

Technical Documentation



TOTALLY ENCLOSED SLIPRING
MOTORS type 2.ZP

2.ZP09EN

Vision



We set your ideas in motion. We do not merely manufacture motors, but instead turn the ambitious concepts of our customers into modern, innovative and reliable products, which are unique and point the way to the future. We bring our customers closer to their goals with reliability, creativity and flexibility.

Business Units



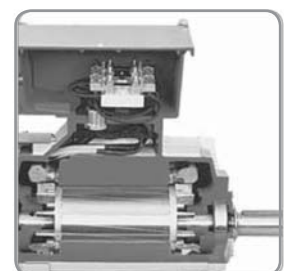
Serial Motors



New Businesses



Home Appliances



Project Motors

Protection: IP 55

Voltage: 400 V, 50 Hz

Type	Output kW	Full load R.P.M. min ⁻¹	Full load Current A	Eff %	Power factor cos φ	BDT RT	Rotor		Weight kg	Moment of inertia J kgm ²
							Voltage ±10%V	Current A		

1500 min⁻¹

2.ZP 225 Mk-4	30	1475	55	91.5	0.86	4.4	347	52	440	0.7
2.ZP 225 M-4	37	1476	68	92	0.86	4.4	420	53	480	0.78
2.ZP 250 Mk-4	45	1475	83	92	0.85	4.2	210	130	640	1.26
2.ZP 250 M-4	55	1475	101	93.7	0.85	4.4	253	130	680	1.48
2.ZP 280 S-4	75	1475	134	92.6	0.87	4.0	326	140	870	2.55
2.ZP 280 M-4	90	1480	164	93	0.85	4.4	390	140	940	3.0
2.ZP 315 S-4	110	1480	195	92.7	0.88	4.8	350	190	1115	3.35
2.ZP 315 M-4	132	1482	232	93.3	0.88	4.8	430	186	1245	4.1
2.ZP 355 Lk-4	160	1485	283	93.9	0.87	4.2	462	210	1655	6.3
2.ZP 355 L-4	200	1487	344	94.2	0.89	4.5	580	209	1860	8.16
2.ZP 400 Lk-4	250	1485	446	94.0	0.86	4.5	835	182	2320	12.36
2.ZP 400 L-4	315	1487	560	94.3	0.86	4.5	1050	182	2640	15.46

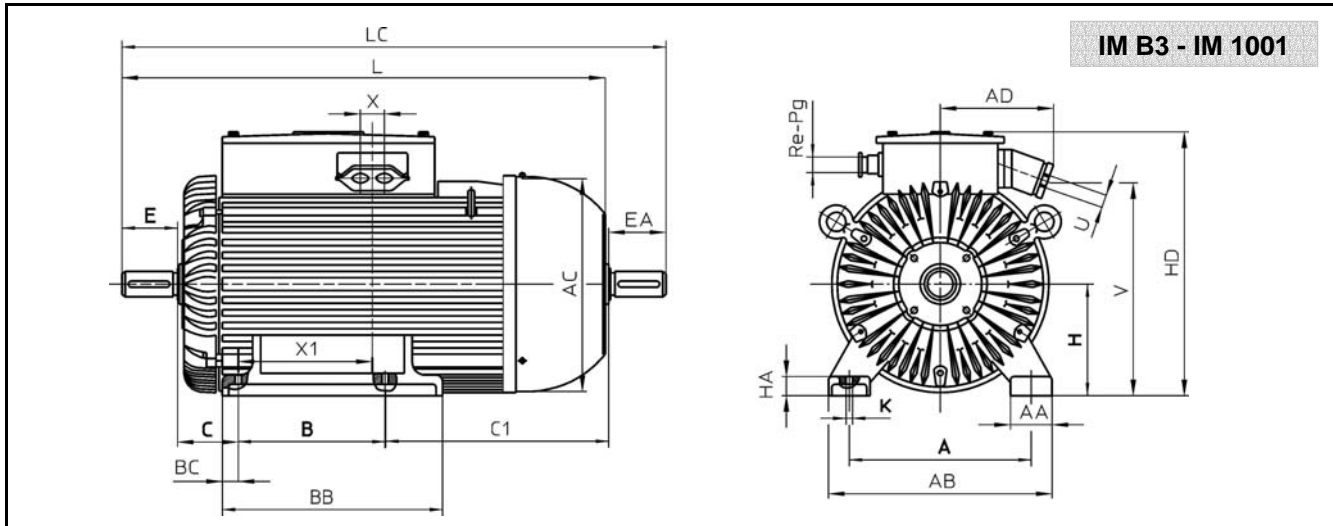
1000 min⁻¹

2.ZP 200 Lk-6	15	975	33	87.5	0.75	3.6	258	33	290	0.53
2.ZP 200 L-6	18.5	975	39.5	89	0.76	3.8	338	33	323	0.68
2.ZP 225 Mk-6	22	975	46	90	0.78	3.6	300	45	440	0.97
2.ZP 225 M-6	30	975	62	90.2	0.78	3.6	395	46	490	1.18
2.ZP 250 Mk-6	37	980	71	90.5	0.83	3.6	158	142	640	1.67
2.ZP 250 M-6	45	980	86	91	0.83	3.6	190	145	700	1.88
2.ZP 280 S-6	55	980	103	92	0.84	4.2	185	180	845	3.1
2.ZP 280 M-6	75	982	141	92.6	0.83	4.2	252	180	975	3.64
2.ZP 315 S-6	90	989	169	92.8	0.83	4.2	295	185	1180	5.57
2.ZP 315 M-6	110	986	203	93.3	0.84	4.2	336	198	1290	6.82
2.ZP 355 Lk-6	132	989	233	94.8	0.87	4.2	526	152	1785	9.70
2.ZP 355 L-6	160	990	282	94.0	0.87	4.6	665	146	2025	11.42
2.ZP 400 Lk-6	200	990	373	94.5	0.82	4.2	666	182	2290	16.48
2.ZP 400 L-6	250	990	464	94.7	0.82	4.2	830	182	2610	19.60

750 min⁻¹

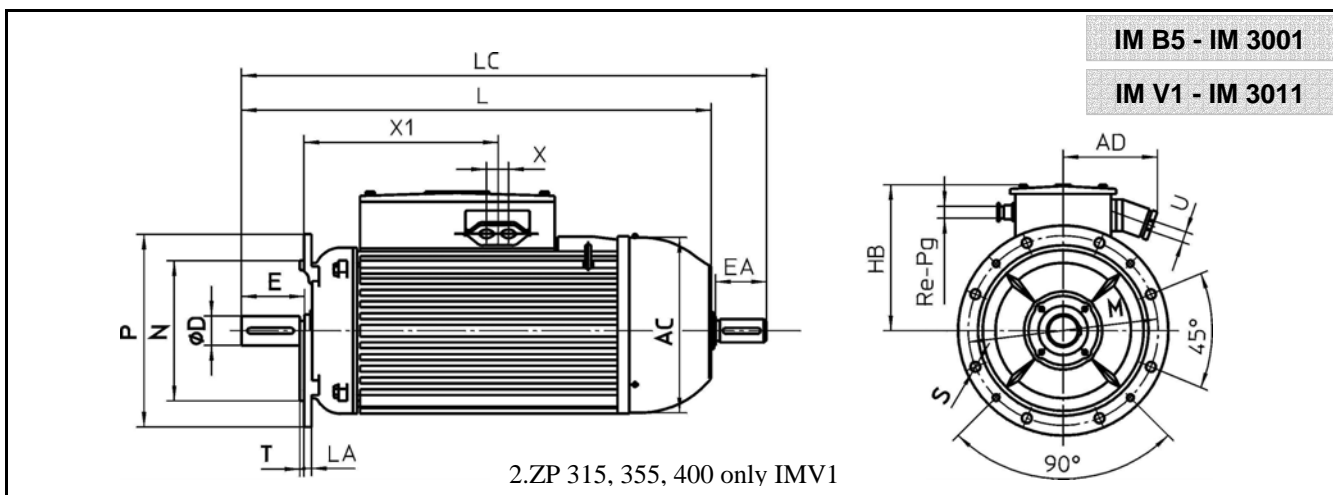
2.ZP 200 Lk-8	11	720	26	87	0.70	3.3	274	27	318	0.64
2.ZP 200 L-8	15	723	35	87	0.70	3.3	374	26	360	0.71
2.ZP 225 Mk-8	18.5	730	39.5	89	0.76	3.8	285	40	455	0.90
2.ZP 225 M-8	22	730	45	90	0.78	3.8	337	40	490	1.10
2.ZP 250 Mk-8	30	730	64	90.2	0.75	3.8	184	99	640	1.79
2.ZP 250 M-8	37	732	79	90.5	0.75	3.9	226	100	700	2.14
2.ZP 280 S-8	45	738	94.8	91.5	0.76	3.8	237	116	865	3.26
2.ZP 280 M-8	55	738	115	92	0.75	3.8	295	116	990	3.85
2.ZP 315 S-8	75	742	153	91.8	0.77	3.6	400	114	1230	7.04
2.ZP 315 M-8	90	742	180	92.5	0.78	3.6	442	124	1300	8.69
2.ZP 355 Lk-8	110	743	232	92.6	0.74	4.5	452	147	1785	11.95
2.ZP 355 L-8	132	743	268	93.4	0.76	4.7	558	143	2025	13.33
2.ZP 400 Lk-8	160	743	300	94	0.82	3.4	589	165	2395	26.07
2.ZP 400 L-8	200	744	380	94.8	0.80	3.5	763	158	2740	31.26

DIMENSIONAL SKETCHES



All dimensions in millimeters

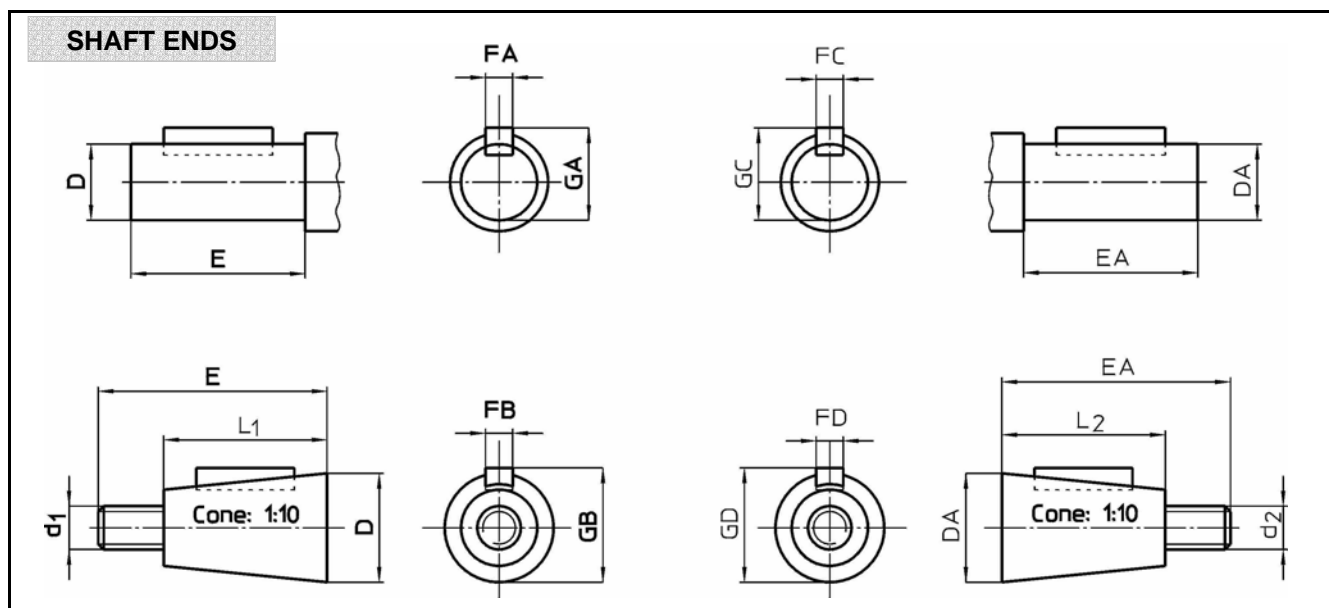
TYPE	A	AA	AB	AC	AD	B	BB	BC	C	C ₁	H	HA	HD	K	L	LC	Re	U	V	X	X ₁
2.ZP 200 Lk,L	318	80	398	395	200	305	458	34.5	133	400	200	35	495	19	943	1058	Re36	-	390	110	280
2.ZP 225 Mk,M	356	90	446	444	275	311	453	34.5	149	461	225	40	575	19	1056	1201	-	∅54	432	110	390
2.ZP 250 Mk,M	406	100	506	490	275	349	517	40.5	168	540	250	40	620	24	1194	1337	-	∅54	475	110	390
2.ZP 280 S	457	110	567	537	275	368	525	34.5	190	540	280	45	680	24	1235	1378	-	∅54	535	110	410
2.ZP 280 M	457	110	567	537	275	419	575	34.5	190	540	280	45	680	24	1286	1429	-	∅54	535	110	410
2.ZP 315 S	508	125	633	598	310	406	606	42.5	216	600	315	50	745	28	1387	1562	-	∅64	510	128	425
2.ZP 315 M	508	125	633	598	310	457	657	42.5	216	600	315	50	745	28	1438	1613	-	∅64	510	128	425
2.ZP 355 Lk,L	610	140	750	688	310	630	895	60	254	618	355	50	830	28	1667	1842	-	∅64	660	128	430
2.ZP 400 Lk,L	686	195	840	782	360	710	1050	60	280	630	400	62	950	36	1785	1960	-	∅75	750	150	500



2.ZP 315, 355, 400 only IMV1

All dimensions in millimeters

TYPE	AC	AD	HB	L	LA	LC	M	N	P	S	Holes	T	Re	U	X	X ₁
2.ZP 200 Lk,L	395	200	295	943	20	1058	350	300	400	19	4	5	Re36	-	110	415
2.ZP 225 Mk,M	444	275	350	1056	20	1201	400	350	450	19	8	5	-	∅54	110	540
2.ZP 250 Mk,M	490	275	370	1194	22	1337	500	450	550	19	8	5	-	∅54	110	560
2.ZP 280 S	537	275	400	1235	22	1378	500	450	550	19	8	5	-	∅54	110	600
2.ZP 280 M	537	275	400	1286	22	1429	500	450	550	19	8	5	-	∅54	110	600
2.ZP 315 S	598	310	430	1387	25	1562	600	550	660	24	8	6	-	∅64	128	640
2.ZP 315 M	598	310	430	1438	25	1613	600	550	660	24	8	6	-	∅64	128	640
2.ZP 355 Lk,L	688	310	475	1667	25	1842	740	680	800	24	8	6	-	∅64	128	685
2.ZP 400 Lk,L	782	360	550	1785	35	1960	740	680	800	24	8	6	-	∅75	150	780



2.ZP	E	EA	D	DA	D6	D7	FA	FC	GA	GC	L ₁	L ₂	FB	FD	GB	GD	d ₁	d ₂
200	110	110	55	55	M20	M20	16	16	59	59	82	82	14	14	56.4	56.4	M 36 x 3	M 36 x 3
225	140	140	60	60			18	18	64	64	105	105	16	16	61.4	61.4	M 42 x 3	M 42 x 3
250	140	140	65	65			18	18	69	69	105	105	16	16	66.4	66.4	M 42 x 3	M 42 x 3
280	140	140	75	75			20	20	79.5	79.5	105	105	18	18	76.4	76.4	M 48 x 3	M 48 x 3
315	170	170	80	80			22	22	85	85	130	130	20	20	81.2	81.2	M 56 x 4	M 56 x 4
355	170	170	90	85	M24	M20	25	22	95	90	130	130	22	20	91.7	86.2	M 64 x 4	M 56 x 4
400	170	170	95	90	M24	M24	25	25	100	95	130	130	22	22	96.7	91.7	M 64 x 4	M 64 x 4

DIMENSIONS

The fixing dimensions given in thick figures are obligatory according to the recommendations of IEC. All the other technical data and dimensions of the motors type 2.ZP may undergo some changes during the further development of these motors and therefore they can be considered as obligatory after our confirmation only.

The totally enclosed fan cooled slipring electromotors type 2.ZP are produced with principal dimensions complying to the recommendations of the IEC publication 72.

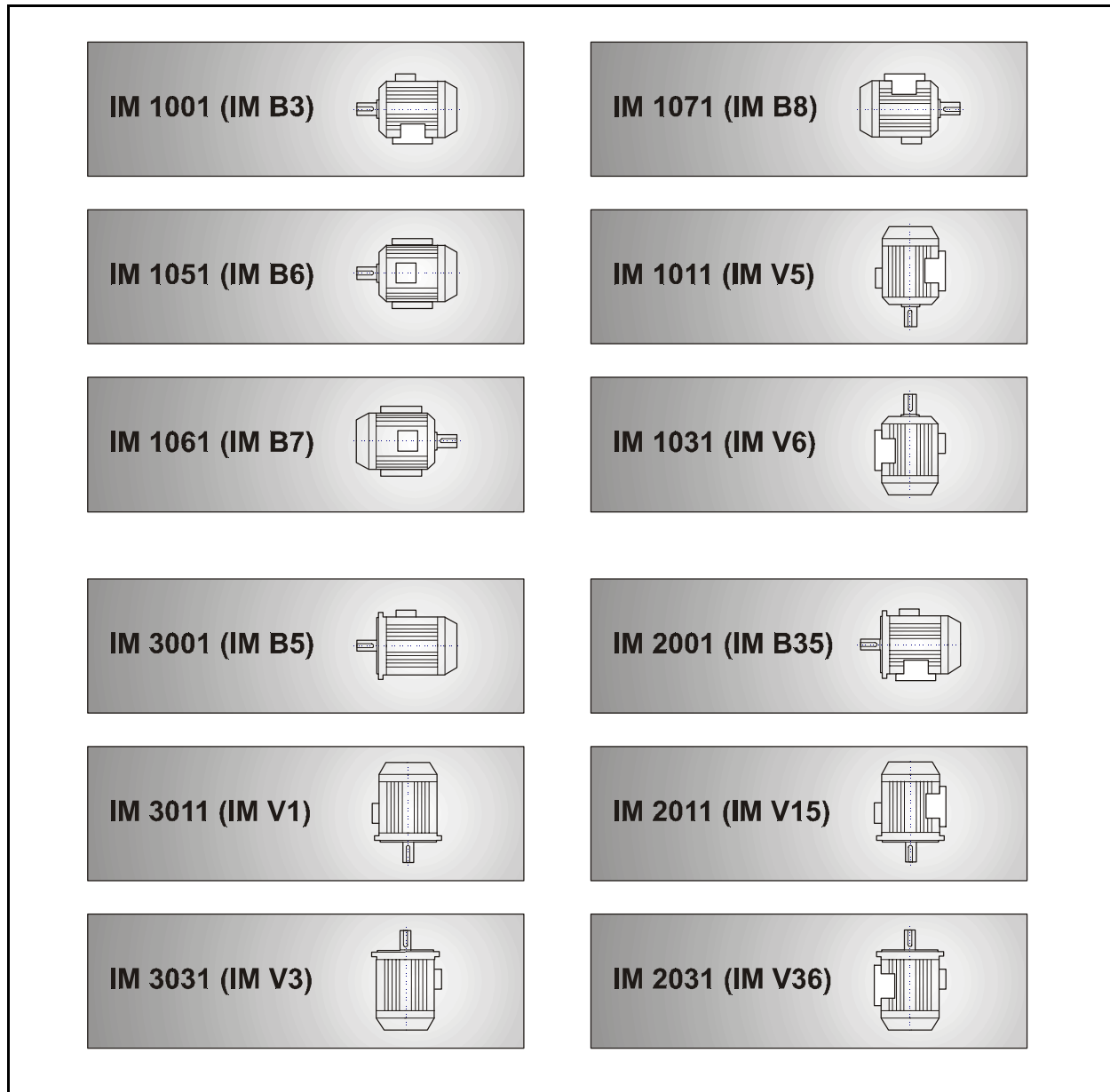
Electromotors type 2.ZP are derivated from our slipring motors for cranes type ZPD, so that they also comply with the prescriptions IEC 60072 and SEB 841 101-70 (Stahl-Eisen-Betrieblatter). On this way, they have all principal dimensions complying the IEC prescriptions, and all other characteristics are accommodated for continual duty type S1.

For these reasons they are used for continual speed regulation, for accelerating the great fly-masses, for starting with small currents and high starting torque. Owing their robust construction and very good mechanical protection they are used for working in very hard conditions and dirty ambient such as in the building industry.

For a suitable drive and very hard working conditions in most cases it is used the pulley-transmission.

I. Mechanical arrangements

Construction and shape: Frames and endshields of all motors included in this leaflet are made of cast iron. The frames are provided with radial cooling ribs equally distributed over the whole circumference and length of the frames. All components are mechanically so dimensioned that they endure the strongest mechanical employment to which motors can be exposed. These motors are produced in three essential shapes IM B3, IM B5 and IM V1. The quoted shapes are in accordance with prescriptions IEC60034-7. On the request the motors may be delivered in the combined shape IM B35.



Mounting arrangements

Cooling: The motors are cooled by an external fan, that is provided with a fan cover. The fan blows the cooling-air equally along the whole outer circumference of the motor independently from the rotation-sense of the motor. The fans are made with blades of aerodynamical profile, providing a noiseless circulation of the cooling air. The type of cooling is IC411, according to the IEC 60034-6.

Mechanical protection: The motors type 2.ZP are constructed and built as totally enclosed, degree of protection IP 55 meaning that they are protected against penetration of water jet and dust. The terminal box is built with the same degree of protection – IP 55.

Insulation of the windings: The windings of the stator are insulated according to insulation class "F". The temperature rise is 105 K supposed that the ambient temperature does not exceed 40°C (according to I.E.C.

recommendations, IEC 60034-1, IEC 60085). The windings of the rotor are insulated according to insulation class "F". The allowed temperature rise of this class is 105 K when the ambient temperature does not exceed 40°C. Both temperature rises refer to a measuring by increased resistance. For manufacturing winding insulation according to other prescriptions, please consult the factory with a special inquiry.

Bearings: Types of bearings and its designations are given in the table. Every type of motor can be delivered with bigger bearings of excessive loading (tension) which reduces the life of bearings and may cause shaft breakage (pulley transmission). Types 2.ZP 250 to 2.ZP 400 have bearing caps which make lubrication possible while the motor is working. The superfluous grease is eliminated by a regulating ring. The penetration of grease into the inside of the motor is prevented by felt rings. The bearings are shown in the table 1.

Table 1. - Bearings

Motor type	Drive end	Opposite end		Grease for additional lubrication		Grease quantity		Additional lubrication time [h]		
				Insulation class				Number of poles		
		horizontal design	vertical design	F	H	[g]	[cm ³]	4	6	8
2.ZP 200 L 2p=4,6,8	6312 C3	6312 C3		Lithium Based grease	Silicon based grease	Without additional lubrication		20000		
2.ZP 225 M 2p=4,6,8	6313 C3	6313 C3				27	34	2700/5900	4800/10500	5900/13000
2.ZP 250 M 2p=4,6,8	NU 314	6314 C3						31	39	2600/5700
2.ZP 280 M,S 2p=4,6,8	NU 316	6316 C3				45/37	56/47			2500/5500
2.ZP 315 M,S 2p=4,6,8	NU 319	6317 C3	7317 B					60/45	75/57	2400/5200
2.ZP 355 L 2p=4,6,8	NU 322	6319 C3	7319 B			72/50	90/63			2200/4300
2.ZP 400 L 2p=4,6,8	NU 324	6320 C3	7320 B							

Lubrication: The bearings for motors for frame size 200 and 225 the bearings are lubricated by the motor manufacturer and cannot be relubricated without disassembling of the motor end shields. The motors from frame size 250 up to 400 are fitted with regreasing device. The type of grease, grease quantity and regreasing time are imprinted to the rating plate. Full range data are shown in the table 1.

Terminal box: The motors are produced with terminal box on the top of the frame. The terminal box is provided with two cable-inlets or with the cable-head. The position of these cable-inlets can be on every side of the terminal box. On the request it is possible to add two cable-inlets, one for earthing and the second for control unit (thermal protection). These cable-inlets are in accordance with VDE 9010 and they have a Pg winding according to DIN 40430. Terminal markings are in accordance with the IEC 60034-8. The main terminal box data are shown in the table 2.

Table 2. Terminal box

Motor type	Number of terminals	Terminal stud thread		Maximal permissible current A	Number of entries	Dimension of entries	Max. cable diameter mm	Terminal box position	
		Stator	Rotor						
2.ZP 200	6+3	M8	M8	100	2	Pg36	38	Top mounted ⁽¹⁾	
2.ZP 225		M10	M10	200	2	54Ø	54		
2.ZP 250									
2.ZP 280									
2.ZP 315									
2.ZP 355		M12	M12	315	2	64Ø	64		
2.ZP 400		M16	M16	315	2	75Ø	75		

(1) –Right or left hand side on a request.

Sliprings: The sliprings are on the drive-end and they are made of cast bronze. Admittance to the brushes very easy by removing the cover of the terminal box. The brush holder and brushes can be complete replaced through the top side of the frame.

Vibration and balancing: The rotors are balanced dynamically with half key to vibration severity grade N (standard) in accordance with the IEC 60034-14. The limits of vibration severity are shown in the following table:

Grade	Limits of vibration severity in mms^{-1} (effective) for frame size H in mm			
	Speed range min^{-1}	Free suspension		
		H \leq 225	255<H \leq 400	H>400
N	$\geq 600 \leq 3600$	2.80	3.50	3.50
R	$\geq 600 \leq 1800$	1.12	1.80	2.80
	$> 1800 \leq 3600$	1.80	2.80	2.80
S	$\geq 600 \leq 1800$	0.71	1.12	-
	$> 1800 \leq 3600$	1.12	1.80	-

Vibration severity grade "R" or "S" available on a request

Noise: The motors satisfy the noise level emission in accordance with the IEC 60034-9. The noise levels shown in the following table refer to a no load motor, 400V, 50 Hz, cooling type IC 411 and protection IP55. Tolerance is + 3dB (A).

Noise levels dB(A)		Frame size						
		200	225	250	280	315	355	400
4 pole	L _{pfA} ⁽¹⁾	71	74	77	79	84	85	87
	L _{wA} ⁽²⁾	84	88	92	94	98	99	100
6 pole	L _{pfA}	67	72	69	68	75	85	87
	L _{wA}	81	86	83	82	89	99	99
8 pole	L _{pfA}	64	71	63	61	80	82	84
	L _{wA}	77	86	75	74	94	96	98

(1) - L_{pfA} - Sound pressure, (2) - L_{wA} - Sound power

Rotor and shaft ends: The rotors are slipring type, normally designed with one free cylindrical shaft extension. Second shaft extension, taper shaft extension and other special shaft extensions are available on a request. The dimensions of shaft extension, key and keyway are in conformity with the IEC 60072, (ISO/R775 and DIN 1448). In order to keep load of bearings and of shaft extension within allowed limits, there must be paid attention to radial and axial forces and to the type of transmission from a motor to a working machine.

For greater axial or radial powers may occur the manufacturer should be consulted in order to check up the loading of the shaft end. In such cases motor can be delivered with special shaft end (with greater diameter, and bigger bearings).

II. Electrical characteristics

Voltage and frequency: The motors are standradly executed for a rated voltage 400 V and rated frequency 50 Hz. On request the motor may be executed for other voltage between 230 and 690 V as well as for a frequency between 40 and 60 Hz. The motor produced for a rated voltage 400 V, 50 Hz may be applied for voltage 460 V, 60 Hz. The winding of rotor is coupled in star-connection also. The stator voltage is in accordance with IEC 60038 and it can differ for $\pm 10\%$. The rotor voltage is in accordance with IEC 60072 and it can differ for $\pm 15\%$.

Output: The rated powers given in schedules are valid for continual duty S1 – IEC 60034-1.

The values given in Data Sheets are valid for the following conditions:

- Rated voltage $\pm 10\%$
- Rated frequency $\pm 5\%$
- Height above sea level not exceeding 1000 m
- Temperature of the coolant not exceeding 40 °C

For other conditions please consult our Construction bureau.

Speed: The motors type 2 ZP are produced as 4, 6, 8 pole motors with corresponding synchronous speeds 1500, 1000, 750 min^{-1} . The speeds given in Data Sheets are valid for the rated voltage, frequency, output and continual duty type S1. On request the motors can be delivered also for greater number of poles respectively for speeds less than 750 min^{-1} .

Thermal protection: The motor can be provided with bilt in thermal protection accordind to the IEC 60034-11. Generally 150 °C thermistors are used for a class F motor. When warning of impending overheat is required a separate set of thermistors is used usually with reference temperatures 10 K lower than the protection thermistors. For this kind of thermal protection the PTC thermistors are used. On special request motors can be delivered with control unit.

Heaters: As a protection against condensed water the motors can be equipped with heaters. During the motor stand still the heaters must be switched on. The power and supply voltage of the heating elements are shown in the following table:

Frame size H, mm	Supply voltage V	Heater's power P _g , W
200-250	115 or 230	80
280-315		130
355		200
400		280

Tolerances: All mechanical dimensions of electrical motors are in accordance with the IEC 60072-1 which also indicates allowed tolerances. The main mounting dimension tolerances are shown in the following table:

Term	Designatio	Dimension	Tolerance
Shaft extension diameter	D, DA	> 50 mm	m6
Flange spigot diameter	N	< 450 mm > 450 mm	j6 h6
Flange pitch diameter	M	> 200 mm > 500 mm	± 0.50 mm ± 1.00 mm
Foot fixing dimensions	A, B	> 250 mm > 500 mm	± 1.0 mm ± 1.50 mm
Shaft height	H	≤ 250 mm > 250 mm	- 0.50 mm - 1.00 mm

All electrical tolerances for rated values and performance are in accordance with the IEC 60034-1, and are shown in the following table:

Term	Designatio	Dimension	Tolerance
Efficiency	η	$P_N \leq 50 \text{ kW}$ $P_N > 50 \text{ kW}$	-0.15 (1- η) -0.10 (1- η)
Power factor	$\cos\varphi$		$-\frac{1 - \cos\varphi}{6}$, $\begin{matrix} \text{Min } 0,02 \\ \text{Max } 0,07 \end{matrix}$
Slip	s	$P_N < 1 \text{ kW}$ $P_N \geq 50 \text{ kW}$	$\pm 30 \%$ $\pm 20 \%$
Locked rotor current	I_1		+ 20 %
Locked rotor torque	T_1		- 15 % + 25 %
Break down torque	T_b		- 10 %
Moment of inertia	J		$\pm 10 \%$

Finish painting: Standard finish painting of the motors is performed by protective alkyd paint (RAL 5010). For special climate conditions, according to IEC 60721-2-1, painting is performed by epoxy paint.

Packing: The motors of frames 200 and bigger are packed in wooden crates. In order to prevent damaging of the bearings during the motor transportation and from excessive vibrations during the motor stand still, the motors of frame size 200-400 are equipped with special rotor blocking system.

Questionnaire: Please, answer the questions from the attached questionnaire as fully as possible, to enable offering motors which will satisfy your requirements the best.

QUESTIONNAIRE FOR THE OFFER OF ASYNCHRONOUS ELECTRIC MOTORS



Enquiry Number: _____

Customer: _____ ITEM: _____
Qty: _____

A MOTOR DATA

1 Motor type: Three phase: _____ Single phase: _____

2 Rotor type: Squirrel cage: _____ Slip-ring: _____

3 Rated output: $P_N =$ _____ kW

4 Rated voltage: $U_N =$ _____ V Connect: Star _____ Delta _____

5 Rated frequency: $f_N =$ _____ Hz

6 Rated speed: $n_N =$ _____ rpm

7 Insulation class: F B

8 Duty type: S1 S2 S3 S4 S5 S6 S7 S8 S9 S10
ED %

--	--	--	--	--	--	--	--	--	--	--

starts /h _____ min _____ J_{mot} _____ kgm^2

9 Standard: _____ IEC or _____

10 Cooling method: _____ IC

11 Mounting arrangement: IM

12 Protection degree: Motor IP: _____ Terminal box IP: _____

13 *Sense of rotation: Left _____ Right _____ Both _____

14 Motor brake: yes no
Braking moment: _____ Nm
Brake voltage: _____ V/Hz _____ V,DC

15 No-load regime? (single phase motor) yes _____ no _____

16 Rotor data: $U_{2c} =$ _____ V $I_{2n} =$ _____ A

B DATA ABOUT THE DRIVEN MACHINE

1 Type: _____

2 Required power: _____

3 Required speed: _____

4 Load torque characteristic:
Constant: _____ Squared _____ or _____
Speed %:

0	25	50	75	100
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Torque Nm:

--	--	--	--	--

5 Moment of inertia: $J =$ _____ kgm^2

6 Running machine special data: _____

C AMBIENT CONDITIONS

1 Ambient temperature: _____ C

2 Relative humidity: _____ %

3 Altitude [above sea level]: _____ m

4 Specific ambient conditions: _____

D POWER TRANSMISSION AND STARTING CONDITIONS

1 Coupling type: _____

2 Starting: _____

3 Number of consecutive startings:
Hot state: _____ Cold state: _____
_____ per hour _____ per hour
_____ per day _____ per day

E ADDITIONAL REQUESTS FOR MOTOR EXECUTION

1 Overloading from: _____ % P_N
Duration: _____ min

2 Temperature rise: F B

3 Request for: vibration level _____ mm/s
noise level _____ db

4 *Terminal box position:
left right On top

5 Additional shaft loading sense
axial force _____ radial force _____

6 Converter feed operation: yes no
Converter type: _____
Manufacturer: _____
Speed range: from _____ to _____ rpm

7 Sensor category (mark in lower field):
Taho gen. _____ Encoder _____ Absolute _____ Resolver _____
Sensor Type: _____

8 Flange size: _____ mm

9 Second shaft end: yes no
DA= _____ mm EA= _____ mm

10 Other requests and limits: _____

F ADDITIONAL EQUIPMENT, SPARE PARTS AND DOCUMENTATION

1 Thermal protection: yes no
Type: _____

2 Bearings thermometers yes no

3 Anti-condensation heaters yes no

4 Spare parts yes no

5 Guarantee sheet yes no

6 Language of instruction list: _____

7 Other requests for packing: _____

You are kindly requested to provide us with as much data as possible thus enabling us to offer satisfactorily

H CUSTOMER

1 Company: _____

2 Address: _____

3 City: _____

4 Country: _____

5 Person: _____

6 Telefon / Telefax: _____

7 e-mail: _____

Company locations

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