6	720	655	140	M63X1.5	M20X46	100	990	25	1500	1670	

Data are subjected to revisions without any prior notice.

Frame Size	Driving End			Non-Driving End		
	2 pole	4,6,8 pole	10 Pole	2 pole	4,6,8 pole	10 Pole
63	6201-ZZ-C3	6201-ZZ-C3		6201-ZZ-C3	6201-ZZA-C3	
71	6202-ZZ-C3	6202-ZZ-C3		6202-ZZ-C3	6202-ZZA-C3	
80	6204-ZZ-C3	6204-ZZ-C3		6204-ZZ-C3	6204-ZZA-C3	
90	6205-ZZ-C3	6205-ZZ-C3		6205-ZZ-C3	6205-ZZA-C3	
100	6206-ZZ-C3	6206-ZZ-C3		6206-ZZ-C3	6206-ZZA-C3	
112	6306-ZZ-C3	6306-ZZ-C3		6206-ZZ-C3	6206-ZZA-C3	
132	6308-ZZ-C3	6308-ZZ-C3		6208-ZZ-C3	6208-ZZA-C3	
160	6309-ZZ-C3	6309-ZZ-C3		6209-ZZ-C3	6209-ZZA-C3	
180	6311-C3	6311-C3		6211-C3	6211-C3	
200	6312-C3	6312-C3		6212-C3	6212-C3	
225	6312-C3	6313-C3		6312-C3	6313-C3	
250	6313-C3	6314-C3		6313-C3	6313-C3	
280	6314-C3	6317-C3		6314-C3	6314-C3	
315	6317-C3	N319	N319	6317-C3	6319-C3	
355	6319-C3	NU322	NU322	6319-C3	6322-C3	6322-C3

Data are subjected to revisions without any prior notice.



This catalogue is only a reference for users. The concrete data may be changed, please contact with us before ordering.

Note type, rated output synchronous speed, voltage and frequency, insulation class, mounting type etc. When ordering.

If particularly required, and consulted with us, we may deliver following special type of motor:

- (1) Voltage: Such as 420V
- (2) Frequency 60Hz
- (3) Double shaft end
- (4) Motor for tropical humid climate



STANDARD SPECIFICATION AND FEATURES OF WY MOTORS

Item	Standard Specifications
Type of Motor	Totally-enclosed fan-cooled squirrel cage induction motor
Design standards	IEC 60034-1
Voltage and frequency	Standard stock available are : 220-240/380-415V/50Hz for 2.2KW & below 380-415/660-720V/50Hz for 3KW & above other voltages such as 200V, 346V, 440V, 460V & 60Hz etc can be supplied on request
Power conditions	± 5% of Rated voltage and ± 1% frequency ± 1% Phase unbalance
Time duty	Continuous SI, MCR (S.F:1.0)
Cooling method	Self external fan, surface cooling (IC 411)
Method of starting	Full voltage direct on line starting or star-delta starting
Mounting	Horizontal foot mounting, flange mounting : B3; B5; B14; B34; B35; VI
Insulation class &	Adopting class F insulation and checking permissible limits of temperature
Temperature rise	rise against that of class B to improve the insulation reliability
Rotor winding	Squirrel cage, aluminum conductor with end-ring and wafter blades integrally cast
Environmental conditions	Place : Non-hazardous, Shaded Ambient temperature : -10°C to 40°C Relative humidity : Less than 90% RH(non-condensation) Altitude : Up to 1,000 metres above sea level
Drive method	Belt service (Note: F#225 and above is for coupling drive)
Direction of rotation	Standard motors are suitable for operation in either direction of rotation Direction of rotation of motor can be reversed by interchanging any two of the power lines
Test procedure	IEC and full voltage measuring starting operation
Fan cover	Pressed steel
Shaft	Carbon steel,round shaft with key
Bearing	Grease pre-packed shielded ball bearing
Lubrication	Lithium-base grease (Shell Alvania R3)
Painting	Phenolic rust-proof base plus lacquer surface finish; Painting in blue colour
Nameplate	Stainless steel
Grounding terminal	NE set inside the terminal box

Motors can be customized in accordance to customers' requirements:

- 1. IP56
- 2. IP66
- 3. Class H Insulation
- 4. Multi-speed
- 5. Special paint finished
- 6. Corrosion-proof
- 7. PTC thermister for heater thermal protection
- 8. Anti-condensation heater
- 9. Special shaft extension
- 10. Inverter duty application
- 11. Grease relief for frames down to 100L
- 12. Sun canopy
- 13. Brake motor
- 14. TENV motors
- 15. Extend lead wire



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