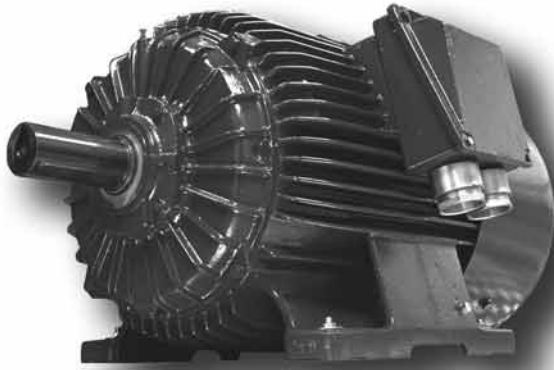


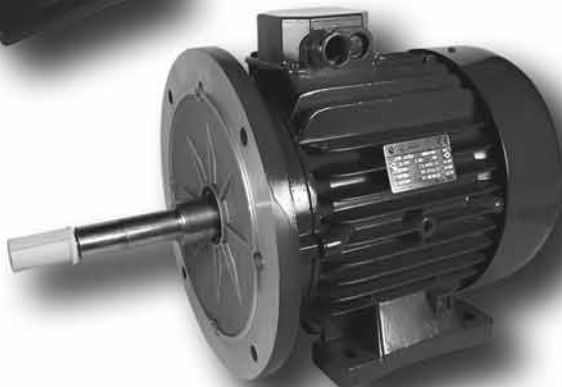
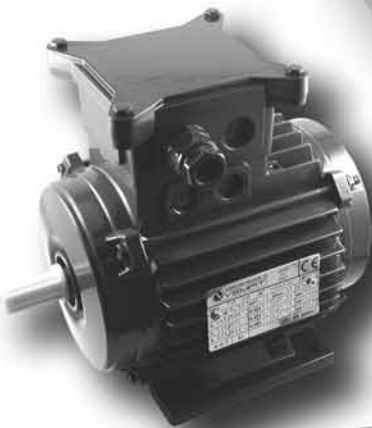


Technical catalogue





VEMAT MOTORI S.r.l. is a company which has been producing electric motors for many years and is recognised among the Italian and international market leaders. Research, experience and continuous technological updating, always and exclusively aimed at perfecting its production, mean that VEMAT MOTORI S.r.l. is a company which can meet the most varied market demands. The investment policy which has always been pursued privileges the quality and reliability of the products, while flexible organisation of production and the high professionalism of the personnel and technicians allow us to offer a range of products which are the result of continuous research and development activities. The production cycle ensures a high and constant quality guaranteed by the certification of the materials used and by the continuous controls carried out during the machining processes.





The range of products envisages: three-phase asynchronous motors, frame size from 56 to 355; single phase electric motors, frame size from 56 to 100.

VTB SERIES: asynchronous three-phase motors, 2-4-6-8 poles, closed-externally ventilated, cage rotor, IP55-CI.F protection rating, frame size UNEL/IEC from 56 to 355.

VDV SERIES: asynchronous three-phase motors with double polarity, closed-externally ventilated, cage rotor, IP55-CI.F protection rating, frame size UNEL/IEC from 56 to 132.

The production program is completed by the new high efficiency IE2 range (please see the dedicated catalogue), and the special electric motors, built in accordance with the customer's particular mechanical and/or electrical requirements.

VMB SERIES: asynchronous single-phase motors, 2-4-6 poles, with permanent condenser, closed-externally ventilated, cage rotor, IP55-CI.F protection rating, frame size UNEL/IEC from 56 to 100.

VMC SERIES: asynchronous single-phase motors, 2-4-6 poles with high starting torque, closed-externally ventilated, cage rotor, IP55-CI.F protection rating, frame size UNEL/IEC from 56 to 100.

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REFERENCE STANDARDS

UNI EN 292-1
Safety of machinery -Fundamental concepts and general design principles; (1992)

UNI EN 292-2
Safety of machinery -Fundamental concepts and general design principles; (1992)

UNI EN 292-2/A1
Safety of machinery - Fundamental concepts and general design principles -Technical specifications and principles; (1995)

UNI EN 294
Safety of machinery - Safety distances to prevent danger zones being reached by the upper limbs; (1993)

UNI CEI EN 60034-1
Safety of machinery - Rotating electrical machines Part 1 – Rating and performance; (2000)

UNI CEI EN 60204-1
Safety of machinery - Electrical equipment of machines Part 1 - General Rules; (2000)

UNI EN ISO 1680
Test procedure for measurement of the aerial noise emitted by rotating electrical machines; (2001)

UNI CEI EN 55011
Electromagnetic compatibility - Industrial surroundings; Limits and methods of measurement of radio disturbance characteristics of industrial, scientific, and medical equipment; (1990)

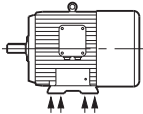
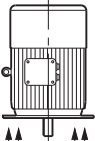
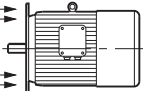
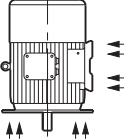
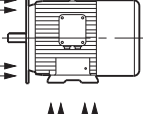
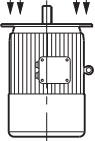
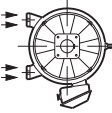
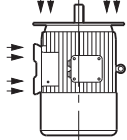
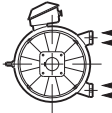
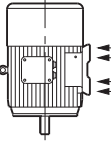
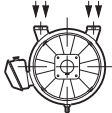
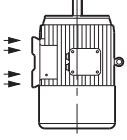
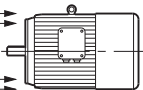
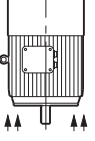
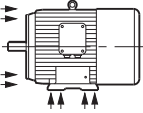
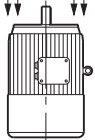
UNI CEI EN 55081-2
Electromagnetic compatibility - Industrial environment; Generic emission standards Part 2; (1993)

UNI CEI EN 55082-2
Electromagnetic compatibility - Industrial environment; Generic immunity standards Part 2; (1993)



MOUNTING ARRANGEMENTS

Constructive shapes and mounting arrangements.
(IEC 34-7)

Horizontal shaft	Vertical shaft
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 <div data-bbox="424 1868 762 1939" style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> IM 2101 B3/B14 (as per DIN 42950) </div>	 <div data-bbox="1123 1868 1461 1939" style="border: 1px solid gray; border-radius: 10px; padding: 5px; text-align: center;"> IM 3631 V19 (as per DIN 42950) </div>



CONSTRUCTIVE SHAPES

Housing and endshields.

Up to size 132, the motor frames are manufactured in die-cast light aluminium alloy, in direct contact with the magnetic circuit plates. The endshields and feet are themselves also made of light alloy.

For sizes 160 to 355 the frames and the shields are made of cast iron and together with the feet they form a single continuous piece.

All the motors from size 160 to size 355 are fitted with a lifting ring.

The frames from size 56 to size 355 have cylindrical outer surfaces equipped with longitudinally running fins in order to aid and increase heat dissipation.

The aluminium alloy covers for size 132 have steel support inserts for the bearing seatings, in order to guarantee rotor centring and an increased lifespan.

Rotor and shaft.

All **Vemat** motors have aluminium die-cast double cage rotors. The rotor is dynamically balanced with half key on the drive shaft extension. The vibration degree corresponds to the "N" value. On request, we can supply motors with vibration degree equal to "R" or higher. Vibration is measured with motors running in idle and fed at rated voltage and frequency as per international ISO2373 Standard.

Vibration intensity measured in the field of 10...1000 Hz is expressed in effective value (mean square) of the vibration speed in mm/s. The ISO2373 Standard and corresponding UTE, DIN and BSI standards envision 3 degrees of vibration intensity for motors with axis heights from 80 to 400 mm and revolution speeds in the range of 600 - 3600 rpm. (see Tab. 1). The shaft is in C40 steel for all sizes.

Terminal box and cable inlet

The terminal box for motors from size 56 to 180 is housed in the upper part of the frame and can be oriented to various positions (see Tab. 2). In motors from size 200 to 355, the box is usually positioned on the right side of the frame (as seen from the control side) and can be turned to 4 positions 90° apart. On request, the motors can be supplied with the terminal board positioned on the left (as seen from the control side).

All motors are constructed with a 6 terminal base.

Total speed value table - mm/s (RMS) and in/s (RMS) ISO 2373.

Quality	Speed Rpm	RMS Maximum effective values of vibration speed for shaft height H in mm					
		56<H<132		132<H<225		225<H<400	
		mm/s	in/s	mm/s	in/s	mm/s	in/s
N (normal)	From 600 to 3600	1.8	0.071	2.8	0.110	4.5	0,177
R (reduced)	From 600 to 1800	0.71	0.028	1.12	0.044	1.8	0.071
	> 1800 to 3600	1.12	0.044	1.8	0.071	2.8	0.110
S (special)	From 600 to 1800	0.45	0.018	0.71	0.028	1.12	0.044
	> 1800 to 3600	0.71	0.028	1.12	0.044	1.8	0.071

Tab. 1

Like ISO 2373 Standard, DIN 45665 Standard also provides for a further SR degree (S degree divided by 1.6) for motors of up to size 160.

Terminal box and cable inlet.

Size	Terminal Box position	Terminal Box orientation	Cable inlet (standard version)		
			Cable gland no.	Cable gland type	Terminal Box material
56 - 63	Upper	180°	1	Pg 11	
71 - 90	Upper	180°	1	Pg 13,5	
100 - 112	Upper		1	Pg 16	Alluminium
132	Upper	180°	1	Pg 21	
160 - 180	Upper	4x90°	2	M40x1,5	
200 - 225			2	Pg 36	
250			2	Pg 42	
	Right side				
280		90°	2	Pg 42	Cast-iron
315			2	M76 x 3	
355					

Tab. 2



CONSTRUCTIVE SHAPES

Bearings.

Vemat motors from size 56 to 180 are equipped with pre-lubricated ball bearings.

Motors from size 200 to 355 are equipped with open-type bearings lubricated with grease using Tecalemit-type lubricators. The supports are equipped with an automatic grease discharging device.

The table at the side indicates the normally constructed motor bearings classified by size and polarity. These bearing offer an expected working life of 30,000 hours with direct coupling.

Cooling fan

The technical features of the cooling fans are provided below.

Motor size	Fan	Fan cover cap
56	Thermoplastic	
180	Thermoplastic	Steel plate
200-355	Steel plate	

Bearing

Motor size	Poles	Bearing type	
		Drive end	Not-drive end
56	2, 4	6201 2Z	6201 2Z
63	2, 4, 6	6201 2Z	6201 2Z
71	2, 4, 6	6202 2Z	6202 2Z
80	2, 4, 6, 8	6204 2Z	6204 2Z
90 S,L	2, 4, 6, 8	6205 2Z	6205 2Z
100 L	2, 4, 6, 8	6206 2Z	6206 2Z
112 M	2, 4, 6, 8	6306 2Z	6306 2Z
132 S,M	2, 4, 6, 8	6308 2Z	6308 2Z
160 M,L	2, 4, 6, 8	6309 2Z-C3	6309 2Z-C3
180 M,L	2, 4, 6, 8	6311 2Z-C3	6311 2Z-C3
200 L	2	6212-C3	6212-C3
200 L	4, 6, 8	NU 212-C3	6212-C3
225 M	2	6213-C3	6212-C3
225 S,M	4, 6, 8	NU 213-C3	6213-C3
250 M	2	6215-C3	6215-C3
250 M	4, 6, 8	NU 215-C3	6215-C3
280 S,M	2	6217-C3	6217-C3
280 S,M	4, 6, 8	NU 217-C3	6217-C3
315 S,M	2	6315-C3	6315-C3
315 S,M	4, 6, 8	NU 318-C3	6315-C3
355 S,M	2	6317-C3	6317-C3
355 S,M,L	4,6,8	NU 322-C3	NU 322-C3

Motor fastening

Motor size	Bolts		
	Shape B3	Flange assembly	
		B5	B14
56	4 x M6	4 x M6	4 x M5
63	4 x M6	4 x M8	4 x M5
71	4 x M6	4 x M8	4 x M6
80	4 x M8	4 x M10	4 x M6
90	4 x M8	4 x M10	4 x M8
100	4 x M10	4 x M12	4 x M8
112	4 x M10	4 x M12	4 x M8
132	4 x M10	4 x M12	4 x M10
160	4 x M12	4 x M16	-
180	4 x M12	4 x M16	-
200	4 x M16	4 x M16	-
225	4 x M16	8 x M16	-
250	4 x M20	8 x M16	-
280	4 x M20	8 x M16	-
315	4 x M24	8 x M20	-
355	4 x M24	8 x M24	-



DEGREE OF PROTECTION

Degree of protection (IP).

The selection of the appropriate degree of protection is a necessary requisite for the optimum operation and working life of the motor and depends on the motor's surrounding conditions.

The types of protection as per IEC 34-5 are specified by the characteristic symbol "IP" (international protection) and a combination of 3 digits: The first digit indicates protection against

accidental contact and infiltration by foreign objects; the second digit specifies the protection against liquid; the third digit defines the mechanical protection.

PROTECTION AGAINST CONTACT WITH FOREIGN SOLID OBJECTS		PROTECTION AGAINST INFILTRATION BY LIQUIDS		MECHANICAL PROTECTION	
1 ^a characteristic digit	DESCRIPTION	2 ^a characteristic digit	DESCRIPTION	3 ^a characteristic digit	DESCRIPTION
				0	No protection
0	Unprotected	0	Unprotected	1	Striking energy: 0,15 J
1	Protected against solid bodies of greater than 50 mm size	1	Protected against vertically falling drops of water	2	Striking energy: 0,20 J
2	Protected against solid bodies of greater than 12 mm size	2	Protected against vertically falling drops of water up to 15°	3	Striking energy: 0,37 J
3	Protected against solid bodies of greater than 2,5 mm size	3	Protected against the rain up to 60°	4	Striking energy: 0,50 J
4	Protected against solid bodies of greater than 1 mm size	4	Protected against the rain from every direction	5	Striking energy: 0,70 J
5	Protected against Dust deposit	5	Protected against sprays from every direction	6	Striking energy: 1 J
6	Totally protected against dust deposit	6	Protected against temporary flooding	7	Striking energy: 2 J
		7	Protected against submersion between 0.15 and 1 meter	8	Striking energy: 5 J
		8	Protected against submersion at established pressure and time	9	Striking energy: 10 J
				10	Striking energy: 20 J

All standard-built **Vemat** motors are provided with IP 55 protection in compliance with the standards in force (IEC 34-5) and the features indicated in the table below.

All motors from size 56 to 180 are provided with o-rings for sealing. From size 200 on up, protection is ensured by labyrinth seals.

The seal of the terminal box is ensured by the appropriate liner.

Motors with higher degree of protection can be provided on request.



INSULATION

Insulation class

The chemical and physical characteristics of the insulation material are fundamental to the optimum operation and duration of any electric motor, and for this reason a temperature limit corresponding to the insulation material used must

be determined; for this reason, each insulation material used must ensure the reliable operation of the motor within its own absolute temperature limits.

Insulation material quality is defined by IEC 34-1 Standards in distinct insulation

classes for each of which an absolute temperature limit has been established..

Class A 105°
Class E 120°

Class F 155°
Class H 180°

Class B 130°

As specified by international standard, temperature is measured in °C, (degrees Celsius) while the difference in temperature is measured in K (1°C = 1K). For Class F, for example, the temperature increase cannot exceed 105K provided that the room temperature does not exceed +40°C. This value is valid when applied to the resistance measurement method. This means that the resistance of the winding at room temperature is measured first and then a thermal test is performed on the motor at rated power, after which the resistance of the winding

is measured again. The temperature increase is calculated with the following formula:

$$\Delta T = [(R2 - R1) / R1] (235 + T1) + (T1 - T2)$$

where:

R¹: low temperature resistance measured at room temperature T¹;

R²: high temperature resistance measured at room temperature T²;

235: constant for copper windings.

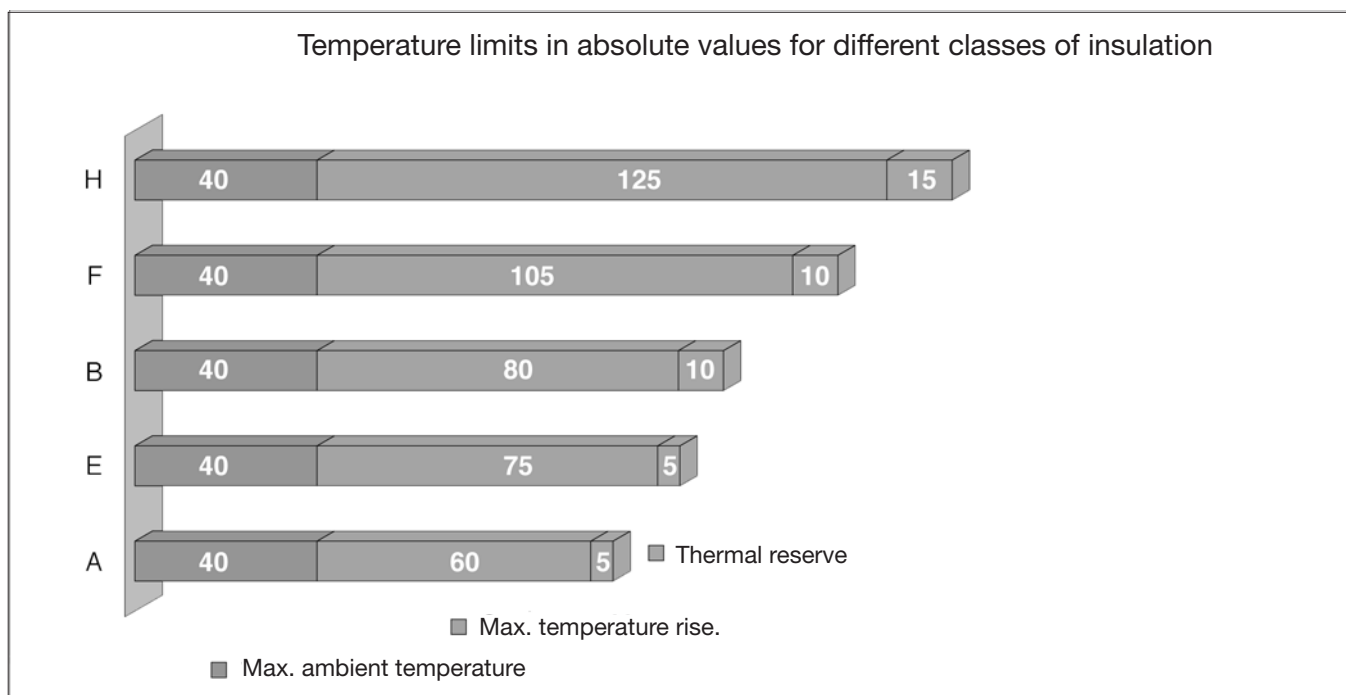
This method requires the determination of the average temperature increase.

For this purpose 10K, for example, provides an additional thermal margin between the

winding's average temperature and the temperature at its hottest point.

All **Vemat** motors are produced using copper wire for the winding in class H and Class F insulation material.

Each winding is provided with a careful hot polymerising resin treatment that grants remarkable resistance against both humidity and sudden changes in room temperature, while the paint treatment employs special protective paint (tropical insulation) that gives the motor elevated protection against the most extreme weather conditions.



All **Vemat** motors come standard-equipped with Class F insulation and Class B operating over-temperature, and therefore the temperature of the stator windings is considerably reduced and the motor's average working life is extended as a result.

All motors come standard-equipped with Class F insulation; Class H available on request.

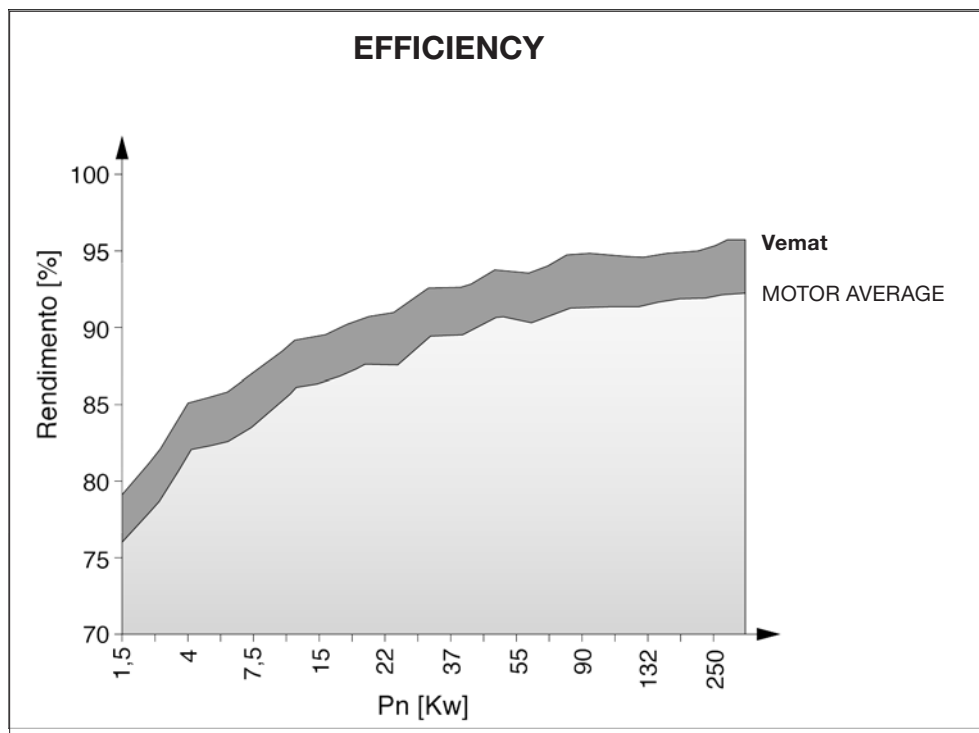


EFFICIENCY

In addition to offering single users savings, the use of improved energy performance asynchronous motors can also provide economic advantages at the national level and make a significant contribution to the reduction of energy consumption

in general; these aspects are considered particularly important in the EU, to the extent that European Commission experts require manufacturers of electric motors to significantly reduce the consumption of power absorbed by their production,

as has already occurred in the electrical appliance sector. Please, at this regard, be so kind to check our new IE2 range catalogue.



Efficiency values per motor power during steady operation																				
Pn (Kw)	1,5	3	4	5,5	7,5	11	15	18,5	22	30	37	45	55	75	90	110	132	160	250	315
Vemat	79	81,5	85,1	85,5	87	89	89,5	90,5	91	92,5	92,6	93,7	93,4	94,7	94,8	94,4	94,8	95	95,5	95,6
Motor average	76	78,5	82,1	82,5	84	86	86,5	87,5	87,5	89,5	89,6	90,7	90,4	91,2	91,3	91,4	91,8	92	92,5	92,6

One important feature of **Vemat** motors is their elevated efficiency, combined with the fact that the respective value remains substantially stable even with load variations of from 100% to 60%.

Increased motor efficiency was achieved in particular through the adequate sizing of both the magnetic circuit and winding that reduces losses in the iron and copper

and by modifying the ventilation system to reduce mechanical losses as well.

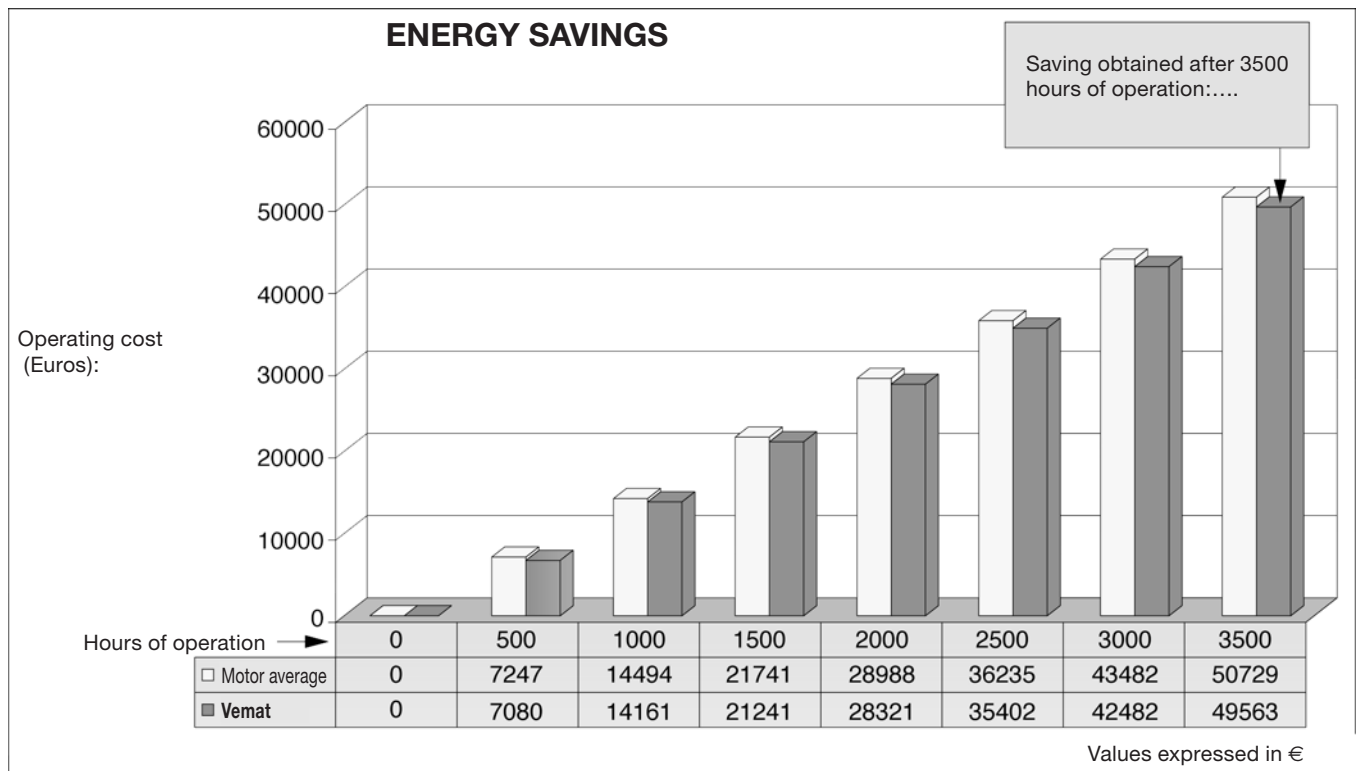


EFFICIENCY

High-efficiency is a standard feature in all **Vemat** motors.

Reduced power consumption at the levels of both single users and industry is closely linked to careful selection of the electric motors and the use of new technologies in their construction. This is why we search constantly for new solutions that provide

even better results. The chart below illustrates the significant savings obtained by using a high-efficiency **Vemat** motor compared to the average value provided using other motors.



Note: calculations made using a hypothetical electrical energy cost of 0.0847 Euro "approx. 164 £"/kWh.

CALCULATION PARAMETERS	Vemat Motor	Motor average
Motor power delivered	160 KW	160 KW
Efficiency	95,70%	93,50%

As may be seen, the longer the operating time, the greater the savings in power, to the degree that savings equal to the cost of a new motor can be accumulated in the period of just a few years.



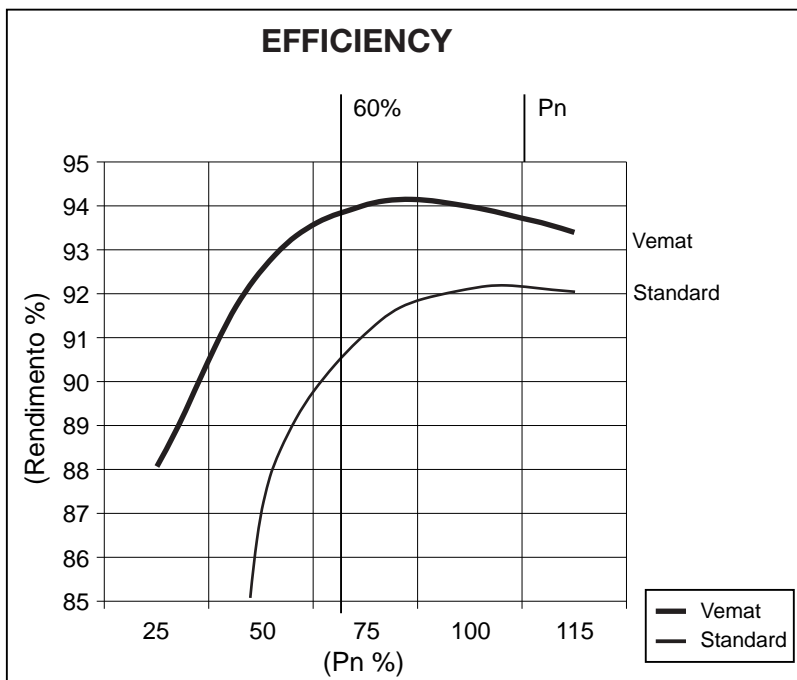
EFFICIENCY AND POWER FACTOR

As illustrated in Fig. 1 below, the remarkable constancy of motor efficiency from 60% to 100% of the load permits significant energy savings to be achieved in nearly every application. Taking a 55 kW, 4-pole VTB 250M4 motor used at 60% of the rated load, for example, the

Figure shows that the efficiency is 3.5% higher than the value supplied by a standard motor.

Hypothesising 4000 hours of operation/year, the following is obtained:
 $55 \text{ kW} \times 60\% \times 0.035 \times 4000 \text{ hours/year} = 4620 \text{ kWh saved annually.}$

This performance is all the more remarkable when considering that the “low load” operating time is the longest and therefore most significant in terms of power consumption.



Efficiency value % in regard to load				
1/4 Pn	1/2 Pn	3/4 Pn	Pn(*)	5/4 Pn
30-32	41	50	55	56
31-33	46	55	57	57
31-34	49	59	60	61
32-35	51	58	62	61
35-42	60	67	65	64
46-50	63	69	68	67
48-58	65	72	70	70
54-59	67	74	73	72
54-65	70	77	75	75
58-65	73	77	78	76
61-65	75	79	80	78
67-69	78	84	85	83
78-80	92	88	87	85
80-81	88	90	90	88
83-86	90	92	92	91
88-89	92	93	93	92
89-90	93	94	94	93
89-92	94	95	95	94
90-92	94	96	96	96

Fig. 1 Characteristic efficiency curve for the power delivered by a 55 kW 4 pole motor.

The power factor

Power factor values in regard to load				
1/4 Pn	1/2 Pn	3/4 Pn	Pn (*)	5/4 Pn
0,27-0,33	0,41-0,45	0,53-0,56	0,65	0,71
0,30-0,34	0,43-0,45	0,52-0,58	0,67	0,72
0,28-0,33	0,45-0,49	0,57-0,58	0,70	0,74
0,28-0,34	0,46-0,52	0,60-0,65	0,72	0,76
0,32-0,35	0,48-0,54	0,62-0,65	0,75	0,77
0,32-0,45	0,48-0,62	0,62-0,74	0,78	0,8
0,39-0,47	0,57-0,65	0,72-0,76	0,80	0,83
0,39-0,46	0,58-0,67	0,74-0,76	0,82	0,84
0,47-0,49	0,68-0,79	0,76-0,79	0,85	0,85
0,52-0,63	0,73-0,80	0,83-0,85	0,87	0,89
0,59-0,70	0,79-0,94	0,87-0,88	0,90	0,91
0,66-0,71	0,84-0,85	0,89	0,91	0,91
0,68-0,71	0,86-0,89	0,89-0,90	0,92	0,92

(*) See the value corresponding to the rated power for the motor selected in “Electrical Characteristics” and transfer this value to the “Pn” column. Then read the values for the other load conditions in the corresponding line.



GENERAL INFORMATION

Electromechanical feature tolerance values

As per IEC 34-1, the following tolerance values are acceptable for rated motor parameters:

Efficiency [η]	Power factor	Slip	Starting current	Starting torque	Pull-in torque	Moment of inertia
Measurement with the separate loss method	-1/6 (1 - cos φ) (min 0.02)	Referred to the Pn and the working temperature	+20%	-15%	-10%	± 10%
Pn < 50KW 15% (1-η)	(max 0.07)	Pn < 1KW ± 30%	(Compared to rated values)	+25%	(Compared to rated values)	(Compared to rated values)
Pn > 50KW 10% (1-η)		Pn > 1KW ± 20%		(Compared to rated values)	(Compared to rated values)	(Compared to rated values)
Direct method measurement: 15% (1-η)						
Approx. Value at 0.1%						

Rotation direction

As per IEC 34-7 publications, the sides of a motor are defined as follows:

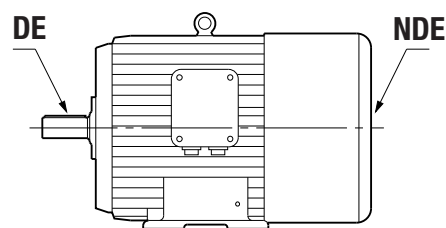
DE SIDE: is the side where the motor coupling is usually made.

NDE SIDE: is the side usually opposite the motor coupling side.

All motors can be run in both rotation directions indifferently. Hypothesising the connection of an L1-L2-L3 right-

hand power supply triad in this order to the U1-V1-W1 terminals of an electric motor, clockwise rotation direction will be obtained when looking at the motor from the control side.

In order to invert rotation direction, the connection to two of the motor's terminals must be inverted.



Unit of measure and simple formulae

Absorbed power [KW]	Powered delivered [KW]	Absorbed current [A]	Power factor [cos φ]	Efficiency [η]
$P_a = \frac{V \times I \times 1.73 \times \cos \varphi}{1000}$	$P_r = \frac{V \times I \times 1.73 \times \cos \varphi \times \eta}{1000}$	$I_n = \frac{P_r \times 1000}{V \times 1.73 \times \cos \varphi \times \eta}$	$\cos \varphi = \frac{P_a \times 1000}{V \times I \times 1.73}$	$\eta \% = \frac{100 P_r}{P_a}$
Rated torque [Kgm]	Synchronous speed [ns]	Slip [s]	Moment of inertia [Kgm ²]	Dynamic moment [Kgm]
$M_n = \frac{P_r \times 1000}{1.027 \times \text{rpm}}$	$n_s = \frac{f \times 120}{\text{no. of poles}}$	$s\% = \frac{100 n_s - n}{n_s}$	$J = \frac{P D^2}{n^2}$	$P D^2 = 364 \times P \times V^2$

Key:

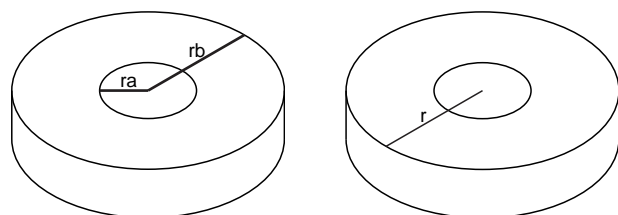
Pa = absorbed power in (kW); Pr = power delivered in (kW); V = input voltage (V); In = rated absorbed current (A); n = rpm with normal working load .

For the starting and braking phases, in addition to the drive torque curve, the moment of inertia of the rotating machine in regard to the motor's speed must also be known.

Notes for the calculation of the moment of inertia J

Calculation of [J] with solid cylinder: $J = m \times \frac{r^2}{2}$

Calculation of [J] with hollow cylinder: $J = m \times \frac{r_a^2 - r_b^2}{2}$





Operating noise level.

The operating noise levels comply with the prescriptions indicated by UNI EN ISO 1680.

Sound pressure and power

The table below provides the average sound pressure (LpA) and sound power (LwA) levels measured at a distance of one meter from the outline of the machine.

The operating noise values are measured with the motor running idle with a 3 dB tolerance (A).

Operation at 60 Hz increases the sound pressure and power values to approx. 4 dB (A).

Frame sizes	A-sound pressure level (LpA) - A-sound power level (LwA)							
	2 poles		4 poles		6 poles		8 poles	
	LpA	LwA	LpA	LwA	LpA	LwA	LpA	LwA
63	62	72	58	68	53	63	-	-
71	64	74	59	69	55	65	-	-
80	68	78	53,8	65,8	55,9	67,8	55	65
90	65,3	77,4	63	73	60	70	58	68
100	69,8	82,0	65	75	62	72	60	70
112	73,7	86,0	66	76	62	72	60	70
132	77,3	89,8	60,8	73,3	62	72	60	70
160	78	88	66	76	62	72	60	70
180M	78	88	66	76	62	72	60	70
180L	80	91	68	79	62	73	62	73
200	80	91	68	79	62	73	62	73
225	85	96	71	82	65	76	63	74
250	85	96	71	82	65	76	63	74
280	86	97	78	88	73	84	73	84
315S	86	97	80	91	73	84	73	84
315M	87	99	81	90	75	86	75	86
355	88	100	84	96	76	88	76	88

All motors comply with the requisites specified by Directive EMC 89/336/CEE regarding electromagnetic compatibility.

Painting.

Vemat motors from size 160 to 355 are provided with standard RAL 5010 paint treatment.

On request, this paint treatment can also be extended to smaller sizes and provided with different colours.

Operating conditions associated with the environment

The tables below illustrate normal characteristics during continuous operation with power supply at the rated voltage and frequency of 50 Hz; max. 40°

room temperature and altitude of up to 1000 metres above sea level. Powers vary under other conditions and are obtained by applying the correction factors indicated in the table.

Room temp.- (°C)	40	45	50	55	60	70
Acceptable Pmax - (%Pn)	100	96,5	93	90	86,5	79

Altitude - (mt)	1000	1500	2000	2500	3000	3500	4000
Acceptable Pmax - (%Pn)	100	97	94,5	92	89	86,5	83,5



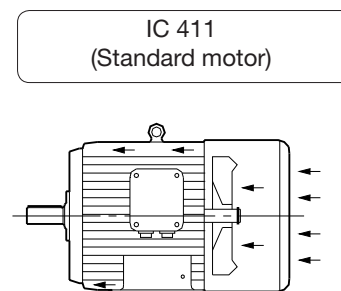
COOLING AND VENTILATION

Cooling circuit characteristic digits (IEC 34.6)

1 st characteristic digit	CIRCUIT LAYOUT Description	2 ^a characteristic digit	CIRCULATION Description
0	The coolant enters and exits the machine freely (Free circulation)	0	The circulation of the coolant occurs through temperature difference. (Free convection)
1	The coolant is tapped from an area outside the machine and conveyed towards the machine through a special suction duct and then freely eliminated in the machine area	1	The circulation of the coolant is made by the action of the rotor and a device fastened to the rotor itself (Self-circulation)
2	The coolant is tapped from around the machine and then conveyed in a special elimination duct to an area outside the machine.	2	-----
3	The coolant is conveyed through a suction duct to the machine and is then eliminated through another duct following its injection and elimination into an area outside the machine.	3	-----
4	The primary coolant circulates in a closed circuit and yields its heat to the secondary fluid that surrounds the machine through its casing.	4	-----
5	The primary coolant circulates in a closed circuit and yields its heat to the secondary fluid that surrounds the machine by passing through a heat exchanger that is a part of the machine.	5	The circulation of the coolant occurs through an integrated device independent from the machine (Example: electric fan fed by a separate power supply).
6	The primary coolant circulates in a closed circuit and yields its heat to the secondary fluid that surrounds the machine by passing through a heat exchanger external to the machine	6	The circulation of the coolant occurs through a device assembled on the machine, but fed by a separate power supply.
7	The primary coolant circulates in a closed circuit and yields its heat to the secondary fluid outside the machine that passes into a heat exchanger that is part of the machine	7	The circulation of the coolant occurs either through a device not installed and independent of the machine or by the pressure of the coolant fluid distribution circuit.
8	The primary coolant circulates in a closed circuit and yields its heat to the secondary fluid outside the machine that passes into a heat exchanger that is also outside the machine.	8	The circulation of the coolant occurs thanks to the movement that the machine makes in regard to the fluid (Example: an electric fan that is cooled by the current of air produced).
9	The primary coolant circulates in a closed circuit and yields its heat to the secondary fluid that passes into a heat exchanger to compose an independent unit separate from the machine.	9	Circulation through devices other than those described above.

Vemat motors are cooled by external surface ventilation. This ventilation is performed by a fan keyed onto the rotor shaft and protected by a cap that permits the flow of air along the finned frame of the motor "IC 411".

Cooling can be performed equally in either motor rotation direction because the fans are of radial two-directional type. On request, motors can also be supplied with "IC 410" free convection cooling systems or in other words without axial ventilation.





SERVO-VENTILATION

Motors for variable speed operation.

The use of three-phase asynchronous motors in standard configuration coupled to speed variation devices requires the following special measures:

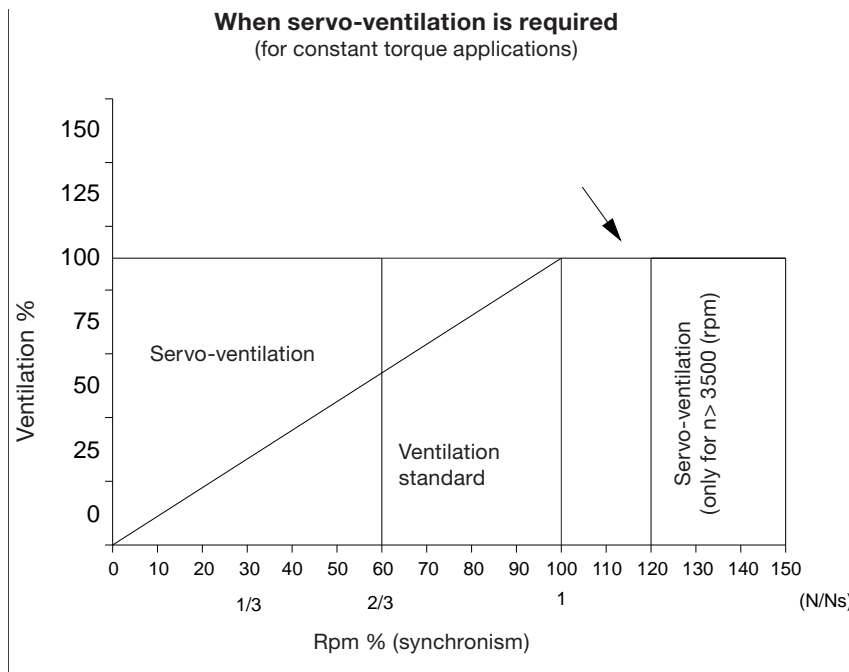
- During the continuous running of the motor at low speed, ventilation is not sufficiently effective;
- Whenever the machine is used at particularly high speed, the noise generated by ventilation can negatively affect the motor's operating silence to

make it no longer in compliance with IEC 34-9.

In both cases, we recommend using forced ventilation or "servo-ventilation" with constant flow and independent of motor speed. This type of forced ventilation consists in a fan mounted coaxially to the rotor shaft provided with a power supply independent from the main motor power supply.

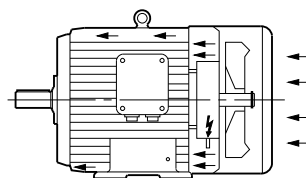
When using servo-ventilation, we also

recommend the use of heat protectors in order to prevent damage caused by the overheating of the stator winding if the servo-ventilation system malfunctions.

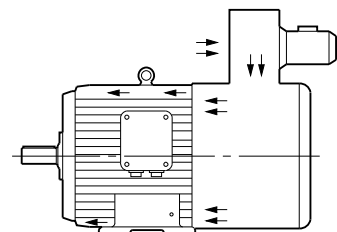


These motors can be applied for:

- Controls speed adjustment through power supply with inverter.
- High-temperature areas where more efficient ventilation is required to keep the motor within the acceptable temperature range.
- Intermittent duty with quiescence (S4) and cycles with a high number of hourly startings for which self-ventilated motors are inappropriate.
- Closed-loop applications with speed/position feedback on inverter.



IC 416 A
(Servo-ventilation)



IC 416 R
(Servo-ventilation)

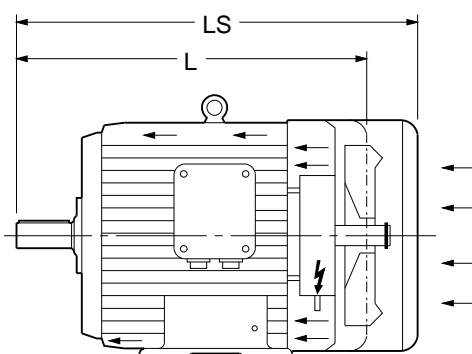
Thanks to both their electromechanical structure and thermal reserve, our motors can also be used at operating speeds that differ significantly from rated speeds. This is why all **Vemat** motors are particularly suited for use with inverters.



SERVO-VENTILATION

Variations in dimensional values

All **Vemat** motors can be equipped with forced ventilation and/or encoders; below we provide the technical features of the servo-ventilation and variations in dimensions compared to standard motors when this type of solution is adopted.



50Hz data

Motor type (size)	Variation in dimensions [LS] compared to value [L] Servoventilation	Servo-ventilation				
		Input [V]	Power [W]	Current [A]	Speed [rpm]	Type connection
71	+ 15 mm	230 (1 ~)	19	0,12	2550	Terminal box
80	+ 20 mm	230 (1 ~)	19	0,12	2550	Terminal box
90 S	+ 45 mm	230 (1 ~)	45	0,15	2800	Terminal box
90 L	+ 45 mm	230 (1 ~)	45	0,15	2800	Terminal box
100	+ 35 mm	230 (1 ~)	45	0,15	2800	Terminal box
112	+ 40 mm	230 (1 ~)	68	0,17	2600	Terminal box
132	+ 50 mm	230 (1 ~)	68	0,17	2600	Terminal box
160	+ 70 mm	400 (3 ~)	105	0,19	2500	Terminal box
180	+ 70 mm	400 (3 ~)	65	0,17	1380	Terminal box
200	+ 80 mm	400 (3 ~)	180	0,35	1360	Terminal box
225	+ 60 mm	400 (3 ~)	180	0,35	1360	Terminal box
250	+ 75 mm	400 (3 ~)	180	0,35	1360	Terminal box
280	+ 75 mm	400 (3 ~)	270	0,48	1300	Terminal box
315	+ 100 mm	400 (3 ~)	270	0,48	1300	Terminal box
355	+ 70 mm	400 (3 ~)	610	1,15	1340	Terminal box

Special versions and voltages available on request.

The technical data provided must not be considered legally binding; we reserve the right to modify data without notice.



TYPE OF DUTY

Power and duty

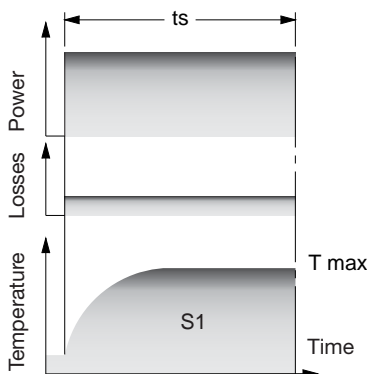
The term rated power is used to indicate the mechanical power delivered to the motor axis expressed in kW. The electrical features page features two power values: one expressed in kW, the other rounded off and expressed in HP. We list the types of duty most commonly utilised below.

Duty.

With the exception of Continuous duty S1, it is difficult to provide exact definitions for other conditions of duty, but given the importance of the topic, we provide an excerpt from IEC 34-1 Standards below. The indication of the duty required must be specified by the purchaser with the greatest precision possible. In some cases, when the load is constant or whenever it varies predictably, the duty can be indicated numerically or by means of a chart that represents the variations over time. Whenever the sequence of values over time is indeterminate, a fictional sequence that is at least as severe as the real sequence must be indicated, together with the choice of preference between the types of duty listed below.

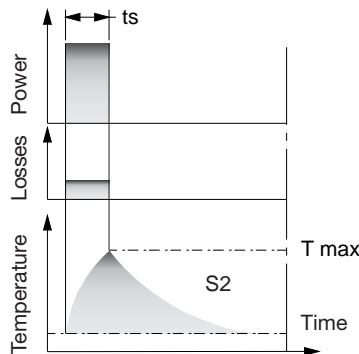
Continuous duty S1.

Operation at constant load and duration required to reach thermal equilibrium.



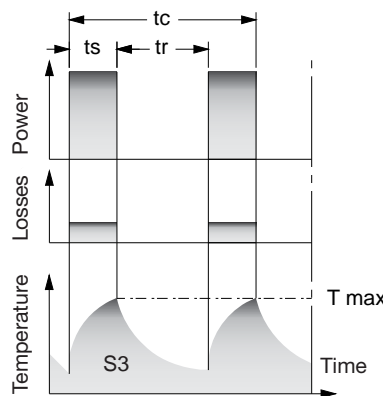
Limited duty S2.

Constant-load operation for a determined time lower than the achievement of thermal equilibrium followed by a pause that permits the re-establishment of the temperature of the room or coolant with approx. 2°C tolerance.



Periodic intermittent duty S3.

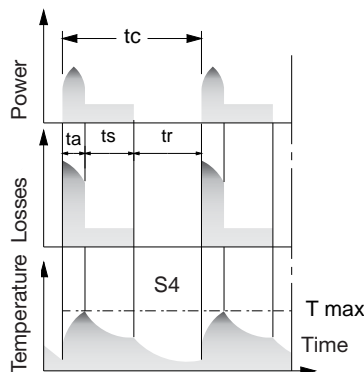
Operation through a series of cycles, each of which composed of a constant load part and a quiescent part. The duty period is short and does not permit the achievement of thermal equilibrium.



$$S3 : [ts / (ts + tr) \times 100\%]$$

Continuous duty with starting S4.

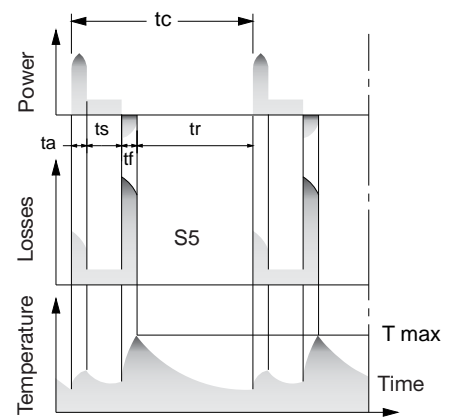
Operation through a series of identical cycles composed of a starting phase sufficient to affect the temperature, a constant load phase, and a quiescent phase. The duty period is short and does not permit the achievement of thermal equilibrium.



$$S4 : [(ta+ts) / (ta+ts+tr) \times 100\%]$$

Intermittent duty with starting and braking S5.

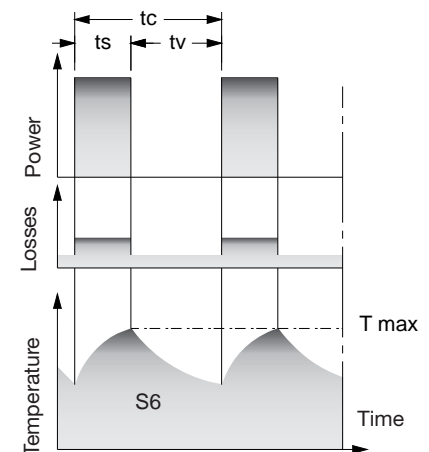
Operation as S4 above with braking performed electrically (e.g. counter-current). S5 duty is composed of a series of equal periods, each one of which represents a starting phase, a constant load phase followed by electric braking, and a quiescent phase. The duty period is short and does not permit the achievement of thermal equilibrium.



$$S5 : [(ta+ts+tf) / tc \times 100\%]$$

Continuous duty with intermittent load S6.

Operation through a series of identical cycles, each of which composed of a constant load work period and a loadless operation phase. There are no quiescent phases. The work period is not sufficient to permit the achievement of thermal equilibrium.



$$S6 : [ts / tc \times 100\%]$$

- ts : constant load operation
- tc : cycle duration
- tr : quiescence
- ta : starting
- tf : electric braking
- tv : idling



OPERATION

Speed.

The speed of an AC three-phase asynchronous motor is in direct correlation to the mains frequency and the number of poles:

$$n_s = (2 \times f \times 60) / p$$

where "ns" = synchronous speed

f = mains frequency

p = number of poles

The rated speed values indicated in the electrical features table apply to full load power and steady speed operation

Slip.

A three-phase electric asynchronous motor does not in any way reach synchronism speed, even if a considerably similar values can be reached during loadless operation, especially in motors with higher power.

The slip is determined by the following formula:

$$S = [(n_s - n) / n_s \times 100\%]$$

where: "s" = slip

ns= synchronous speed

n = asynchronous speed

according to the standards in force, slip values are valid to a tolerance of $\pm 20\%$.

Although most applications require motors with a single fixed speed; special needs often require 2 or 3 speed operation. This can be achieved using motors with multiple polarity.

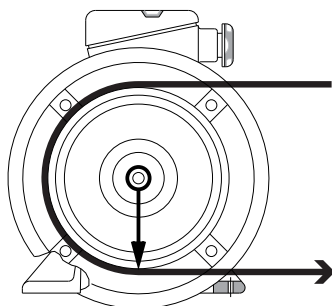
There are essentially 2 methods of construction for the above.

1. Motors with single windings("Dahlander") with 1 to 2 speed ratios. The most commonly-used are 2 – 4 pole (3000/1500 rpm) and 4 – 8 pole (1500/750 rpm).
2. Motors with numerous windings with speed ratios other than 1 to 2. The most commonly-used are 4 – 6 pole (1500/1000 rpm) and 6 – 8 pole (1000/750 rpm).

Torque

An electric motor's torque value expresses the rotor's torsion force and depends on the power delivered to the axis and the rpm.

Hypothesising use with a belt drive, for example, a certain force F will be determined near the pulley. The torque corresponds to the product of such force multiplied by the pulley's radius..



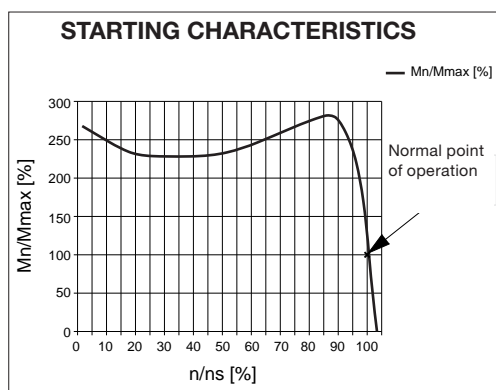
A motor's rated torque is usually calculated as follows:

$$M_n = \frac{P_n \times 1000}{1,027 \times n} \quad [\text{Kgm}]$$

where: Pn = rated power expressed in kW.

n = rpm

We provide the characteristic starting torque curve as a function of the speed of a Sg 180 L4 type motor as an example below.



MOTOR ELECTRIC FEATURES	
Type:	SG 180 L4
Voltage frequency (V/Hz):	380t50
Power delivered (KW):	22
Poles/rpm:	4/1470
Efficiency (%):	91,4
Rated current (A):	40,6
Rated torque (Kgm):	14,61
Moment of inertia (Kgm ²):	0,155



OPERATION

Voltage and frequency.

As per CEI 8-6 Standard dated March, 1990, "the rated voltages for the 1st category of AC power mains are 230/400 V".

For a maximum period of 10 years, the voltage values at the distribution points must be maintained at the following maximum values:

- **Single-phase current: from 207 to 244 V**

- **Three-phase current: from 358 to 423 V**

The IEC 38 publication indicates that European reference voltage will be 230/400V with three-phase current and 230V in single-phase current with a tolerance

value of from +6% to -10% until the year 2003 and from $\pm 10\%$ subsequently.

In standard motors with 60 Hz input, the rotation speeds indicated in the technical data tables increase by 20%, power by 15%, while the starting torque, starting current and pull-in torque values remain more or less unchanged but on the basis of the increases in power.

Important! All motors can be run indifferently at both 50 and 60 Hz but with their respective operating voltages. If this does not occur, the rated data will vary

as shown in Table 3 below; for example, when the mains voltage at 60 Hz is equal to the motor's rated voltage (for example, mains voltage of 220V – 60 Hz, voltage of the motor 220V – 50 Hz), the motor's rated power and current values remain practically the same, while the starting torque and current values decrease by around 17% compared to the values of motor at 50 Hz.

Table for variation of 50 Hz motor characteristics when supplied with 60 Hz frequency

Motor wound for 50 Hz and voltage values	Voltage at 60 Hz	Catalogue characteristic variation coefficient						
		Power	Speed	Rated current	Rated torque	Starting torque	Starting current	Pull-in torque
230 V	220 V	1	1,2	1	0,83	0,83	0,83	0,83
400 V	380 V	1	1,2	1	0,83	0,83	0,83	0,83
400 V	440 V	1,15	1,2	1	0,96	0,96	0,96	0,96
500 V	500 V	1	1,2	1	0,83	0,83	0,83	0,83
500 V	550 V	1,1	1,2	1	0,91	0,91	0,91	0,91
500 V	600 V	1,2	1,2	1	1	1	1	1

Tab.3

EUROVOLTAGE

Eurovoltage.

All **Vemat** motors have been designed for use in European 230/400 V $\pm 10\%$ - 50 Hz power mains.

This means that the same motor can be run in any of the following mains that still exist:

- 220/380 V $\pm 5\%$
- 230/400 V $\pm 5\%$ and $\pm 10\%$
- 240/415 V $\pm 5\%$

Motor characteristics undergo evident variations whenever the voltage varies in the range of $\pm 10\%$ (See Tab. 4).

Table for variation of motor characteristics in regard to variations in voltage

Torque curve	0,81	0,90	1	1,10	1,21
Slip	1,23	1,11	1	0,91	0,83
Rated current	1,10	1,05	1	0,98	0,98
Rated efficiency	0,97	0,98	1	1,00	0,98
Rated Cos φ	1,03	1,02	1	0,97	0,94
Starting current	0,90	0,95	1	1,05	1,10
Rated heating	1,18	1,05*	1	1*	1,10
P (Watt) loadless (idle)	0,85	0,92	1	1,12	1,25
Q (Var) loadless (idle)	0,81	0,9	1	1,1	1,21

Tab.4

Motors can be built for voltages between 110V and 600V with Δ connection, with the exception of size 180÷355 motors, which are solely supplied for voltages of no lower than 220V with delta connection.



OPERATION

DETERMINATION OF STARTING TIME

The knowledge of a three-phase electric asynchronous motor's starting time assumes fundamental importance; in fact, the current absorbed by the motor during this phase is very high and if it persists for too long triggers the deterioration of the insulation, thereby significantly reducing the motor's average working life. In order to determine the starting time, the following must be known:

MN = motor torque [Nm]
 ML = torque of the load applied [Nm]
 JM = motor moment of inertia [Kgm²]
 JL = moment of inertia of the load [Kgm²]
 ω = motor angular velocity
 and the following equation must be applied:

$$M_N - M_L = (J_M + J_L) (d\omega/dt)$$

Experience and testing have enabled us to conduct everything to a simplified formula that adopts constants that let us calculate the times desired with sufficient precision:

$$t_{avv} = (J_M + J_L) K / M_{acc}$$

where:

tavv = starting time [sec]
 Macc = acceleration torque [Nm] (*)
 Mmax = Pull-in torque
 K = constant

(*) Machine (fans)
 Machine (piston pumps)
 Machine (elevators, etc.) = 0.45 (ML + Mmax)
 Machine (flywheels) = 0.45 (ML + Mmax)

Cnstant K	No. of poles			
	2	4	6	8
50 Hz	350	160	105	80
60Hz	420	190	125	95

If a speed ratio exists between the motor and the load, both the latter's torque and moment of inertia must be recalculated on the basis of the new speed.

MAXIMUM LOADLESS STARTING TIMES AND MAXIMUM MOMENT OF INERTIA APPLICABLE AT STARTING.

Motor size	Direct starting time (sec)				Starting time Y/Δ (sec)				Maxim moment (*) of inertia applicable [Kgm ²]			
	p=2	p=4	p=6	p=8	p=2	p=4	p=6	p=8	p=2	p=4	p=6	p=8
56	15	30	30	30								
63	15	15	25	30								
71	10	15	20	30								
80	7	10	15	15								
90	7	10	20	30								
100	5	10	20	30								
112	5	10	15	30	40	30	50	60				
132	10	12	9	20	35	20	20	40				
160	10	12	15	20	35	35	40	40	0,55	2,6	5,4	7,9
180	10	12	15	20	35	35	40	40	0,65	3,7	7,2	11
200	10	12	15	20	35	35	40	40	1,05	4,9	10	14,7
225	10	12	15	20	35	35	40	40	1,25	6,7	13,3	17,7
250	11	14	13	10	35	40	45	45	1,5	8,4	16	27,5
280	10	15	13	11	35	40	38	36	2,3	13	23	39,5
315	10	15	13	10	35	40	37	35	3,9	21,8	42,9	73,5
355	10	15	13	10	30	35	35	30	3,1	19,1	46	95

(*) The moment of inertia applied during starting cannot exceed the value of ML = MN x.. The values provided at the side permit:
 1. two successive startings from cold;
 2. one single starting when already hot.

MAXIMUM NUMBER OF STARTINGS/HOUR.

Motor size	No. of poles				Motor size	No. of poles			
	2	4	6	8		2	4	6	8
56	5800	7200	8600	9000	160	350	600	1250	1800
63	4300	6100	7200	7200	180	190	440	1000	1300
71	3150	4800	5800	6500	200	140	290	350	710
80	1750	2650	4500	5000	225	110	265	340	560
90	1200	1800	4000	4200	250	60	170	290	440
100	950	1350	2500	3300	280	38	120	240	320
112	600	1100	1800	2800	315	30	70	140	230
132	550	850	1500	1800	355	20	50	120	160

These data apply to motors supplied with rated voltage and 50 Hz frequency without load and without external moment of inertia applied to the shaft. In addition, once again the power of the motor will be define don the basis of the number of startings (or equivalent) per hour.



CONNECTION

Direct starting

The simplest way to start a three-phase motor is performed by connecting the winding terminals directly to the power supply line. This system is widely used for low-power motors, while higher power motors require the checking of the characteristics of the system, which must withstand the motor's starting current (which is from 4 to 8 times greater than the rated value) without problem. If the motor's starting current is higher than the value permitted by the mains, Y/Δ starting can be used.

Y - Δ starting.

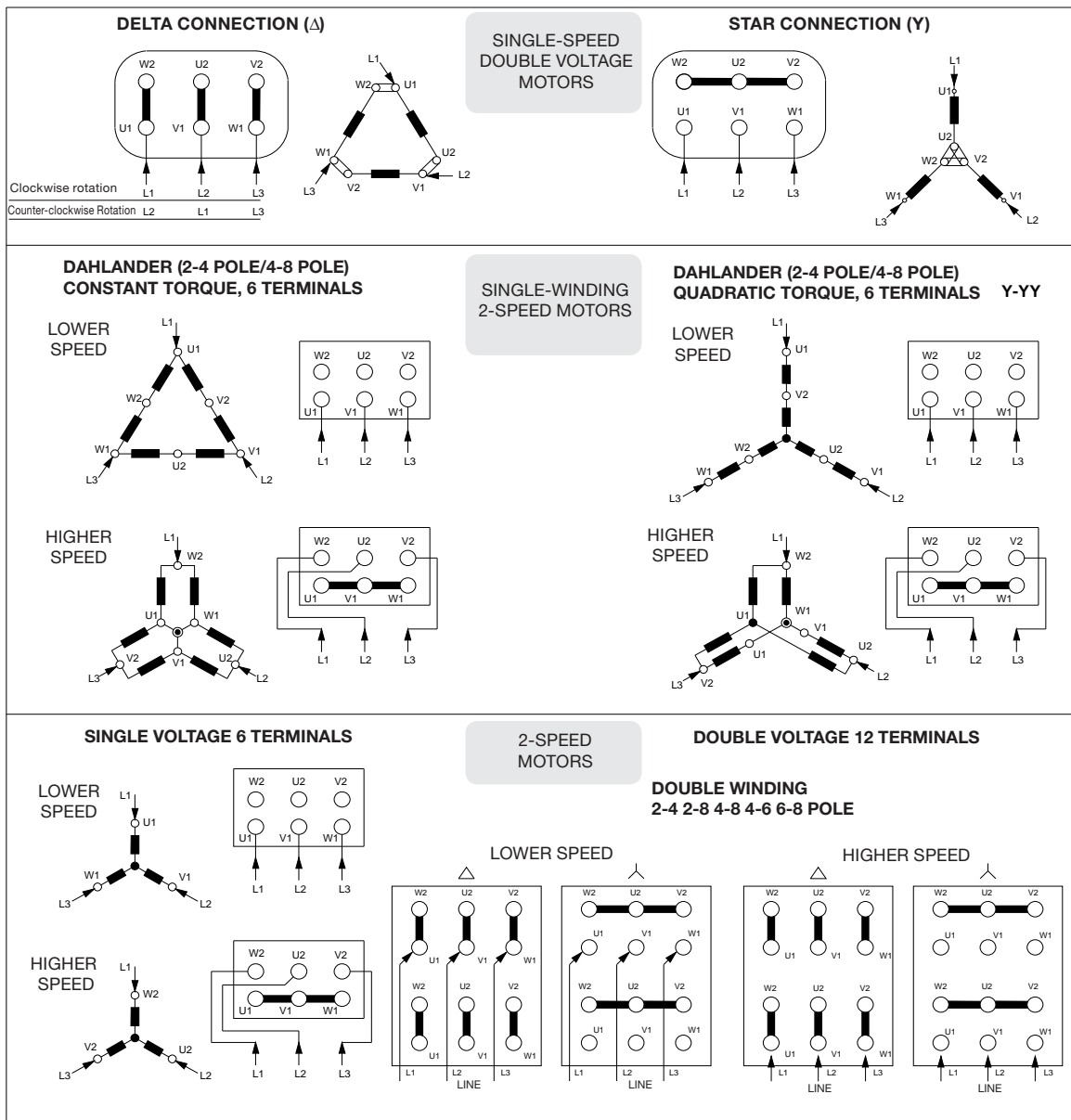
This system is widely used for medium and large size motors. Y/Δ starting means that a 380 Δ wound motor is started with a star connected winding. Using this system, the starting current and the starting torque are reduced by around 30%. The disadvantage in this system is the interruption of power supply during the passage from star to delta that can result in current peaks of extremely short duration but with elevated magnetic value. This phenomenon is considerably increased whenever a load with elevated resisting torque is applied during starting.

Connection diagrams

Single-pole three-phase asynchronous motors are usually supplied with 6 terminals to permit connection by star or delta. Whenever the order specifies the rotation direction (see from the shaft side), the winding phase terminals are mounted in such way that with the application of a voltage triad in L1-L2-L3 order, the motor will turn clockwise. With L2-L1-L3 connection, the opposite (counter-clockwise) direction is obtained.

Although other types of starting exist, reasons of space prohibit us from even a brief explanation. For more information, please contact our Technical Office.

WIRING DIAGRAMS AS PER IEC 34-08





PROTECTION SYSTEMS

MOTOR PROTECTION

The protection of a three-phase asynchronous motor against malfunction requires the installation of adequate protection devices upstream in the line capable of detecting the fault responsible and then disconnecting the power supply to the machine in the moment that such fault persists for the length of time considered dangerous for the motor itself or its power supply line.

Protections can be divided as follows:

1. protection against overcurrent
2. protection against over-temperature
3. protection against short-circuit
4. protection against earth faults.

1. Protection against overcurrent is usually provided by thermal cutouts with operation based on the principle of the thermal dilation of a bimetallic strip sensitive to the overheating produced by an excess absorption of current. (Fig. 1)

than 50 or 60 Hz, and in order to solve this problem thermal relays can be used. However for startings that take longer than 30 seconds, the relays above cannot be used and must be by-passed during this transitory period.

2. Protection against over-temperature is provided by temperature probes, which are used to particular advantage in the protection of motors with extremely high keying frequency because thermal cutouts are not suited for use with keying frequencies of more than 15 starting cycles/hour. The thermistor used most widely is the binary-type positive coefficient PTC, in which when the critical temperature is reached the resistance increases abruptly to trigger the immediate triggering of the devices to which the PTC is connected (Fig. 2).

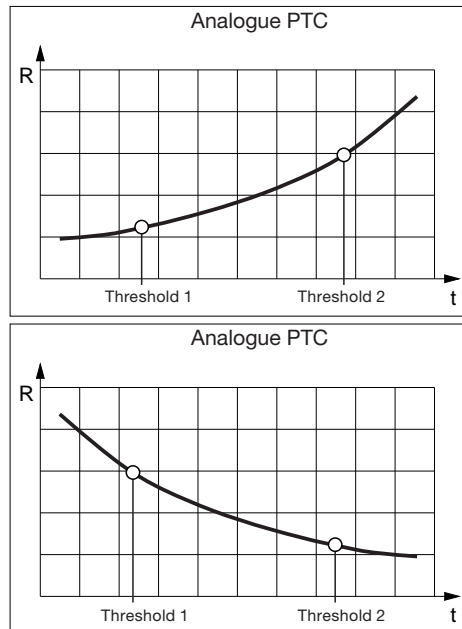


Fig.3

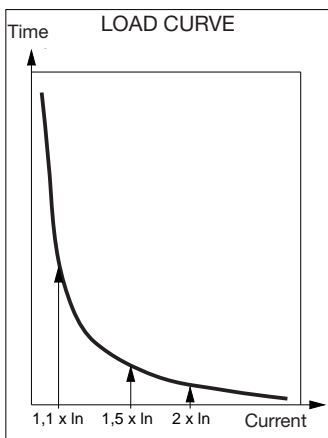


Fig.1

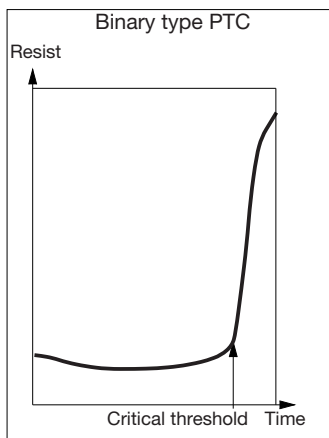


Fig.2

Special attention must be paid to the type of thermal cutout, which must be selected also on the basis of the type of motor starting. Startings that do not last longer than 10 seconds are defined by the standards as normal, and in such cases thermal cutouts with 10 or 10A triggering rating can be used. (IEC 947-4).

Particularly demanding startings usually require the use of bimetallic strip thermal cutouts with saturated iron TA in class 20 o 30; unlike normal thermal cutouts that can be used with frequencies of up to 500 Hz without problem, these however cannot be used with frequencies other

Positive coefficient analogue PTC and negative coefficient NTC are also used; the latter are usually adopted whenever two thresholds are required: one for signalling and one for intervention (Fig. 3). These types of devices are also used for the protection of motors with servo-assisted ventilation because thermal cutouts are incapable of detecting the stator temperature increase caused by a ventilation malfunction.

3. Protection against short-circuit requires the use of fuses or automatic circuit-breakers . Fuses offer the advantage of offering remarkable circuit-breaking power at low cost, while their constructive principle guarantees triggering times that decrease considerably with the increase of the short-circuit current in order to permit the constancy of the specific energy curve ($I^2 t$). Automatic circuit-breakers offer the possibility of greater precision in adjustment compared to fuses. There are also electromagnetic thermal cutouts that can protect the motor against both overloads and short-circuits; in any case however, the magnetic protection must assume values of at least 12 - 15 greater than the "In" in order to prevent triggering during starting.

4. Protection against earth faults is usually obtained by using differential relays that are sensitive to the leakage of current towards earth caused by either malfunction or an interruption in insulation in the machine; in medium and large size motors (from 30 kW 2 pole on upwards) with direct starting, such differential protection must be bypassed in order to avoid unnecessary triggering due to the imbalance between the three phases that occurs during starting. There are also special differential relays for the protection of motors.



CONSTRUCTIVE PARTS

Bearing working life foreseen: 30,000 hours

High-quality bearings

MAXIMUM LOAD APPLICABLE TO THE SHAFT

Maximum acceptable axial (Fa1/Fa2) and radial forces (Fr) at the end of the shaft in [N]

MOTOR TYPE		Horizontal duty			Vertical duty		
		Fr	Fa1	Fa2	Fr	Fa1	Fa2
56	2	160	35	35	215	25	45
	4	200	50	50	215	40	60
63	2	200	40	40	270	40	60
	4	250	55	55	270	45	65
71	2	290	70	70	390	50	90
	4	360	90	90	390	70	110
	6	400	100	100	390	80	120
80	2	330	90	90	470	60	120
	4	440	120	120	520	90	150
	6	510	140	140	570	110	170
90	2	520	100	100	675	80	120
	4	650	120	120	775	100	150
	6	750	150	150	875	130	170
	8	780	170	170	925	150	200
100	2	950	610	610	980	580	730
	4	1100	610	610	1130	730	880
	6	1140	600	600	1170	770	920
	8	1150	600	600	1180	780	930
112	2	1130	810	810	1170	770	920
	4	1150	800	800	1190	790	940
	6	1200	790	790	1240	840	990
	8	1200	780	780	1240	840	990
132	2	1400	850	850	1460	760	1160
	4	1850	820	820	1910	1210	1610
	6	2010	800	800	2070	1370	1770
	8	2050	800	800	2110	1410	1810



CONSTRUCTIVE PARTS

Bearing working life foreseen: 30,000 hours

High-quality bearings

MAXIMUM LOAD APPLICABLE TO THE SHAFT

Maximum acceptable axial (Fa1/Fa2) and radial forces (Fr) at the end of the shaft in [N]

MOTOR TYPE		Horizontal duty			Vertical duty		
		Fr	Fa1	Fa2	Fr	Fa1	Fa2
160	2	1600	1500	1500	1650	1300	1700
	4	2000	2100	2100	2050	1800	2400
	6	2300	2400	2400	2360	2100	2700
	8	2700	2600	2600	2760	2400	3000
180	2	2200	2000	2000	2300	1700	2400
	4	2900	2900	2900	3000	2400	3400
	6	3200	3300	3300	3300	2800	3900
	8	3600	3600	3600	3700	3200	4200
200	2	2600	2300	2300	2700	1900	2900
	4	6800	3200	3200	6900	2600	4000
	6	8100	3700	3700	8200	3000	4600
	8	8100	4100	4100	8200	3400	5000
225	2	3000	2600	2600	3150	2000	4600
	4	8500	3700	3700	8650	3000	4700
	6	11800	3600	3600	11950	3200	5400
	8	13000	4700	4700	13150	3900	5700
250	2	3600	3200	3200	3750	2400	4200
	4	11700	4400	4400	11850	3400	5800
	6	13500	5000	5000	13650	3800	6700
	8	15100	5600	5600	15250	4300	7200
280	2	4500	3100	3100	4650	2100	4500
	4	14500	5100	5100	14650	3700	7000
	6	16200	6000	6000	16350	4700	7700
	8	17800	6600	6600	17950	5200	8500
315	2	7500	6200	6200	7650	5500	7100
	4	15800	10600	10600	15950	9200	12000
	6	18400	11100	11100	18550	8300	12450
	8	20100	11400	11400	20250	8500	12800
355	2	/	/	/			
	4	26500	14200	14200			
	6	31000	16500	16500			
	8	35000	18000	18000			



CONSTRUCTIVE CHARACTERISTICS

Non drive end

BEARING ASSEMBLY

For motors sized from 56 to 180 (2-8 poles) : diagram 1
For motors sized from 200 to 315 (2 poles) : diagram 2
For motors sized from 200 to 315 (4-8 poles) : diagram 3
For motors sized from 355 (2 poles) : diagram 4
For motors sized from 355 (4-8 poles) : diagram 5

NOTE:

The diagrams below are purely indicative with rights to modification in any moment without warning reserved.

At the request of the client, we can also supply motors with special bearings for particularly demanding applications.

Diagram 1

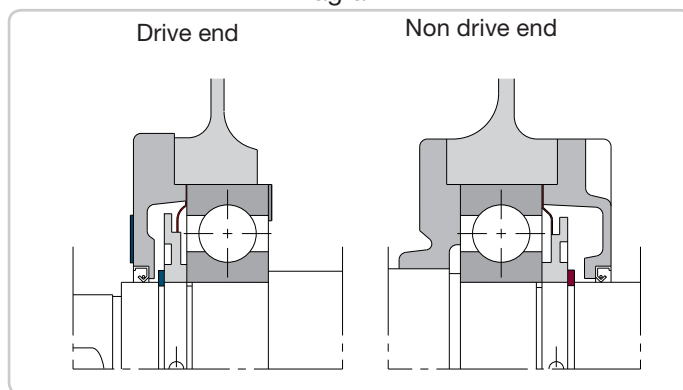


Diagram 2

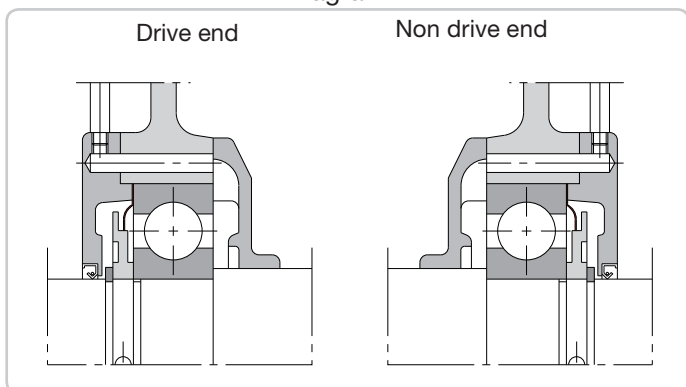


Diagram 3

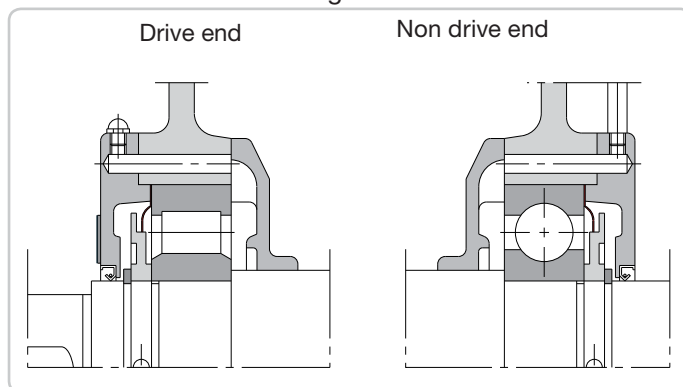


Diagram 4

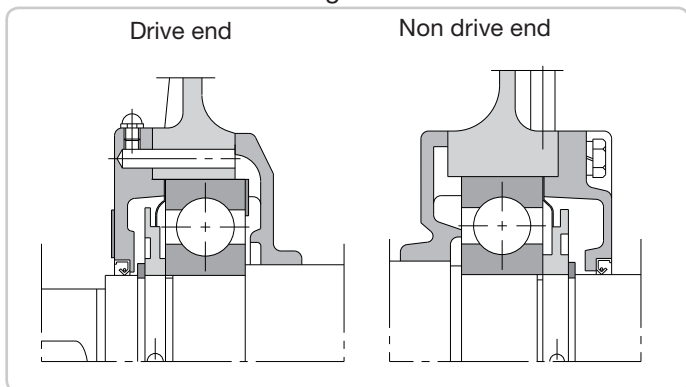
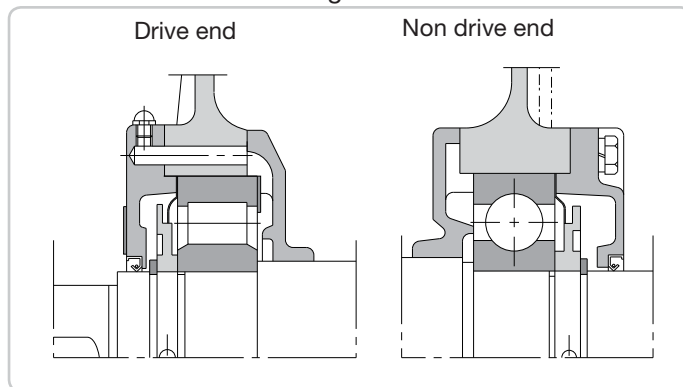


Diagram 5





“SERIES VTB” ELECTRICAL CHARACTERISTICS

EUROVOLTAGE

MOTOR TYPE	Power		Rotation speed [Giri 1']	Rated current		Efficiency η [%]	Power factor $\cos \varphi$	Characteristic data			Moment of inertia J [Kgm ²]	Weight		
				230 Volt [A]	400 Volt [A]			Current I_L/I_N	Torque			IM B3 [Kg]	IM B5 [Kg]	IM B3 B5 [Kg]
	[KW]	[HP]	[A]	[A]	M_L/M_N	M_{max}/M_N								
2 POLES 50/60 Hz 3000/3600 RPM														
VTB 56-2A	0,09	0,12	2820	0,50	0,29	65,0	0,73	4,5	2,1	2,1	0,000076	3,0	3,2	3,3
VTB 56-2B	0,12	0,17	2820	0,60	0,35	65,0	0,75	4,8	1,9	2,1	0,000095	3,3	3,5	3,6
VTB 63-2A	0,18	0,25	2760	1,10	0,63	66,0	0,75	3,8	1,9	1,9	0,000175	3,6	3,8	3,9
VTB 63-2B	0,25	0,33	2760	1,18	0,80	68,0	0,78	4,0	2,0	2,0	0,000235	4,2	4,4	4,5
VTB 63-2C	0,37	0,50	2800	1,95	1,13	68,0	0,78	4,3	2,0	2,0	0,000350	4,8	5,0	5,0
VTB 71-2A	0,37	0,50	2800	1,80	1,05	68,0	0,78	4,4	1,9	2,0	0,000389	5,2	5,3	5,4
VTB 71-2B	0,55	0,75	2790	2,65	1,55	70,0	0,80	4,7	2,0	2,1	0,000484	6,0	6,2	6,3
VTB 71-2C	0,75	1,00	2800	3,50	2,00	71,0	0,79	4,8	2,0	2,1	0,000570	6,5	6,7	6,7
VTB 80-2A	0,75	1,00	2780	3,30	1,90	73,0	0,86	4,5	2,0	2,1	0,000829	7,9	8,1	8,1
VTB 80-2B	1,10	1,50	2780	4,30	2,50	75,0	0,87	5,0	2,1	2,2	0,00100	9,4	9,6	9,6
VTB 80-2C	2,00	1,50	2800	6,20	3,60	76,0	0,83	5,6	2,1	2,2	0,00097	9,6	9,8	9,8
VTB 90S-2	1,5	2,0	2840	5,70	3,30	81,0	0,84	6,2	3,0	3,1	0,00130	14,0	15,5	15,5
VTB 90L-2	2,2	3,0	2840	8,50	4,90	82,0	0,84	7,1	3,4	3,5	0,00200	16,8	18,2	18,5
VTB 90LB-2	3,00	4,00	2840	10,50	6,50	82,0	0,84	6,1	3,4	3,5	0,00280	18,0	18,5	18,5
VTB 100L-2	3,0	4,0	2840	10,6	6,10	83,4	0,86	7,5	2,7	2,8	0,00480	25,0	26,7	27,1
VTB 100LB-2	4,00	5,50	2840	19,0	8,10	83,0	0,85	6,5	2,8	2,9	0,00850	25,0	26,7	27,1
VTB 112M-2	4,0	5,5	2850	15,0	8,50	85,4	0,90	6,4	2,1	2,3	0,00790	34,0	36,0	36,5
VTB 112MB-2	5,50	7,50	2850	18,00	11,00	84,0	0,86	6,8	2,2	2,7	0,01200	34,0	36,0	36,5
VTB 132S-2A	5,5	7,5	2910	18,1	10,4	87,0	0,88	7,0	2,4	3,2	0,01500	50,0	51,0	51,0
VTB 132S-2B	7,5	10	2920	24,2	13,9	88,5	0,88	7,5	2,5	3,2	0,01800	53,0	53,5	53,5
VTB 132MA-2	9,00	12,50	2900	33,00	18,50	86,0	0,87	7,3	2,5	3,5	0,02800	54,0	55,0	55,0
VTB 132MB-2	11,0	15,00	2900	39,00	22,50	86,0	0,87	6,8	2,7	3,7	0,03000	60,0	61,0	61,0
VTB 160M-2A	11,0	15	2930	34,6	19,9	89,5	0,89	6,1	2,4	2,9	0,0420	100	106	108
VTB 160M-2B	15,0	20	2920	45,6	26,2	90,5	0,91	6,2	2,4	2,7	0,0480	115	122	125
VTB 160L-2	18,5	25	2930	55,8	32,1	91,0	0,91	6,5	2,8	3,0	0,0590	130	139	142
VTB 180M-2	22,0	30	2920	70,3	40,4	89,4	0,88	6,0	2,5	2,5	0,076	165	173	180
VTB 200L-2A	30	40	2960	92,5	53,2	92,9	0,89	6,0	1,9	2,5	0,150	245	245	255
VTB 200L-2B	37	50	2960	111	63,6	93,7	0,88	6,7	2,2	2,5	0,180	265	265	275
VTB 225M-2	45	60	2968	134	77,0	94,5	0,89	7,0	2,4	2,5	0,260	335	335	345
VTB 250M-2	55	75	2970	164	94,0	93,4	0,90	6,9	2,0	2,5	0,360	410	410	425
VTB 280S-2	75	100	2977	222	127	94,2	0,89	7,5	2,3	3,3	0,760	535	535	555
VTB 280M-2	90	125	2975	263	151	94,7	0,91	7,0	2,0	3,2	0,870	605	605	622
VTB 315S-2	110	150	2975	312	179	95,4	0,92	8,1	1,8	2,6	0,910	690	690	730
VTB 315M-2A	132	180	2975	377	216	95,0	0,91	8,5	2,0	2,7	0,980	725	725	765
VTB 315M-2B	160	220	2972	458	263	95,3	0,92	8,3	2,0	2,6	1,120	790	790	830
VTB 355S-2	200	270	2975	582	334	94,9	0,91	6,0	1,5	2,6	2,600	1350	1350	1410
VTB 355M-2	250	340	2978	722	415	95,5	0,91	7,0	1,8	3,0	3,000	1520	1520	1580

• Full load data



“SERIES VTB” ELECTRICAL CHARACTERISTICS

EUROVOLTAGE

MOTOR TYPE	Power		Rotation speed [Giri 1']	Rated current		Efficiency η [%]	Power factor $\cos \varphi$	Characteristic data			Moment of inertia J [Kgm ²]	Weight		
	[KW]	[HP]		230 Volt	400 Volt			Current I_L/I_N	Torque			IM B3 [Kg]	IM B5 [Kg]	IM B3 B5 [K g]
				[A]	[A]				M_L/M_N	M_{max}/M_N				
4 POLES 50/60 Hz 1500/1800 RPM														
VTB 56-4A	0,06	0,08	1400	0,60	0,35	61,0	0,66	3,3	2,0	2,1	0,000145	2,7	2,9	3,0
VTB 56-4B	0,09	0,12	1400	0,65	0,38	61,0	0,66	3,2	2,1	2,0	0,000186	2,9	3,1	3,2
VTB 63-4A	0,12	0,18	1380	0,80	0,50	54,0	0,70	3,2	2,0	2,0	0,000240	3,6	3,8	3,9
VTB 63-4B	0,18	0,25	1380	1,30	0,75	54,0	0,70	3,2	2,0	2,0	0,000307	4,2	4,4	4,5
VTB 63-4C	0,25	0,33	1400	1,35	0,80	55,0	0,70	3,2	2,0	2,0	0,000400	4,5	4,6	4,6
VTB 71-4A	0,25	0,33	1380	1,50	0,85	65,0	0,72	3,8	2,0	2,0	0,000610	4,8	5,0	5,1
VTB 71-4B	0,37	0,50	1370	1,90	1,10	65,0	0,72	3,7	2,0	2,0	0,000770	6,3	6,4	6,5
VTB 71-4C	0,55	0,75	1380	2,50	1,50	65,0	0,72	3,8	2,0	2,0	0,000900	6,8	6,9	6,9
VTB 80-4A	0,55	0,75	1380	2,60	1,50	71,0	0,78	3,8	1,7	1,8	0,001578	7,7	7,9	8,1
VTB 80-4B	0,75	1,00	1400	3,50	2,00	75,0	0,80	4,5	1,8	1,9	0,001874	9,0	9,1	9,2
VTB 80-4C	1,1	1,5	1400	4,50	3,00	75,0	0,80	4,3	1,9	1,9	0,00230	9,5	9,6	9,6
VTB 90S-4	1,10	1,50	1400	4,70	2,80	76,7	0,80	4,9	2,2	2,8	0,00230	14,0	15,0	15,5
VTB 90L-4	1,50	2,00	1410	6,10	3,50	79,0	0,78	5,3	2,5	2,8	0,00280	16,5	17,4	17,7
VTB 90LB-4	2,20	3,00	1400	8,50	4,90	79,0	0,80	4,7	2,5	2,8	0,00500	17,0	17,5	17,5
VTB 100L-4A	2,20	3,00	1425	8,80	5,00	81,0	0,80	6,1	2,5	2,8	0,00580	25,0	26,5	27,5
VTB 100L-4B	3,00	4,00	1415	11,7	6,80	81,5	0,81	6,1	2,6	2,7	0,00650	26,0	27,7	28,0
VTB 112M-4	4,00	5,50	1435	15,5	8,80	84,1	0,82	6,3	2,6	3,0	0,01180	34,0	35,5	36,0
VTB 112MB-4	5,50	7,50	1420	20,0	12,0	82,0	0,81	5,5	2,7	3	0,01600	37,0	38,0	38,0
VTB 132S-4	5,50	7,50	1450	19,8	11,5	85,0	0,84	6,9	2,2	3,1	0,02900	60	62	62
VTB 132MA-4	7,50	10,0	1450	26,5	15,0	86,0	0,85	6,7	2,4	3,1	0,03500	70	73	73
VTB 132MB-4	9,00	12,50	1450	35,0	20,0	85,0	0,83	6,7	3	3,2	0,03400	75	76	76
VTB 132MC-4	11,00	15,00	1450	40,0	24,0	85,0	0,83	6,9	3	3,2	0,03500	78	79	79
VTB 160M-4	11,0	15,0	1460	36,4	20,9	89,0	0,85	7,0	2,3	3,1	0,061	105	115	118
VTB 160L-4	15,0	20,0	1460	48,2	27,7	89,5	0,87	7,3	2,4	3,2	0,075	125	135	138
VTB 180M-4	18,5	25,0	1470	57,0	32,8	90,5	0,90	6,8	2,4	2,9	0,135	165	175	178
VTB 180L-4	22,0	30,0	1465	67,5	38,8	91,0	0,90	7,3	2,7	2,8	0,155	175	185	188
VTB 200L-4	30,0	40,0	1472	92,5	53,0	92,5	0,88	7,1	2,9	2,5	0,310	265	265	275
VTB 225S-4	37,0	50,0	1476	114	65,5	92,6	0,88	6,3	2,1	2,2	0,440	320	320	330
VTB 225M-4	45,0	60,0	1480	137	78,8	93,7	0,89	7,0	2,4	2,3	0,530	345	345	355
VTB 250M-4	55,0	75,0	1478	162	93,0	93,4	0,90	7,3	2,4	2,6	0,790	425	425	440
VTB 280S-4	75,0	100	1486	222	127	94,7	0,91	7,3	2,5	2,5	1,370	565	565	582
VTB 280M-4	90	125	1484	260	149	94,8	0,91	7,5	2,6	2,6	1,630	635	635	652
VTB 315S-4	110	150	1480	322	185	94,4	0,91	7,0	2,2	2,4	1,670	720	720	760
VTB 315M-4A	132	180	1487	388	223	94,8	0,90	8,1	2,8	2,7	1,840	750	750	790
VTB 315M-4B	160	220	1484	465	267	95,0	0,90	8,3	3,0	2,7	2,080	795	795	835
VTB 355M-4	250	340	1489	739	424	95,5	0,89	6,7	2,2	3,0	6,800	1640	1640	1700
VTB 355L-4	315	430	1488	919	528	95,6	0,90	6,7	2,0	3,0	8,000	1750	1750	1810

• Full load data

DEFINITIONS

P_a = Absorbed power [kW]
 P_n = Rated power (delivered) [kW]
 V_n = Input voltage [V]
 N_n = Speed (with load) [rpm]
 $\cos \varphi$ = Power factor
 η = Efficiency

I_N = rated current [A]
 I_L = Starting current [A]
 M_N = rated torque [Kgm]
 M_L = Starting torque [Kgm]
 M_{MAX} = Pull-in torque [Kgm]
 J = Moment of inertia [Kgm²]



"SERIES VTB" ELECTRIC CHARACTERISTICS

EUROVOLTAGE

MOTOR TYPE	Power		Rotation speed [Giri 1']	Rated current		Efficiency η [%]	Power factor $\cos \varphi$	Characteristic data			Moment of inertia J [Kgm ²]	Weight		
				230 Volt [A]	400 Volt [A]			Current I_L/I_N	Torque			IM B3 [Kg]	IM B5 [Kg]	IM B3 B5 [Kg]
	M_L/M_N	M_{max}/M_N												
6 POLES 50/60 Hz 1000/1200 RPM														
VTB 71-6A	0,18	0,25	900	1,60	0,95	55,0	0,60	2,7	1,6	1,7	0,000736	4,7	4,9	5,0
VTB 71-6B	0,25	0,33	900	1,90	1,10	55,0	0,60	3,0	1,8	1,8	0,000946	5,6	5,9	6,0
VTB 80-6A	0,37	0,50	930	2,15	1,25	65,0	0,70	3,3	1,7	1,9	0,001693	7,5	7,7	7,8
VTB 80-6B	0,55	0,75	900	3,00	1,75	69,0	0,72	3,4	1,7	1,9	0,002070	8,9	9,0	9,2
VTB 90S-6	0,75	1,00	915	3,65	2,10	72,4	0,72	3,7	1,9	2,2	0,002000	13,5	14,7	15,0
VTB 90L-6	1,10	1,50	920	5,05	2,90	75,4	0,71	4,0	2,2	2,3	0,002800	16,5	17,8	18,1
VTB 100L-6	1,50	2,00	945	6,80	3,90	76,7	0,73	4,6	1,9	2,3	0,009000	24,0	26,3	26,7
VTB 112M-6	2,20	3,00	960	8,40	4,80	83,8	0,78	5,9	2,2	2,8	0,0177	33,0	34,5	35,5
VTB 132S-6	3,0	4,0	950	11,9	6,80	81,0	0,78	5,4	2,1	2,8	0,0250	54,0	57,0	58,0
VTB 132M-6A	4,0	5,5	950	15,0	8,60	84,0	0,79	6,0	2,4	3,1	0,0320	66,0	69,0	70,0
VTB 132M-6B	5,5	7,5	950	20,5	11,8	85,0	0,79	6,3	2,7	3,1	0,0400	72,0	76,0	77,0
VTB 160M-6	7,5	10,0	960	26,5	15,2	87,5	0,81	6,5	2,3	3,1	0,0720	100,0	106,0	110,0
VTB 160L-6	11,0	15,0	960	38,1	21,9	88,5	0,82	7,0	2,4	3,1	0,0960	125,0	132,0	136,0
VTB 180L-6	15,0	20	975	50,5	29,0	89,0	0,84	6,0	2,8	2,4	0,2200	170,0	177,0	181,0
VTB 200L-6A	18,5	25	980	58,6	33,7	88,8	0,85	6,8	2,5	2,4	0,4100	250	250	260
VTB 200L-6B	22,0	30	981	69,4	40,0	89,8	0,88	6,9	2,4	2,2	0,4700	265	265	275
VTB 225M-6	30,0	40	982	92,5	53,0	91,0	0,88	6,3	2,1	2,2	0,7600	325	325	335
VTB 250M-6	37,0	50	985	112	64,6	92,2	0,90	6,8	2,6	2,3	1,230	425	425	440
VTB 280S-6	45	60	985	140	80,7	91,0	0,85	6,5	2,0	2,3	1,350	510	510	527
VTB 280M-6	55	75	982	165	95,0	92,4	0,89	6,2	2,2	2,2	1,610	535	535	552
VTB 315S-6	75	100	984	228	131	92,7	0,88	6,7	2,4	2,1	2,160	730	730	770
VTB 315M-6A	90	125	980	274	158	93,5	0,88	6,4	2,3	2,0	2,290	740	740	780
VTB 315M-6B	110	150	984	349	192	92,9	0,88	6,9	2,4	2,0	2,860	830	830	870
VTB 355S-6	160	220	990	495	284	94,6	0,86	5,7	1,7	2,5	7,500	1330	1330	1390
VTB 355M-6A	200	270	991	613	352	95,3	0,86	6,3	2,0	2,7	9,300	1530	1530	1590
VTB 355M-6B	250	340	991	764	439	95,6	0,86	6,7	2,2	2,9	11,300	1720	1720	1780
8 POLES 50/60 Hz 750/900 RPM														
VTB 80B-8	0,25	0,33	690	1,90	1,10	53,0	0,63	2,8	2,3	2,5	0,00250	13	13,5	13,5
VTB 90-S8	0,37	0,50	695	2,45	1,40	63,4	0,59	3,0	1,7	2,3	0,0021	13,4	14,7	15,0
VTB 90-L8	0,55	0,75	675	3,30	1,90	65,0	0,64	2,8	1,7	1,9	0,0024	15,3	16,8	17,1
VTB 100L-8A	0,75	1,00	710	4,00	2,30	71,1	0,66	3,5	1,5	1,9	0,0090	23,6	25,0	25,4
VTB 100L-8B	1,10	1,50	705	5,90	3,40	72,2	0,65	3,6	1,6	1,9	0,0100	26,3	28,0	28,4
VTB 112M-8	1,50	2,00	720	6,95	4,00	76,8	0,71	4,6	1,9	2,3	0,0192	31,0	31,5	33,0
VTB 132S-8	2,20	3,00	710	9,57	5,50	78,0	0,74	4,7	2,0	2,4	0,0330	53	55	56
VTB 132M-8	3,00	4,00	710	12,7	7,30	80,0	0,74	5,0	2,3	3,0	0,0440	65	66	67
VTB 160M-8A	4,00	5,50	705	16,2	9,30	81,5	0,76	5,0	2,2	2,7	0,060	85	89	91
VTB 160M-8B	5,50	7,50	710	22,1	12,7	83,0	0,75	5,5	2,7	3,0	0,077	95	99	102
VTB 160L-8	7,50	10	705	28,4	16,3	84,5	0,78	5,8	2,7	3,0	0,102	115	120	123
VTB 180L-8	11,0	15	730	40,1	23,5	89,0	0,76	5,5	2,0	2,4	0,213	165	170	173
VTB 200L-8	15,0	20	732	50,4	29,0	88,6	0,81	5,5	2,2	2,1	0,450	255	255	265
VTB 225S-8	18,5	25	735	64,5	37,0	87,9	0,77	5,6	2,0	2,0	0,580	280	280	290
VTB 225M-8	22	30	735	74,4	42,7	88,6	0,79	5,2	2,0	1,8	0,680	315	315	325
VTB 250M-8	30	40	737	99,0	57,0	90,1	0,78	6,3	2,5	2,1	1,270	420	420	435
VTB 280S-8	37	50	738	121	69,0	92,4	0,81	5,3	2,0	1,8	1,470	520	520	537
VTB 280M-8	45	60	737	145	83,6	92,3	0,80	5,4	2,1	2,0	1,800	580	580	597
VTB 315S-8	55	75	735	182	104	92,0	0,80	5,0	2,1	1,8	2,160	720	720	760
VTB 315M-8A	75	100	737	256	147	92,5	0,78	5,7	2,4	1,8	2,290	750	750	790
VTB 315M-8B	90	125	737	296	170	92,3	0,82	5,9	2,5	2,0	2,860	825	825	875
VTB 315M-8C	110	150	740	346	200	94,1	0,84	7,5	1,8	2,7	5,100	1060	1060	1110
VTB 355S-8	132	180	743	438	251	94,5	0,80	6,0	1,4	2,5	7,200	1320	1320	1380
VTB 355M-8A	160	220	744	535	307	95,1	0,79	6,7	1,6	2,7	8,900	1520	1520	1580
VTB 355M-8B	200	270	743	649	373	95,4	0,81	6,7	1,6	2,7	10,80	1700	1700	1760

• Full load data

DEFINITIONS

Pa = Absorbed power [kW]
 Pn = Rated power (delivered) [kW]
 Vn = Input voltage [V]
 Nn = Speed (with load) [rpm]

Cos φ = Power factor
 η = Efficiency
 IN = rated current [A]
 IL = Starting current [A]

M_N = rated torque [Kgm]
 M_L = Starting torque [Kgm]
 M_{MAX} = Pull-in torque [Kgm]
 J = Moment of inertia [Kgm²]



“SERIES VDV” TWO SPEED ELECTRIC CHARACTERISTICS

• For constant torque applications

MOTOR TYPE	Power				Rotation speed [Giri 1']		Rated current 400 Volt [A]		Efficiency η [%]		Power factor $\cos \varphi$		Characteristic data						Moment of inertia J [Kgm ²]	Weight IM B3 [Kg]																	
	[KW]		[HP]		2p	4p	2p	4p	2p	4p	2p	4p	Current I_L/I_N		Torque M_L/M_N M_{max}/M_N																						
	2p	4p	2p	4p									2p	4p	2p	4p	2p	4p			2p	4p	2p	4p													
2-4 POLES 3000/1500 RPM																			SINGLE COMMUTABLE WINDING –DAHLANDER YY/Δ																		
VDV 71-2/4A	0,29	0,22	0,4	0,3	2800	1400	1,2	0,9	50	58	0,7	0,6	3,2	3,2	1,6	1,6	2	1,8	0,00061	4,8																	
VDV 71-2/4B	0,44	0,29	0,6	0,4	2820	1400	1,6	1,0	60	68	0,67	0,6	4	3,9	1,7	2	1,9	2,1	0,00077	6,3																	
VDV 80-2/4A	0,59	0,44	0,8	0,6	2820	1420	1,8	1,3	61	68	0,76	0,74	3,7	4	1,6	1,7	1,8	2	0,001578	7,7																	
VDV 80-2/4B	0,88	0,66	1,2	0,9	2770	1360	2,1	1,8	72	68	0,85	0,76	4,1	3,7	1,9	1,7	1,8	1,7	0,001874	9																	
VDV 90S-2/4	1,25	0,95	1,7	1,3	2785	1410	2,8	2,4	73	72	0,89	0,81	4,5	4,35	1,7	1,65	2,1	2,1	0,0023	14																	
VDV 90L-2/4	1,61	1,25	2,2	1,7	2750	1410	3,5	3,0	74	74	0,91	0,8	4,4	4,4	1,65	1,8	2,2	2,2	0,0028	16,5																	
VDV 100L-2/4A	2,35	1,69	3,2	2,3	2810	1400	4,8	3,6	77	78	0,92	0,88	4,7	4,8	1,8	1,6	2,4	2,1	0,0058	25																	
VDV 100L-2/4B	2,94	2,2	4	3	2785	1380	5,9	4,6	78	78	0,92	0,89	4,9	4,8	1,8	1,7	2,2	2	0,0065	26																	
VDV 112M-2/4	4,4	3,3	6	4,5	2865	1435	8,8	6,8	82	83	0,88	0,85	5,9	6,9	2,2	2,2	2,6	2,7	0,0118	34																	
VDV 132S-2/4	5,9	4,77	8	6,5	2895	1445	11,9	9,4	78	84	0,92	0,87	6,1	5,6	1,7	1,6	2,4	2,3	0,029	62																	
VDV 132M-2/4B	7,35	5,88	10	8	2915	1450	14,2	11,6	81	85	0,92	0,86	7	6	1,8	1,7	2,7	2,5	0,035	73																	
VDV 160M-2/4	11	8,8	15	12	2900	1450	20,3	17,4	85	87	0,92	0,84	6,7	6,2	1,7	1,8	2,5	2,5	0,061	105																	
VDV 160L-2/4	14,7	11,7	20	16	2915	1455	26,8	22,6	86	88	0,92	0,85	7,6	6,8	2	2	2,7	2,6	0,075	125																	
VDV 180M-2/4	18,3	14,7	25	20	2930	1470	33,4	30,5	86	88	0,92	0,79	6,5	7	1,7	2,4	2,5	2,8	0,135	165																	
VDV 180L-2/4	22	18,3	30	25	2940	1480	40,1	38,5	87	89	0,91	0,77	7,5	8	2,2	3	3	3,2	0,155	175																	
VDV 200L-2/4B	30,8	25,7	42	35	2940	1475	54,9	45,8	89	92	0,91	0,88	7,7	7	2,3	2,6	2,5	2,7	0,31	265																	
VDV 225S-2/4	36,7	29,4	50	40	2945	1475	64,0	52,4	90	92	0,92	0,88	6,5	6,1	1,5	1,9	2,5	2,2	0,44	320																	
VDV 225M-2/4	44,1	36,7	60	50	2955	1480	75,2	64,7	91	93	0,93	0,88	7,5	6,5	1,8	2	2,9	2,2	0,53	345																	
VDV 250M-2/4	55,1	44,1	75	60	2955	1485	91,0	75,2	92	93	0,95	0,91	7,7	7,7	2	2,5	2,2	2,5	0,79	425																	
VDV 280S-2/4	73,5	58,8	100	80	2960	1485	121,4	101,4	92	93	0,95	0,9	6,7	7,5	1,5	2	2,5	2,4	1,37	565																	
VDV 280M-2/4	84,5	69,8	115	95	2960	1485	138,1	117,8	93	94	0,95	0,91	6,3	6,8	1,3	1,8	1,9	1,9	1,63	635																	

MOTOR TYPE	Power				Rotation speed [Giri 1']		Rated current 400 Volt [A]		Efficiency η [%]		Power factor $\cos \varphi$		Characteristic data						Moment of inertia J [Kgm ²]	Weight IM B3 [Kg]																	
	[KW]		[HP]		4p	8p	4p	8p	4p	8p	4p	8p	Current I_L/I_N		Torque M_L/M_N M_{max}/M_N																						
	4p	8p	4p	8p									4p	8p	4p	8p	4p	8p			4p	8p	4p	8p													
4-8 POLES 1500/750 RPM																			SINGLE COMMUTABLE WINDING –DAHLANDER YY/Δ																		
VDV 71-4/8A	0,14	0,07	0,2	0,1	1350	650	0,6	0,4	51	40	0,7	0,65	3,5	1,9	2	1,6	2,3	2	0,00061	5,2																	
VDV 71-4/8B	0,18	0,11	0,25	0,15	1350	650	0,7	0,6	52	41	0,74	0,67	3,4	1,8	1,9	1,4	2	2	0,00077	6,1																	
VDV 80-4/8A	0,25	0,14	0,35	0,2	1380	690	0,6	0,7	70	47	0,88	0,65	3,8	1,9	1,6	1,5	2,3	2,1	0,001578	7,8																	
VDV 80-4/8B	0,36	0,22	0,5	0,3	1370	680	1,0	1,0	65	55	0,77	0,6	4,1	2	1,6	1,5	2,1	2,2	0,001874	9,2																	
VDV 90S-4/8	0,55	0,36	0,75	0,5	1385	710	1,5	1,6	66	55	0,78	0,6	4,3	2,8	1,4	1,6	2,4	2	0,0023	14,2																	
VDV 90L-4/8	0,8	0,44	1,1	0,6	1380	710	2,2	1,9	66	54	0,78	0,61	5	3	1,4	1,6	2,7	2	0,0028	16,7																	
VDV 100L-4/8A	1,32	0,73	1,8	1	1425	700	3,4	3,1	70	55	0,8	0,61	5,2	3,5	1,6	1,7	2,6	2	0,0058	25,2																	
VDV 100L-4/8B	1,83	0,95	2,5	1,3	1415	700	4,8	3,9	70	58	0,79	0,6	5,7	3,5	1,6	1,7	2,9	2,1	0,0065	26,2																	
VDV 112M-4/8	2,2	1,32	3	1,8	1415	710	5,2	5,0	75	64	0,82	0,59	6,9	4,2	1,6	1,8	2,7	1,8	0,0118	34,2																	
VDV 132S-4/8	3,3	2,2	4,5	3	1410	710	7,7	6,8	75	69	0,83	0,68	6,7	4,7	1,8	2	2,9	2,3	0,029	62,3																	
VDV 132M-4/8A	4,4	2,94	6	4	1415	710	9,5	8,2	80	75	0,84	0,69	7,2	5	1,8	2	3	2,4	0,035	73,3																	
VDV 132M-4/8B	5,1	3,3	7	4,5	1415	710	11,0	9,1	80	75	0,84	0,7	7,2	5,2	1,8	2,2	3	2,4	0,035	73,4																	
VDV 160M-4/8	7,35	4,4	10	6	1435	715	15,8	11,8	81	77	0,83	0,7	6,7	5,5	2,1	2,3	3	2,7	0,061	105																	
VDV 160L-4/8	10,2	6,6	14	9	1440	715	20,9	15,9	83	80	0,85	0,75	7	5,8	2,2	2,7	3,2	3	0,075	125																	
VDV 180M-4/8	11,7	7,35	16	10	1460	720	22,6	16,0	85	83	0,88	0,8	6,5	5,5	1,8	2	2,9	2,5	0,135	165																	
VDV 180L-4/8	14,7	9,5	20	13	1460	720	27,7	20,2	87	85	0,88	0,8	6,8	5,7	1,8	2	3	2,5	0,155	176																	
VDV 200L-4/8A	18,3	11,7	25	16	1480	720	34,9	25,2	88	86	0,86	0,78	6,8	5,3	2,1	2,2	2,5	2	0,31	177																	
VDV 200L-4/8B	22	14,7	30	20	1480	725	41,5	31,7	89	87	0,86	0,77	6,8	5,5	2,1	2,3	2,5	2	0,31	266																	
VDV 225S-4/8	27,9	18,3	38	25	1475	725	53,2	40,5	89	87	0,85	0,75	6	5,6	1,8	2	2,2	1,9	0,44	321																	
VDV 225M-4/8	33	22	45	30	1475	725	60,1	48,1	89	88	0,89	0,75	7	5,2	1,8	2	2,3	1,8	0,53	347																	
VDV 250M-4/8	40,4	29,4	55	40	1480	735	73,6	58,9	90	90	0,88	0,8	7	6	2,2	2,5	2,5	2	0,79	427																	
VDV 280S-4/8	51,4	36,7	70	50	1480	735	90,6	74,5	91	90	0,9	0,79	6,6	5,6	2	2,3	2,5	1,8	1,37	567																	
VDV 280M-4/8	62,5	44,1	85	60	1480	740	106,6	88,4	93	90	0,91	0,8	7,2	5,4	2,2	2,3	2,6	1,8	1,63	637																	

• Full load data



“SERIES VDV” TWO SPEED ELECTRIC CHARACTERISTICS

• For constant torque applications

MOTOR TYPE	Power				Rotation speed [Giri 1']		Rated current 400 Volt [A]		Efficiency η [%]		Power factor $\cos \varphi$		Characteristic data						Moment of inertia J [Kgm ²]	Weight IM B3 [Kg]																			
	[KW]		[HP]		4p	6p	4p	6p	4p	6p	4p	6p	Current I_L/I_N		Torque M_L/M_N M_{max}/M_N																								
	4p	6p	4p	6p									4p	6p	4p	6p	4p	6p			4p	6p	4p	6p															
4-6 POLES 1500/1000 RPM																				DOUBLE WINDING																			
VDV 71-4/6A	0,14	0,1	0,4	0,3	1380	850	0,47	0,39	54	50	0,8	0,74	2,4	2,2	1,1	1,3	1,2	1,4	0,000736	4,7																			
VDV 71-4/6B	0,22	0,14	0,6	0,4	1380	860	0,68	0,43	56	56	0,84	0,84	2,7	2,4	1,1	1,5	1,4	1,6	0,000946	5,6																			
VDV 80-4/6A	0,36	0,22	0,8	0,6	1400	920	0,98	0,77	64	54	0,83	0,76	3	2,9	1,3	1,4	1,5	1,7	0,001693	7,5																			
VDV 80-4/6B	0,51	0,29	1,2	0,9	1410	950	1,3	1,1	66	52	0,85	0,75	4,3	3,4	1,5	1,3	1,9	1,8	0,00207	8,9																			
VDV 90S-4/6	0,66	0,36	1,7	1,3	1425	950	1,8	1,2	67	64	0,78	0,67	4	3,7	1,55	2	2,4	2,2	0,0023	14,2																			
VDV 90L-4/6	0,95	0,58	2,2	1,7	1420	950	2,7	1,9	67	65	0,77	0,67	4,4	4	1,5	1,9	2,5	2,3	0,0028	16,7																			
VDV 100L-4/6A	1,32	0,88	3,2	2,3	1440	960	3,6	2,7	68	66	0,77	0,7	4,85	4,2	1,55	1,75	2,6	2,6	0,0058	25,2																			
VDV 100L-4/6B	1,69	1,1	4	3	1435	960	4,0	3,4	74	64,2	0,82	0,72	4,5	4,15	1,2	1,5	2,25	2,7	0,0065	26,2																			
VDV 112M-4/6	2,2	1,47	6	4,5	1445	965	5,0	3,8	79	78	0,8	0,72	5,6	5,8	1,55	2,3	2,6	2,9	0,0118	34,2																			
VDV 132S-4/6	3,16	1,83	8	6,5	1440	970	6,3	4,6	81	77	0,89	0,74	5,5	5,3	1,6	1,8	2	2,6	0,029	62,3																			
VDV 132M-4/6A	4	2,57	10	8	1445	965	8,0	6,2	82	79	0,88	0,76	5,7	5,7	1,6	1,8	2,5	2,7	0,035	73,3																			
VDV 132M-4/6B	4,77	2,94	15	12	1445	965	9,3	6,6	83	80	0,89	0,8	6	5,7	1,6	1,8	2,4	2,6	0,061	105																			
VDV 160M-4/6	6,6	4,4	15	12	1450	965	16,6	12,5	85	83	0,88	0,82	6,5	6,2	1,7	1,8	2,4	2,4	0,061	105																			
VDV 160L-4/6	8,8	5,8	20	16	1450	970	16,6	12,5	87	85	0,88	0,79	7,2	7,3	1,9	2,3	2,8	2,9	0,075	125																			
VDV 180L-4/6	13,2	9,5	30	25	1470	985	25,2	20,4	85	84	0,89	0,8	6,5	6,8	2,2	2,6	2,3	2,8	0,155	176																			
VDV 200L-4/6A	16,1	10,6	42	35	1473	985	29,4	20,0	87	86	0,91	0,89	6,4	6,4	1,5	1,5	2,3	2,5	0,41	250																			
VDV 200L-4/6B	19,8	13,2	27	18	1470	985	36,1	24,9	88	86	0,9	0,89	6,3	7	1,6	1,6	2,3	2,6	0,47	265																			
VDV 225S-4/6	25,7	16,9	50	40	1470	985	44,8	32,2	89	88	0,93	0,86	6,4	7,6	1,7	2,5	2,4	2,9	0,44	320																			
VDV 225M-4/6	30,8	20,5	60	50	1480	990	54,9	42,6	90	88	0,9	0,79	7,2	7,8	2	3	1,9	3,1	0,76	325																			
VDV 250M-4/6	36	24,2	75	60	1485	990	64,2	49,0	90	87	0,9	0,82	8,4	7,8	2,8	2,1	3,9	3,5	1,23	425																			
VDV 280S-4/6	51,4	33,8	100	80	1480	990	87,7	60,9	91	90	0,93	0,89	6,7	8,5	1,7	2,8	2,3	2,6	1,35	510																			
VDV 280M-4/6	62,5	40,4	115	95	1480	990	105,4	72,0	93	92	0,92	0,88	7	8,7	1,8	3,2	1,9	3	1,61	535																			

MOTOR TYPE	Power				Rotation speed [Giri 1']		Rated current 400 Volt [A]		Efficiency η [%]		Power factor $\cos \varphi$		Characteristic data						Moment of inertia J [Kgm ²]	Weight IM B3 [Kg]																			
	[KW]		[HP]		6p	8p	6p	8p	6p	8p	6p	8p	Current I_L/I_N		Torque M_L/M_N M_{max}/M_N																								
	6p	8p	6p	8p									6p	8p	6p	8p	6p	8p			6p	8p	6p	8p	6p	8p													
6-8 POLES 1000/750 RPM																				DOUBLE WINDING																			
VDV 80-6/8A	0,22	0,11	0,3	0,15	940	700	0,69	0,52	64	49	0,72	0,62	3,4	2,4	1,4	1,2	1,8	1,7	0,001578	7,8																			
VDV 80-6/8B	0,29	0,14	0,4	0,2	935	700	0,95	0,67	63	50	0,7	0,6	3,6	2,8	1,5	1,4	1,9	1,7	0,001874	9,2																			
VDV 90S-6/8	0,36	0,22	0,5	0,3	930	705	1,11	1,09	61,6	45	0,76	0,65	3,2	2,6	1,5	1,7	2,1	1,85	0,0023	14,2																			
VDV 90L-6/8	0,58	0,29	0,8	0,4	930	705	1,6	1,3	64,8	48,3	0,79	0,67	3,2	2,8	1,4	1,8	1,9	2,1	0,0028	16,7																			
VDV 100L-6/8A	0,88	0,44	1,2	0,6	935	710	2,6	1,9	63	50	0,78	0,67	3,7	3	1,5	1,4	2,2	2,4	0,0058	25,2																			
VDV 112M-6/8	1,32	0,73	1,8	1	955	720	3,3	2,4	78	71	0,73	0,63	4,8	4,5	1,5	2,2	2	2,8	0,0118	34,2																			
VDV 132S-6/8	1,83	1,1	2,5	1,5	960	730	4,4	3,5	80	69	0,75	0,65	4,2	3,3	1,2	1,3	2,4	2,6	0,029	62,3																			
VDV 132M-6/8A	2,5	1,69	3,4	2,3	970	735	5,6	4,8	82	74	0,78	0,68	4,3	3,5	1,5	1,5	2,6	2,8	0,035	73,3																			
VDV 132M-6/8B	2,94	1,83	4	2,5	970	735	6,4	5,0	84	75	0,79	0,7	4,3	3,8	1,5	1,8	2,6	2,8	0,035	73,4																			
VDV 160M-6/8	4,41	2,94	6	4	975	735	9,7	7,1	84	80	0,78	0,75	5	4	1,8	2	2,2	2,5	0,061	105																			
VDV 160L-6/8	5,88	4,41	8	6	975	735	12,5	10,5	85	80	0,8	0,76	5,1	3,9	2	1,9	2	2,2	0,075	125																			
VDV 180L-6/8	9,55	6,25	13	8,5	980	730	19,5	14,1	86	82	0,82	0,78	5,3	4,3	1,9	1,7	2	1,5	0,155	176																			
VDV 200L-6/8A	11	8	15	11	990	740	21,7	17,4	87	84	0,84	0,79	7,1	6,2	2,1	2,3	2,7	2,5	0,31	177																			
VDV 200L-6/8B	13,2	9,5	18	13	990	735	26,7	20,7	86	85	0,83	0,78	7	6,1	2	2,4	2,5	2,6	0,31	266																			
VDV 225M-6/8	22	16,1	30	22	990	740	44,0	37,0	89	86	0,81	0,73	6,7	6,2	2,1	2,7	2,5	2,7	0,53	347																			
VDV 250M-6/8	27,9	20,5	38	28	990	740	52,0	41,5	89	88	0,87	0,81	7	5,9	2,1	2,4	3	2,4	0,79	427																			
VDV 280S-6/8	33	25	45	34	990	740	58,8	49,4	90	89	0,9	0,82	6	6,8	1,6	2,5	2	2,5	1,37	567																			
VDV 280M-6/8	40,4	25,7	55	35	985	740	72,8	48,6	91	92	0,88	0,83	7	7,1	1,8	2,6	1,9	2,6	1,63	637																			

• Full load data

DEFINITIONS

Pa = Absorbed power	[kW]	I_N = rated current	[A]
Pn = Rated power (delivered)	[kW]	I_L = Starting current	[A]
Vn = Input voltage	[V]	M_N = rated torque	[Kgm]
Nn = Speed (with load)	[rpm]	M_L = Starting torque	[Kgm]
Cos φ = Power factor		M_{MAX} = Pull-in torque	[Kgm]
η = Efficiency		J = Moment of inertia	[Kgm ²]



"SERIES VDV" TWO SPEED ELECTRIC CHARACTERISTICS

For quadratic torque applications

FOR FUN

MOTOR TYPE	Power				Rotation speed [Giri 1']		Rated current 400 Volt [A]		Efficiency η [%]		Power factor $\cos \varphi$		Characteristic data						Moment of inertia J [Kgm ²]	Weight IM B3 [Kg]
	[KW]		[HP]		2p	4p	2p	4p	2p	4p	2p	4p	Current I_L/I_N		Torque M_L/M_N M_{max}/M_N					
	2p	4p	2p	4p									2p	4p	2p	4p	2p	4p		
2-4 POLES 3000/1500 RPM										SINGLE COMMUTABLE WINDING – DAHLANDER YY/Δ										
VDV 71-2/4A	0,36	0,09	0,5	0,12	2800	1420	1,5	0,32	50	58	0,7	0,7	3,2	3,7	1,6	1,6	1,8	2	0,00061	4,8
VDV 71-2/4B	0,55	0,15	0,75	0,2	2800	1370	2,0	0,48	60	65	0,67	0,7	3,5	2,8	1,6	1,4	2	1,9	0,00077	6,3
VDV 80-2/4A	0,73	0,18	1	0,25	2780	1430	2,1	0,49	63	66	0,8	0,8	3,3	4,6	1,7	1,8	1,8	2,3	0,001578	7,7
VDV 80-2/4B	1,1	0,25	1,5	0,35	2770	1360	2,8	0,61	66	72	0,85	0,82	4,1	3,3	1,9	1,7	1,8	1,6	0,001874	9
VDV 90S-2/4	1,47	0,36	2	0,5	2755	1420	3,5	1,0	66,2	64	0,92	0,85	4,2	4	1,6	1,65	2	2,1	0,0023	14
VDV 90L-2/4	1,98	0,51	2,7	0,7	2775	1420	4,2	1,2	73,9	73,2	0,91	0,85	4,7	4,5	1,8	1,85	2,5	2,9	0,0028	16,5
VDV 100L-2/4A	2,5	0,66	3,5	0,9	2810	1400	5,1	1,5	77	73	0,92	0,89	4,7	3,7	1,8	1,35	1,8	1,35	0,0058	25
VDV 100L-2/4B	3,3	0,81	4,5	1,1	2785	1415	6,6	1,6	78	79	0,92	0,9	4,9	4,6	1,8	1,5	2,2	1,95	0,0065	26V
VDV 112M-2/4	4,7	1,1	6,5	1,5	2860	1445	10,3	2,3	78,4	79,6	0,84	0,87	6,1	6,3	2,3	1,85	2,7	2,9	0,0118	34
VDV 132S-2/4	6,2	1,47	8,5	2	2910	1470	13,4	3,1	77	84	0,87	0,82	6,7	7	2,2	1,8	2,9	3	0,029	62
VDV 132M-2/4	8,1	1,83	11	2,5	2930	1470	16,8	3,8	79	85	0,88	0,82	7,9	7,5	2,3	2,2	3,1	3,4	0,035	73
VDV 160M-2/4	13,2	3,3	18	4,5	2920	1470	25,2	7,0	84	85	0,9	0,8	7,4	7	2	1,9	2,9	3,2	0,061	105
VDV 160L-2/4	16,1	4	22	5,5	2930	1470	30,0	8,3	86	87	0,9	0,8	8,3	6,9	2,1	1,9	3	3	0,075	125
VDV 180M-2/4	19,8	5,14	27	7	2930	1480	39,6	9,5	87	85	0,83	0,92	6,8	6,5	2,2	1,7	2,2	1,7	0,135	165
VDV 180L-2/4	24,2	5,88	33	8	2940	1480	44,1	11,8	87	88	0,91	0,82	7,5	7,7	2,2	2,5	3,3	3	0,155	175
VDV 200L-2/4	33	8,08	45	11	2935	1465	59,5	17,5	87	75	0,92	0,89	6,1	4,5	1,8	1,7	2,6	2,3	0,31	265
VDV 225S-2/4	36,7	9,55	50	13	2945	1475	64,0	17,0	92	90	0,9	0,9	5,6	5,3	1,2	1,4	2,3	2,1	0,44	320
VDV 225M-2/4	41,9	11	57	15	2935	1480	70,7	19,4	93	91	0,92	0,9	6,8	5,9	1,6	1,6	2,7	2,3	0,53	345
VDV 250M-2/4	47,8	13,2	65	18	2940	1480	78,1	22,8	93	91	0,95	0,92	5,3	5,8	1,3	1,7	2,7	2,3	0,79	425

MOTOR TYPE	Power				Rotation speed [Giri 1']		Rated current 400 Volt [A]		Efficiency η [%]		Power factor $\cos \varphi$		Characteristic data						Moment of inertia J [Kgm ²]	Weight IM B3 [Kg]
	[KW]		[HP]		4p	8p	4p	8p	4p	8p	4p	8p	Current I_L/I_N		Torque M_L/M_N M_{max}/M_N					
	4p	8p	4p	8p									4p	8p	4p	8p	4p	8p		
4-8 POLES 1500/750 RPM										SINGLE COMMUTABLE WINDING - DAHLANDER YY/Y										
VDV 71-4/8A	0,22	0,05	0,3	0,07	1420	680	0,80	0,24	60	40	0,66	0,75	3	2	1,5	1,5	1,4	1,7	0,000606	5,2
VDV 71-4/8B	0,29	0,07	0,4	0,1	1430	680	1,1	0,34	60	40	0,65	0,75	4	2	1,5	1,5	1,6	1,6	0,00077	6,1
VDV 80-4/8A	0,47	0,11	0,65	0,16	1420	715	1,6	0,51	62	50	0,7	0,62	3,4	2,9	1,4	1,4	1,9	1,9	0,001578	7,8
VDV 80-4/8B	0,62	0,15	0,85	0,2	1400	705	1,9	0,56	58	65	0,8	0,6	4,1	3	1,4	1,6	1,9	1,9	0,001874	9,2
VDV 90S-4/8	0,91	0,22	1,25	0,3	1400	690	2,5	0,91	65	50	0,81	0,7	3,9	2,7	1,5	1,5	1,7	1,9	0,0023	14,2
VDV 90L-4/8	1,17	0,29	1,6	0,4	1405	690	3,1	1,1	68	58	0,79	0,66	4,3	2,7	1,8	1,7	2,5	1,9	0,0028	16,7
VDV 100L-4/8A	1,83	0,44	2,5	0,6	1400	680	4,0	1,3	75	64	0,88	0,74	4,5	2,7	1,5	1,2	2	1,9	0,0058	25,2
VDV 100L-4/8B	2,5	0,58	3,4	0,8	1405	685	5,8	1,8	72	65	0,87	0,73	4,55	2,9	1,5	1,4	2	1,9	0,0065	26,2
VDV 112M-4/8	3,38	0,88	4,6	1,2	1415	700	7,2	2,4	79	72	0,86	0,75	5,3	3,3	1,6	1,5	2,2	1,9	0,0118	34,2
VDV 132S-4/8	4,4	1,1	6	1,5	1420	700	8,8	2,9	80	72	0,9	0,75	5,3	3,6	1,6	1,3	2	2	0,029	62,3
VDV 132M-4/8A	6,1	1,47	8,3	2	1420	700	13,2	3,5	74	82	0,9	0,75	6	3,6	1,7	1,3	2,3	1,9	0,035	73,3
VDV 132M-4/8B	7,35	1,83	10	2,5	1430	720	15,5	4,1	75	83	0,91	0,78	6	3,6	1,8	1,4	2,3	1,9	0,035	73,4
VDV 160M-4/8	8,8	2,2	12	3	1460	730	16,8	5,2	84	81	0,9	0,75	5,8	3,8	1,6	1,1	2,3	1,9	0,061	105
VDV 160L-4/8	11,7	2,9	16	4	1440	710	21,8	6,8	86	82,6	0,9	0,74	7,1	4,2	1,9	1,3	2,8	2,1	0,075	125
VDV 180M-4/8	15,4	3,6	21	5	1460	730	29,1	8,1	85	83	0,9	0,77	6,1	4,2	2	1,7	2,1	1,8	0,135	165
VDV 180L-4/8	18,3	4,6	25	6,3	1460	730	33,8	9,9	86	86	0,91	0,78	6,2	4,3	2	1,7	2	1,9	0,155	176
VDV 200L-4/8	24,2	6,1	33	8,3	1470	735	49,2	12,1	84,5	89,7	0,84	0,81	6,3	5,2	2,1	1,8	2,6	2,3	0,31	177
VDV 225S-4/8	29,4	7,3	40	10	1475	740	57,4	14,4	87	89	0,85	0,82	5,7	7	2	1,8	2,4	2,2	0,44	321
VDV 225M-4/8	36,7	9,1	50	12,5	1475	740	70,5	15,7	92,7	89,8	0,81	0,93	5,5	7,1	1,8	1,8	2,2	2,1	0,53	347
VDV 250M-4/8	44,1	11	60	15	1470	740	81,4	19,6	92	90	0,85	0,9	6,3	5,4	1,7	1,7	2,1	2,4	0,79	427

• Full load data



“SERIES VDV” TWO SPEED ELECTRIC CHARACTERISTICS

For quadratic torque applications

FOR FUN

MOTOR TYPE	Power				Rotation speed [Giri 1']		Rated current 400 Volt [A]		Efficiency η [%]		Power factor $\cos \varphi$		Characteristic data						Moment of inertia J [Kgm ²]	Weight IM B3 [Kg]	
	[KW]		[HP]		4p	6p	4p	6p	4p	6p	4p	6p	Current I_L/I_N		Torque M_L/M_N M_{max}/M_N						
	4p	6p	4p	6p									4p	6p	4p	6p	4p	6p			4p
4-6 POLES 1500/1000 RPM DOUBLE WINDING																					
VDV 71-4/6A	0,18	0,05	0,25	0,08	1380	860	0,55	0,18	56	54	0,84	0,75	2,7	2,4	1,1	1,5	1,4	1,6	0,000736	4,7	
VDV 71-4/6B	0,29	0,09	0,4	0,12	1380	860	0,90	0,31	56	55	0,83	0,76	3	2,6	1,3	1,5	1,6	1,8	0,000946	5,6	
VDV 80-4/6A	0,44	0,13	0,6	0,18	1390	900	1,3	0,47	62	54	0,8	0,74	3,4	3,2	1,1	1,6	2	2,1	0,001693	7,5	
VDV 80-4/6B	0,58	0,18	0,8	0,25	1400	910	1,5	0,56	64	58	0,85	0,8	4,4	3	1,2	1,7	2	2,2	0,00207	8,9	
VDV 90S-4/6	0,88	0,25	1,2	0,35	1410	950	2,3	0,84	65,8	62,6	0,84	0,69	5,4	2,8	1,2	1,95	2,25	2,4	0,0023	14,2	
VDV 90L-4/6	1,1	0,36	1,5	0,5	1410	935	2,9	1,1	66,7	62,2	0,83	0,75	3,8	3,7	1,3	1,7	2,2	2,25	0,0028	16,7	
VDV 100L-4/6A	1,69	0,58	2,3	0,8	1410	950	4,1	1,9	71,6	58,1	0,83	0,76	4,25	3,4	1,4	1,3	2,2	2,1	0,0058	25,2	
VDV 100L-4/6B	2,2	0,73	3	1	1425	965	5,2	2,3	74,1	64,2	0,82	0,72	4,5	4,15	1,2	1,5	2,25	2,7	0,0065	26,2	
VDV 112M-4/6	2,94	0,88	4	1,2	1420	975	6,4	2,5	78,4	73	0,84	0,69	5,25	5,45	1,65	2,1	2,35	3	0,0118	34,2	
VDV 132S-4/6	3,8	1,17	5,3	1,6	1450	940	7,9	2,8	80	69,3	0,87	0,86	5,8	3,8	1,6	1,2	2,3	2	0,029	62,3	
VDV 132M-4/6A	5,1	1,47	7	2	1450	950	10,1	3,3	82,7	75,5	0,88	0,86	6	4,7	1,7	1,3	2,3	2	0,035	73,3	
VDV 132M-4/6B	5,8	1,83	8	2,5	1435	960	11,7	4,2	82	76	0,87	0,83	5,9	5	1,5	1,3	2,3	2	0,061	105	
VDV 160M-4/6	8	2,5	11	3,5	1450	930	22,0	7,6	82,2	75,1	0,86	0,86	6,5	3,3	1,6	1	2,5	1,5	0,061	105	
VDV 160L-4/6	11	3,6	15	5	1455	950	22,0	7,6	85	79,2	0,85	0,86	7,9	4,3	2,4	1,3	3,1	2,1	0,075	125	
VDV 180M-4/6	13,2	4,5	18	6,2	1470	970	29,8	10,3	85,4	82	0,89	0,88	6,5	4,8	2,2	1,7	2,3	1,8	0,135	165	
VDV 180L-4/6	16,1	5,14	22	7	1465	980	29,8	10,3	86,7	81,6	0,9	0,88	6,2	5,3	2,1	1,9	2,3	2,1	0,155	176	
VDV 200L-4/6A	18,3	5,5	25	7,5	1470	985	32,3	10,6	90	84	0,91	0,89	5,5	6,4	1,6	1,7	2,2	2,5	0,41	250	
VDV 200L-4/6B	22	6,6	30	9	1475	985	38,8	12,7	91	85	0,9	0,88	5,5	6,6	1,5	1,8	2,2	2,5	0,47	265	
VDV 225M-4/6	29,4	8,8	40	12	1480	990	50,5	16,3	91,4	87,5	0,92	0,89	5,7	7	1,5	2,1	2,2	2,6	0,76	325	
VDV 250M-4/6	36,7	11	50	15	1480	985	61,6	20,1	92,4	86,7	0,93	0,91	6,7	5,7	2,1	1,9	2,6	2,2	1,23	425	

MOTOR TYPE	Power				Rotation speed [Giri 1']		Rated current 400 Volt [A]		Efficiency η [%]		Power factor $\cos \varphi$		Characteristic data						Moment of inertia J [Kgm ²]	Weight IM B3 [Kg]	
	[KW]		[HP]		6p	8p	6p	8p	6p	8p	6p	8p	Current I_L/I_N		Torque M_L/M_N M_{max}/M_N						
	6p	8p	6p	8p									6p	8p	6p	8p	6p	8p			6p
6-8 POLES 1000/750 RPM DOUBLE WINDING																					
VDV 80-6/8A	0,29	0,11	0,4	0,16	930	700	1,0	0,63	58	42	0,75	0,6	3,1	2,6	1,1	1,6	1,8	1,7	0,001578	7,8	
VDV 80-6/8B	0,36	0,15	0,5	0,2	930	700	1,2	0,75	60	48	0,75	0,6	3	2,5	1,2	1,7	1,9	1,8	0,001874	9,2	
VDV 90S-6/8	0,47	0,18	0,65	0,25	930	705	1,4	0,89	61,6	45,1	0,76	0,65	3,25	2,6	1,5	1,7	2,1	1,85	0,0023	14,2	
VDV 90L-6/8	0,66	0,25	0,9	0,34	920	700	1,9	1,1	64,8	48,3	0,79	0,67	3,2	2,75	1,4	1,8	1,9	2,1	0,0028	16,7	
VDV 100L-6/8A	0,88	0,36	1,2	0,5	935	710	2,5	1,5	63	49,4	0,81	0,71	3,15	2,8	1,2	1,2	1,65	1,7	0,058	25	
VDV 100L-6/8B	1,17	0,44	1,6	0,6	945	715	3,2	1,9	65	52	0,82	0,65	4	3,2	1,3	1,6	1,7	2,2	0,0058	25,2	
VDV 112M-6/8	1,47	0,58	2	0,8	955	720	3,7	1,9	75,1	67,8	0,77	0,64	4,5	4,25	1,6	2,05	1,85	2,75	0,0118	34,2	
VDV 132S-6/8	2,2	0,88	3	1,2	960	725	5,3	2,8	80	69	0,75	0,65	4,15	3,3	1,2	1,1	2,4	2,6	0,029	62,3	
VDV 132M-6/8A	3,3	1,39	4,5	1,9	960	730	7,8	4,8	79	67	0,77	0,63	4	3,6	1,3	1,1	2,5	2,3	0,035	73,3	
VDV 132M-6/8B	4	1,69	5,5	2,3	965	725	8,8	5,1	83	69	0,79	0,7	4,5	3,9	1,5	1,2	2,4	2,2	0,035	73,4	
VDV 160M-6/8	5,5	2,2	7,5	3	965	730	12,1	6,3	82	68	0,8	0,74	4,5	4	1,8	1,3	2,1	2	0,061	105	
VDV 160L-6/8	7,35	2,9	10	4	970	735	16,0	8,0	84	70	0,79	0,75	5	4,1	1,7	1,4	2	2,1	0,075	125	
VDV 180M-6/8	8,8	3,6	12	5	975	730	18,4	8,9	85	75	0,81	0,78	5	4	1,8	1,6	2,1	2	0,135	165	
VDV 180L-6/8	10,2	4,4	14	6	980	730	20,9	9,8	86	82	0,82	0,79	5,3	4,3	1,9	1,8	2	1,6	0,155	176	
VDV 200L-6/8A	11,7	5,14	16	7	990	740	24,8	11,0	85	84	0,8	0,8	5,2	6,2	2,3	2,1	2	2,2	0,31	177	
VDV 200L-6/8B	14,7	6,2	20	8,5	990	740	30,5	12,5	87	84	0,8	0,85	6	7,1	2,3	2,1	2,3	2,7	0,31	266	
VDV 225M-6/8	22	7,35	30	10	985	740	42,5	15,4	88	83	0,85	0,83	6,5	6	2,1	2,3	2,5	2,2	0,53	347	
VDV 250M-6/8	29,4	9,55	40	13	990	740	54,2	19,6	90	88	0,87	0,8	7	5,8	2,1	2,4	3	2,4	0,79	427	

• Full load data

DEFINITIONS

Pa = Absorbed power	[kW]	I_N = rated current	[A]
Pn = Rated power (delivered)	[kW]	I_L = Starting current	[A]
Vn = Input voltage	[V]	M_N = rated torque	[Kgm]
Nn = Speed (with load)	[rpm]	M_L = Starting torque	[Kgm]
Cos φ = Power factor		M_{MAX} = Pull-in torque	[Kgm]
η = Efficiency		J = Moment of inertia	[Kgm ²]



DIMENSIONAL DRAWINGS

THREE-PHASE ASYNCHRONOUS MOTORS WITH SQUIRREL CAGE ROTOR

Completely sealed IP55 Eurovoltage.

Assembly values comply with IEC - UNEL - MEC recommendations.

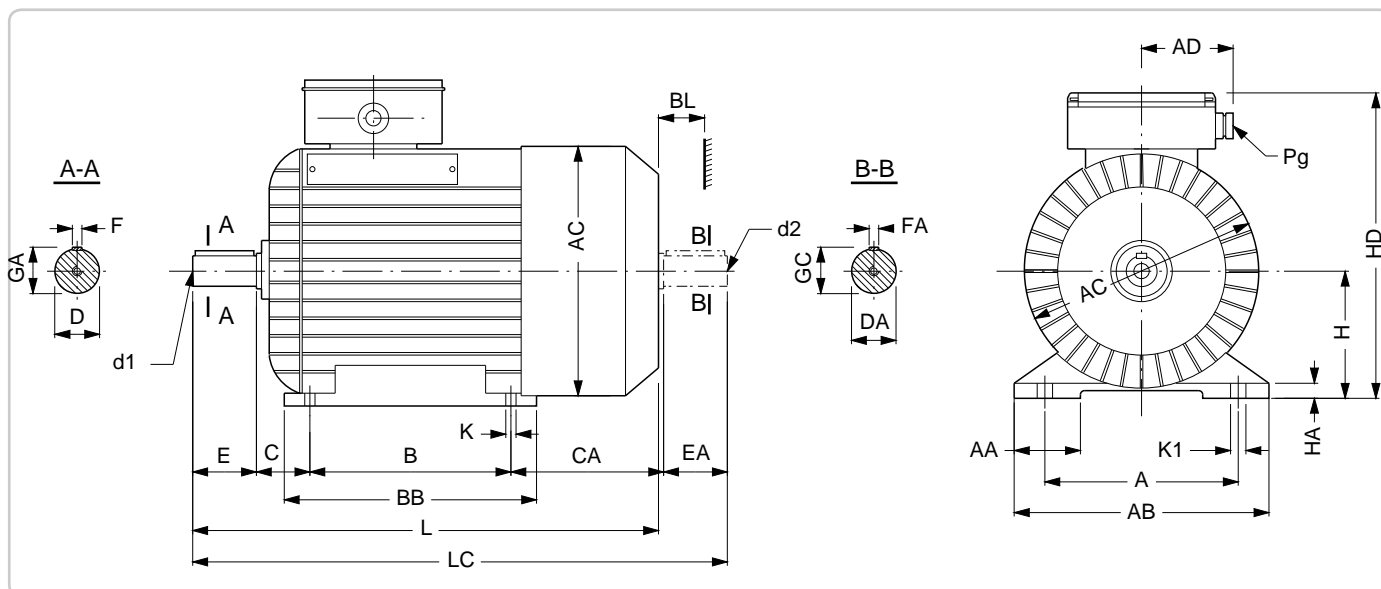
VTB - VDV Series

Size of frame: from 56 to 63.

Support-foot mounted motors as per UNEL 13113

B3, B6, B7, B8, V5, V6 as per DIN 42950

IM1001, IM1051, IM1061, IM1071, IM1011, IM1031 as per IEC.



Motor SIZE	Assembly values in mm										Dimensional values in mm												
	A	B	C	H	K	K1	Pg	Shaft					AA	AB	AC max	AD	BB min	BL	CA	HA	HD	L	LC
								D DA	E EA	F FA	GA GC	d1 d2											
56	90	71	36	56	5,8	8	M20x1,5	9j6	20	3h9	10,2	M3	30	110	117	74	92	11	66,5	7	154	188	213,5
				-0,5															74,5			196	221,5
63	100	80	40	63	7	10	M20x1,5	11j6	23	4h9	12,5	M4	36	124	126	70	106	11	67	8,5	165	202	233
				-0,5															79			214	245

NOTE

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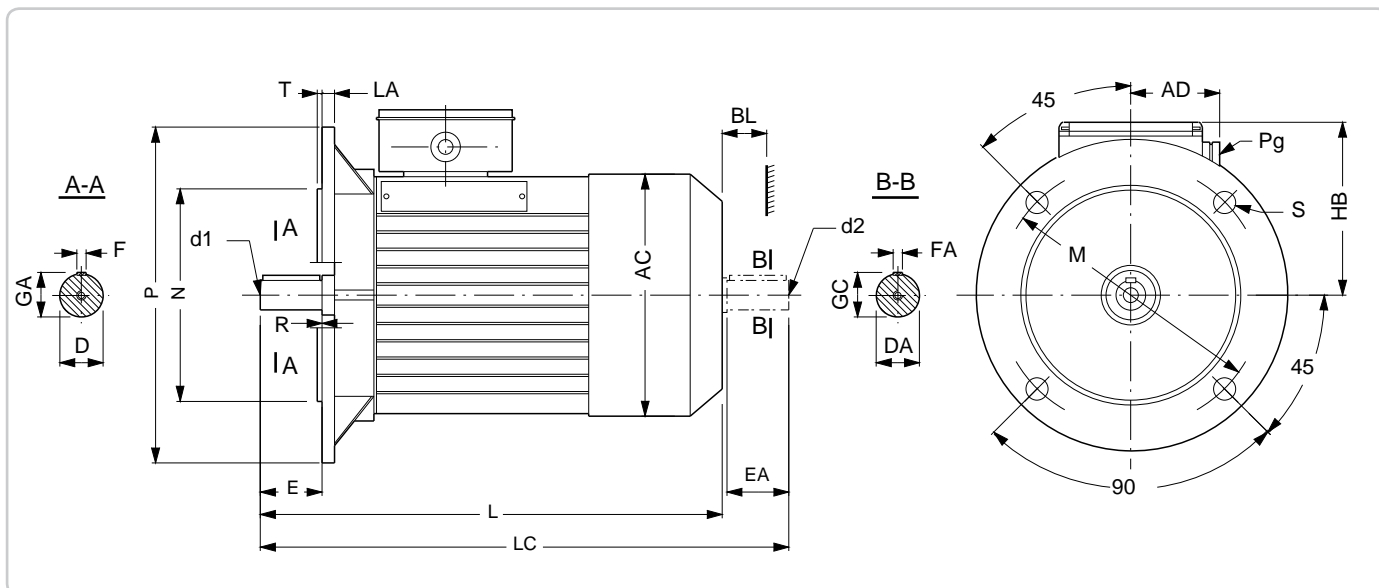
DIMENSIONAL DRAWINGS

THREE-PHASE ASYNCHRONOUS MOTORS WITH SQUIRREL CAGE ROTOR

Completely sealed IP55 Eurovoltage.
 Assembly values comply with IEC - UNEL - MEC recommendations.

VTB - VDV Series

Size of frame: from 56 to 63.
 Flange motors as per UNEL 13117
 B5, V1, V3 as per DIN 42950
 IM3001, IM3011, IM3031 as per IEC.



Motor SIZE	Assembly values in mm													Dimensional values in mm						
	Shaft				Normal flange									Pg	AC	AD max	BL min	HB	L	LC
	D DA	E EA	F FA	GA GC	d1 d2	M	N	P	LA	R	S ∅	T n°								
56	9j6	20	3h9	10,2	M3	100	80j6	120	8	0	6,6	4	3	M20x1,5	117	74	11	98	188	213,5
																			196	221,5
63	11j6	23	4h9	12,5	M4	115	95j6	140	9	0	9	4	3	M20x1,5	126	70	11	102	202	233
																			214	245

NOTE

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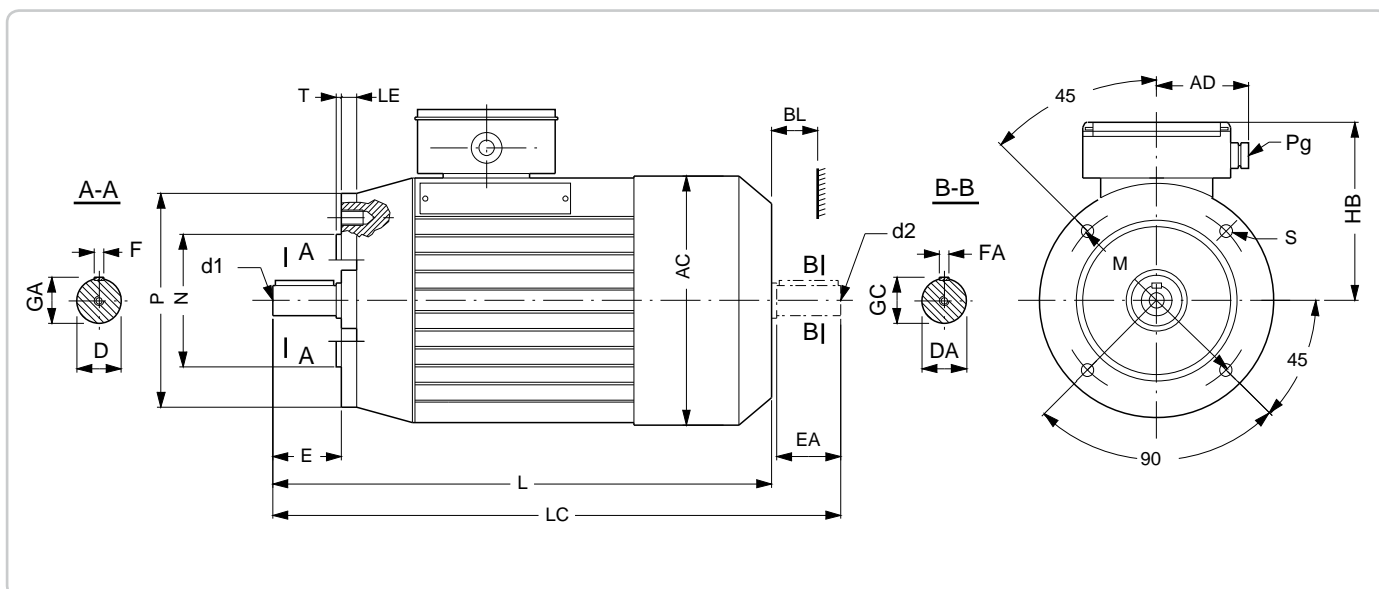
DIMENSIONAL DRAWINGS

THREE-PHASE ASYNCHRONOUS MOTORS WITH SQUIRREL CAGE ROTOR

Completely sealed IP55 Eurovoltage.
 Assembly values comply with IEC - UNEL - MEC recommendations.

VTB - VDV Series

Size of frame: from 56 to 63.
 Special flange motors as per UNEL 13118
 B14, V18, V19 as per DIN 42950
 IM3601, IM3611, IM3631 as per IEC.



Motor	Assembly values in mm												Dimensional values in mm					
	Shaft					B 14 flange							AC	AD	BL	HB	L	LC
	D	E	F	GA	d1	M	N	P	LE	S	T	DA						
56	9j6	20	3h9	10,2	M3	65	50j6	80	12,5	M5	4	2,5	117	74	11	98	188	213,5
																	196	221,5
63	11j6	23	4h9	12,5	M4	75	60j6	90	9,5	M5	4	2,5	126	70	11	102	202	233
																	214	245

NOTE

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DIMENSIONAL DRAWINGS

THREE-PHASE ASYNCHRONOUS MOTORS WITH SQUIRREL CAGE ROTOR

Completely sealed IP55 Eurovoltage.

Assembly values comply with IEC - UNEL - MEC recommendations.

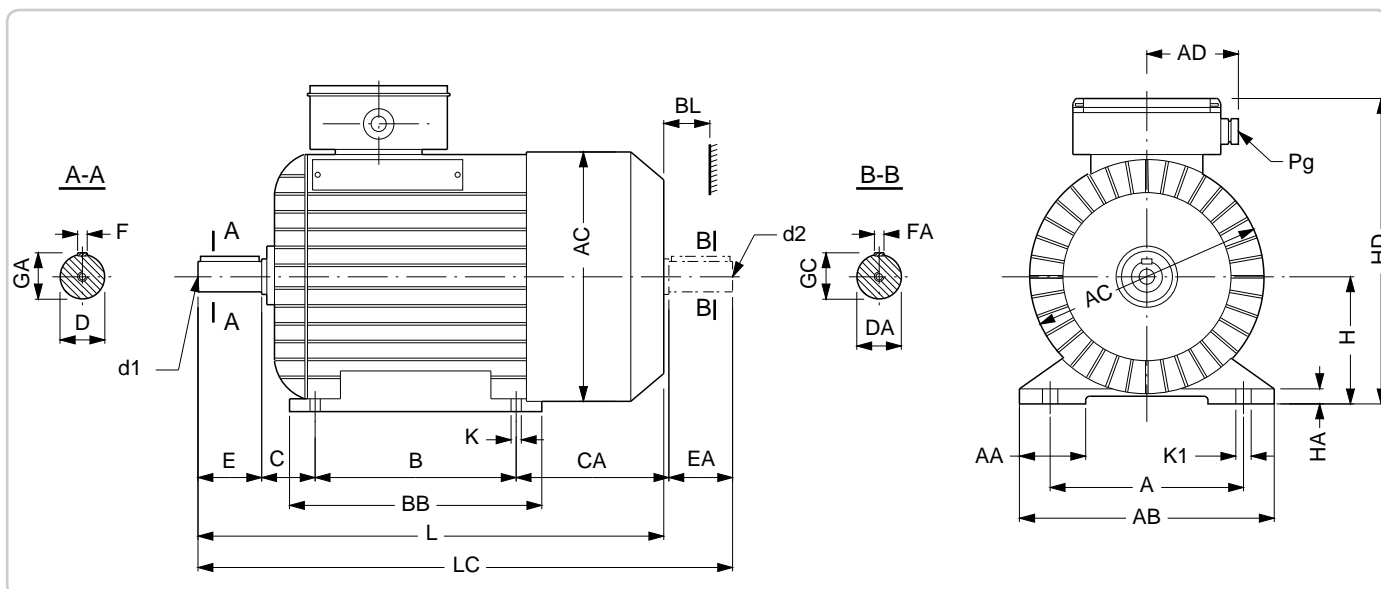
VTB - VDV Series

Size of frame: from 71 to 80.

Support-foot mounted motors as per UNEL 13113

B3, B6, B7, B8, V5, V6 as per DIN 42950

IM1001, IM1051, IM1061, IM1071, IM1011, IM1031 as per IEC.



Motor SIZE	Assembly values in mm										Dimensional values in mm												
	A	B	C	H	K	K1	Pg	Shaft					AA	AB	AC	AD max	BB	BL min	CA	HA	HD	L	LC
								D DA	E EA	F FA	GA GC	d1 d2											
71	112	90	45	71	7	10	M20x1,5	14j6	30	5h9	16	M5	45	142	141	70	116	12	65	8	182	222	260
																			-0,5			83	245
80	125	100	50	80	10	13	M20x1,5	19j6	40	6h9	21,5	M6	55	160	157	70	130	15	76	9	195	255	306
																			-0,5			93	272

NOTE

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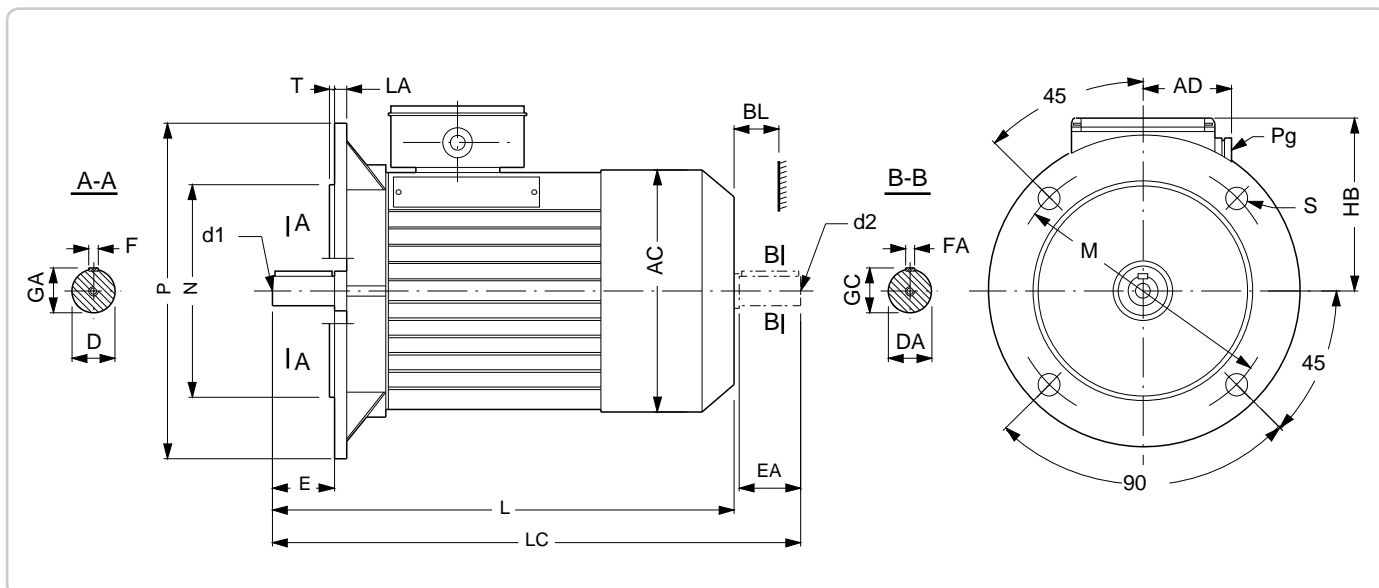
DIMENSIONAL DRAWINGS

THREE-PHASE ASYNCHRONOUS MOTORS WITH SQUIRREL CAGE ROTOR

Completely sealed IP55 Eurovoltage.
 Assembly values comply with IEC - UNEL - MEC recommendations.

VTB - VDV Series

Size of frame: from 71 to 80.
 Flange motors as per UNEL 13117
 B5, V1, V3 as per DIN 42950
 IM3001, IM3011, IM3031 as per IEC.



Motor SIZE	Assembly values in mm														Dimensional values in mm										
	Shaft					B5 flange					Reduced B5 flange				AC	AD	BL	HB	L	LC					
	D	E	F	GA	d1	M	N	P	LA	S	T	M	N	P							S	T			
DA	EA	FA	GC	d2					Ø	n°				Ø	n°	max	min								
71	14j6	30	5h9	16	M5	130	110j6	160	9	10	4	3,5	115	95j6	140	14	M6	4	3	141	70	12	111	222	260
																							245	283	
80	19j6	40	6h9	21,5	M6	165	130j6	200	10	12	4	3,5	130	110j6	160	14	M6	4	3,5	157	70	15	115	255	306
																							272	323	

NOTE

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DIMENSIONAL DRAWINGS

THREE-PHASE ASYNCHRONOUS MOTORS WITH SQUIRREL CAGE ROTOR

Completely sealed IP55 Eurovoltage.

Assembly values comply with IEC - UNEL - MEC recommendations.

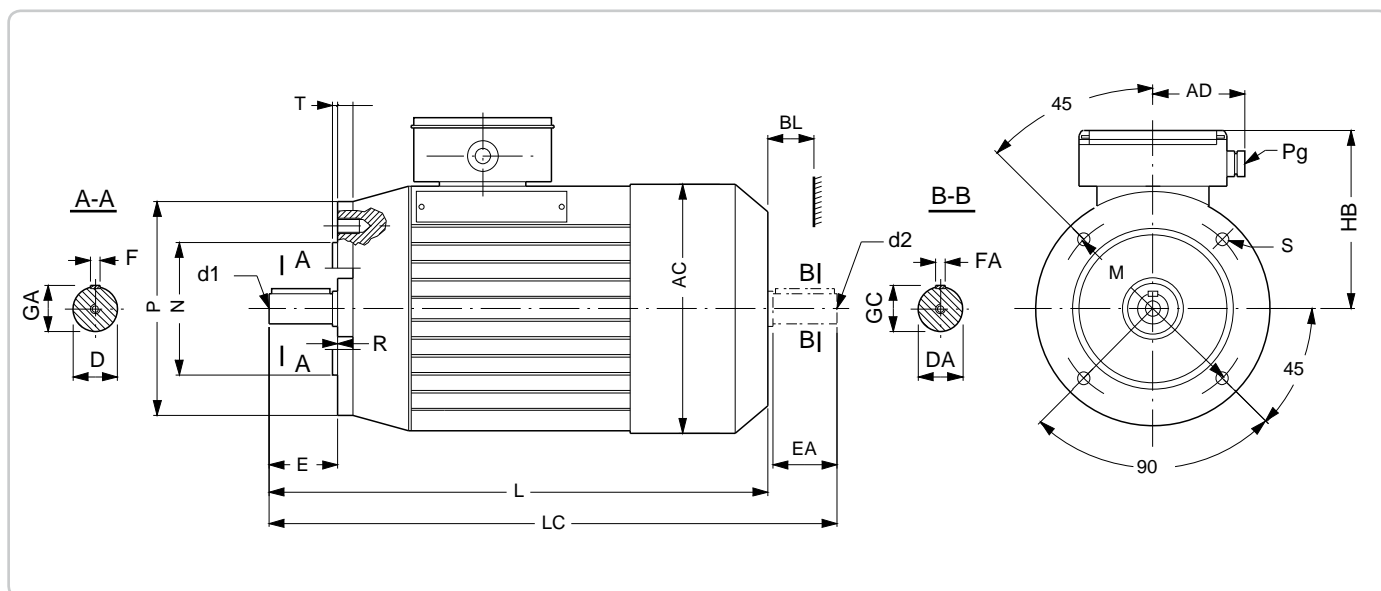
VTB - VDV Series

Size of frame: from 71 to 80.

Special flange motors as per UNEL 13118

B14, V18, V19 as per DIN 42950

IM3601, IM3611, IM3631 as per IEC.



Motor SIZE	Assembly values in mm											Dimensional values in mm							
	Shaft					B14 flange						Pg	AC	AD	BL	HB	L	LC	
	D	E	F	GA	d1	M	N	P	S	T	R								DA
71	14j6	30	5h9	16	M5	85	70j6	105	M6	4	2,5	0	M20x1,5	141	70	12	111	222	260
																		245	283
80	19j6	40	6h9	21,5	M6	100	80j6	120	M6	4	3	0	M20x1,5	157	70	15	115	255	306
																		272	323

NOTE

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DIMENSIONAL DRAWINGS

THREE-PHASE ASYNCHRONOUS MOTORS WITH SQUIRREL CAGE ROTOR

Completely sealed IP55 Eurovoltage.

Assembly values comply with IEC - UNEL - MEC recommendations.

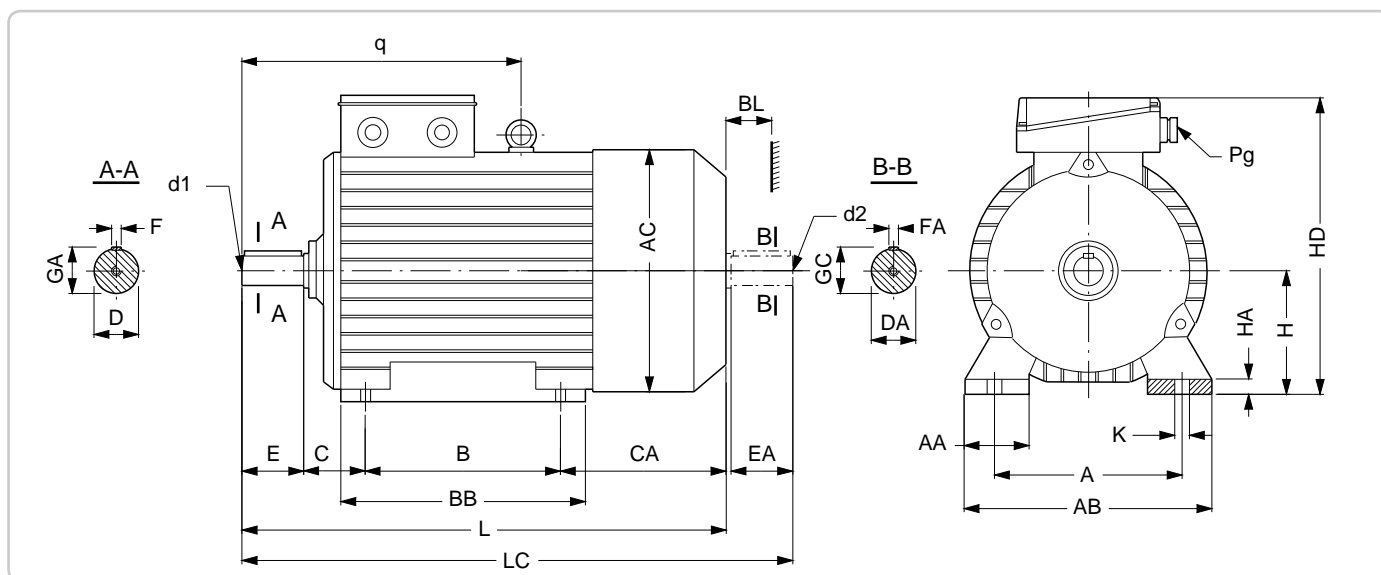
VTB - VDV Series

Size of frame: from 90 to 112.

Support-foot mounted motors as per UNEL 13113

B3, B6, B7, B8, V5, V6 as per DIN 42950

IM1001, IM1051, IM1061, IM1071, IM1011, IM1031 as per IEC.



Motor SIZE	Assembly values in mm										Dimensional values in mm												
	A	B	C	H	K	Pg	Shaft					AA	AB	AC	BB	BL	CA	HA	HD	L	LC	q	
							D	E	F	GA	d1												DA
S	100																		305	360			
	0,75																						
90	140		56	90	10	M20x1,5	24j6	50	8h9	27	M8	50	170	185	153	15	104	10	220			/	
	-0,5																						
L	125																			330	385		
100L	160	140	63	100	12	M20x1,5	28j6	60	8h9	31	M10	45	200	206	172	20	116	14	240	376	441	/	
	-0,5																						
112M	4																						
	190	140	70	112	12	M25x1,5	28j6	60	8h9	31	M10	54	230	245	174	20	119	14	276	384	449	257	
	-0,5																						

NOTE

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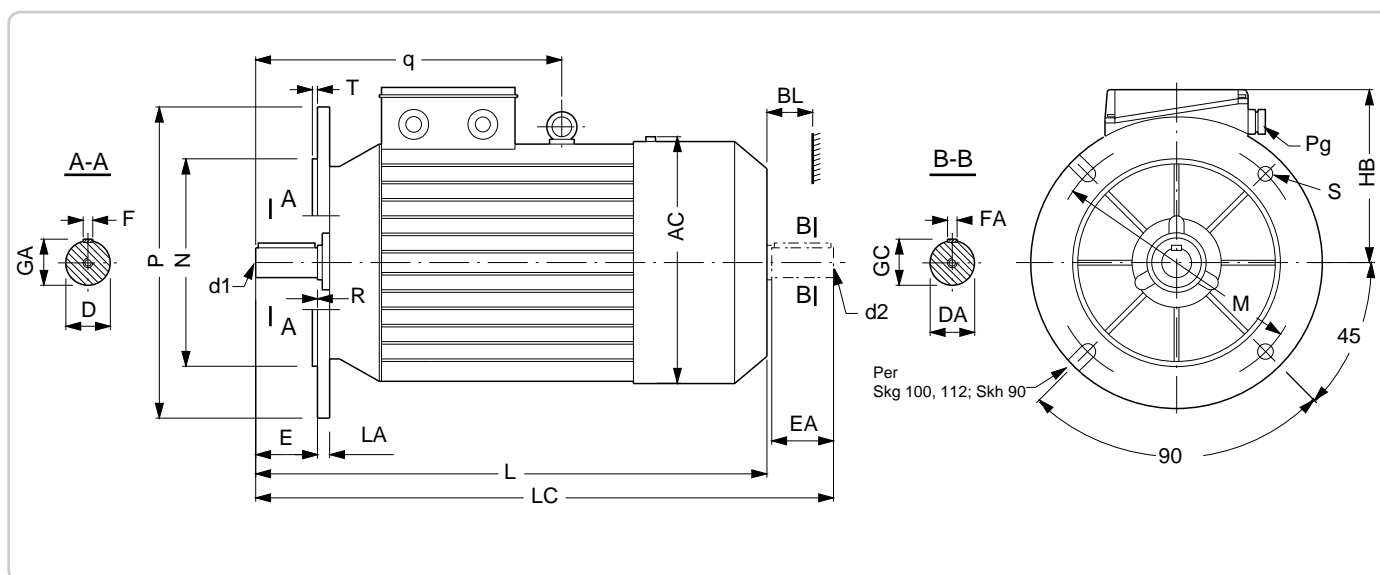
DIMENSIONAL DRAWINGS

THREE-PHASE ASYNCHRONOUS MOTORS WITH SQUIRREL CAGE ROTOR

Completely sealed IP55 Eurovoltage.
 Assembly values comply with IEC - UNEL - MEC recommendations.

VTB - VDV Series

Size of frame: from 90 to 112.
 Flange motors as per UNEL 13117
 B5, V1, V3 as per DIN 42950
 IM3001, IM3011, IM3031 as per IEC.



Motor GR	Assembly values in mm																			Dimensional values in mm							
	Shaft					B5 flange							Reduced B5 flange							Pg	AC	BL	HB	L	LC	q	
	D	E	F	GA	d1	M	N	P	LA	S	T	M	N	P	LE	S	T	R									
DA	EA	FA	GC	d2					∅	n°					∅	n°			min								
S 90 L	24j6	50	8h9	27	M8	165	130j6	200	8	12	4	3,5	130	110j6	160	M8	4	3	0	M20x1,5	185	15	130		305	360	/
																								330	385		
100L	28j6	60	8h9	31	M10	215	180j6	250	11	15	4	4	165	130j6	200	M8	4	3,5	0	M20x1,5	206	20	140	376	441	/	
112M	28j6	60	8h9	31	M10	215	180j6	250	11	15	4	4							0	M20x1,5	245	20	164	384	449	257	

NOTE

The technical data, dimensional values and all other information provided in this catalogue must not be considered legally binding; we reserve the right to modify data without notice.



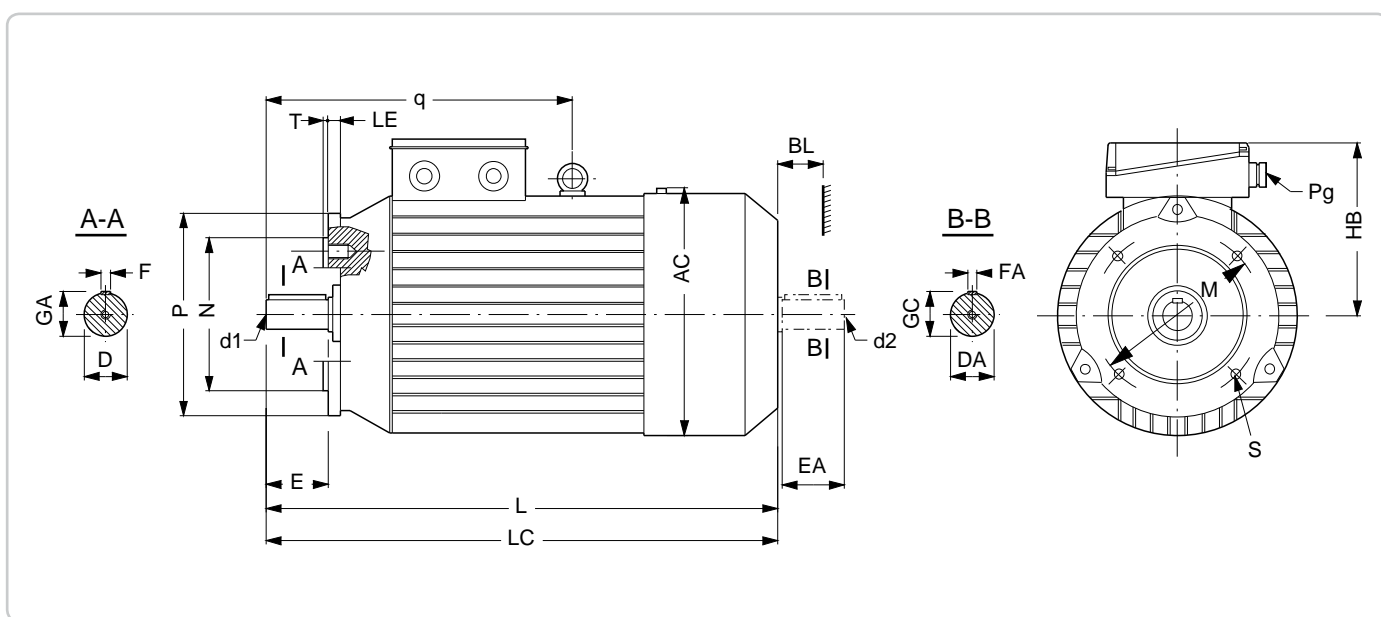
DIMENSIONAL DRAWINGS

THREE-PHASE ASYNCHRONOUS MOTORS WITH SQUIRREL CAGE ROTOR

Completely sealed IP55 Eurovoltage.
 Assembly values comply with IEC - UNEL - MEC recommendations.

VTB - VDV Series

Size of frame: from 90 to 112.
 Special flange motors as per UNEL 13118
 B14, V18, V19 as per DIN 42950
 IM3601, IM3611, IM3631 as per IEC.



Motor SIZE	Assembly values in mm										Dimensional values in mm					
	Shaft				B14 flange						AC	BL min	HB	L	LC	q
	D DA	E EA	F FA	GA GC	M	N	P	S Ø	T	n°						
S													305	360		
90	24j6	50	8h9	27	115	95j6	140	M8	4	3	185	15	130			/
L													330	385		
100	28j6	60	8h9	31	130	110j6	160	M8	4	3,5	206	20	140	376	441	/
112M	28j6	60	8h9	31	130	110j6	160	M8	4	3,5	245	20	164	384	449	257

NOTE

The technical data, dimensional values and all other information provided in this catalogue must not be considered legally binding; we reserve the right to modify data without notice.



DIMENSIONAL DRAWINGS

THREE-PHASE ASYNCHRONOUS MOTORS WITH SQUIRREL CAGE ROTOR

Completely sealed IP55 Eurovoltage.

Assembly values comply with IEC - UNEL - MEC recommendations.

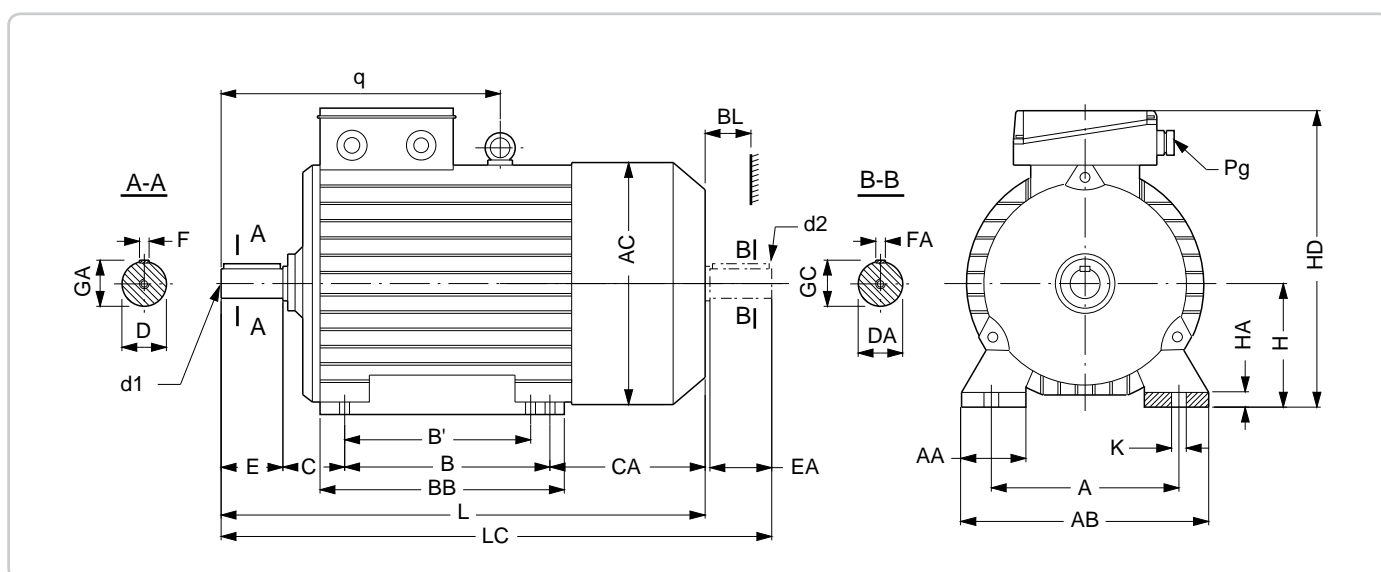
VTB - VDV Series

Size of frame: from 132 to 180.

Support-foot mounted motors as per UNEL 13113

B3, B6, B7, B8, V5, V6 as per DIN 42950

IM1001, IM1051, IM1061, IM1071, IM1011, IM1031 as per IEC.



Motor SIZE	Assembly values in mm							Dimensional values in mm														
	A	B	B'	C	H	K	Pg	Shaft					AA	AB	AC	BB	BL	CA	HA	HD	L	LC
								D DA	E EA	F FA	GA GC	d1 d2				min						
S																160		463	549			
		140														198						
																182						
132	216			89	132	12	M25x1,5	38k6	80	10h9	41	M12	56	278	274	40	160	16	310	501	587	284
		178			-0,5											220						
160		210														256				620	738	
	254																					
				108	160	15	M40x1,5	42k6	110	12h9	45	M16	60	305	323	40	200	20	370			350
L	254			-0,5												300				664	782	
180		241																				
	279			121	180	15	M40x1,5	48	110	14h9	51,5	M16	70	350	360	320	40	243	26	408	705	825
L	279	241		-0,5				k6									205					

NOTE

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DIMENSIONAL DRAWINGS

THREE-PHASE ASYNCHRONOUS MOTORS WITH SQUIRREL CAGE ROTOR

Completely sealed IP55 Eurovoltage.

Assembly values comply with IEC - UNEL - MEC recommendations.

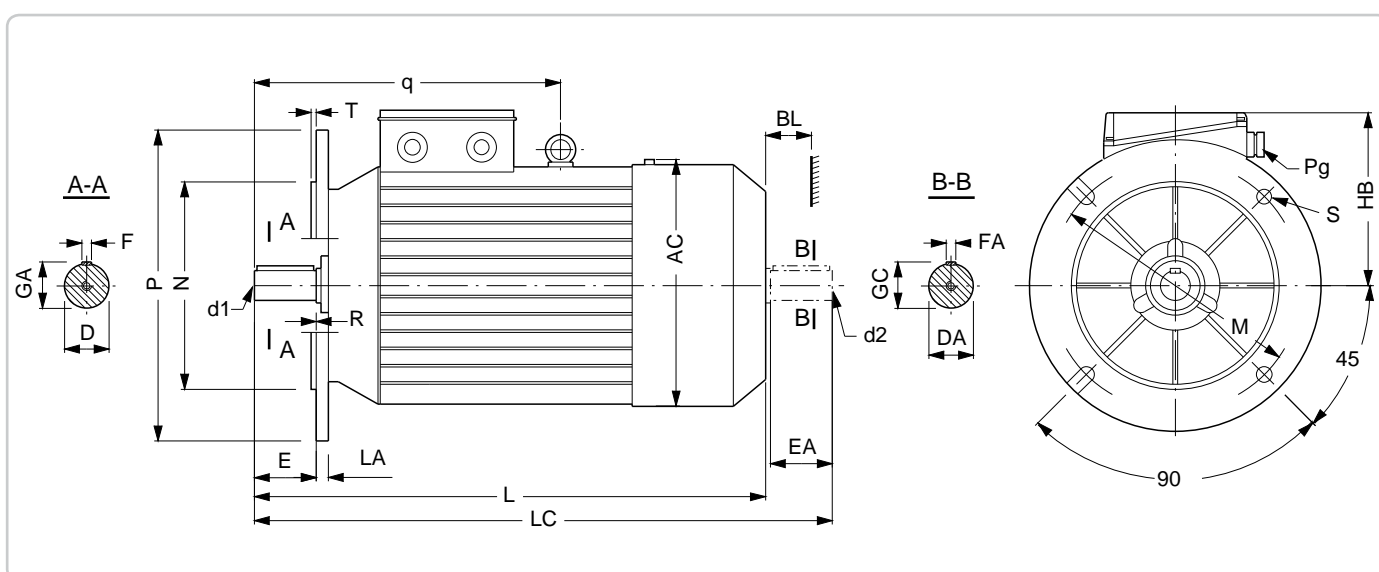
VTB - VDV Series

Size of frame: from 132 to 180.

Flange motors as per UNEL 13117

B5, V1, V3 as per DIN 42950

IM3001, IM3011, IM3031 as per IEC.



Motor SIZE	Assembly values in mm																			Dimensional values in mm							
	Shaft					B5 flange							B14 flange							Pg	AC	BL	HB	L	LC	q	
	D	E	F	GA	d1	M	N	P	LA	S	T	M	N	P	LE	S	T	R									
DA	EA	FA	GC	d2					∅	n°					∅	n°											
S 132 M	38k6	80	10h9	41	M12	265	230j6	300	12	15	4	4	165	130j6	200	M10	4	3	0	21	274	40	178		463	549	284
																								501	587		
M 160 L	42k6	110	12h9	45	M16	300	250j6	350	13	19	4	5							0	M40x1,5	323	40	210		620	738	350
																								664	782		
180M	48k6	110	14h9	51,5	M16	300	250j6	350	13	19	4	5							0	M40x1,5	360	40	228	705	825	358	

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DIMENSIONAL DRAWINGS

THREE-PHASE ASYNCHRONOUS MOTORS WITH SQUIRREL CAGE ROTOR

Completely sealed IP55 Eurovoltage.

Assembly values comply with IEC - UNEL - MEC recommendations.

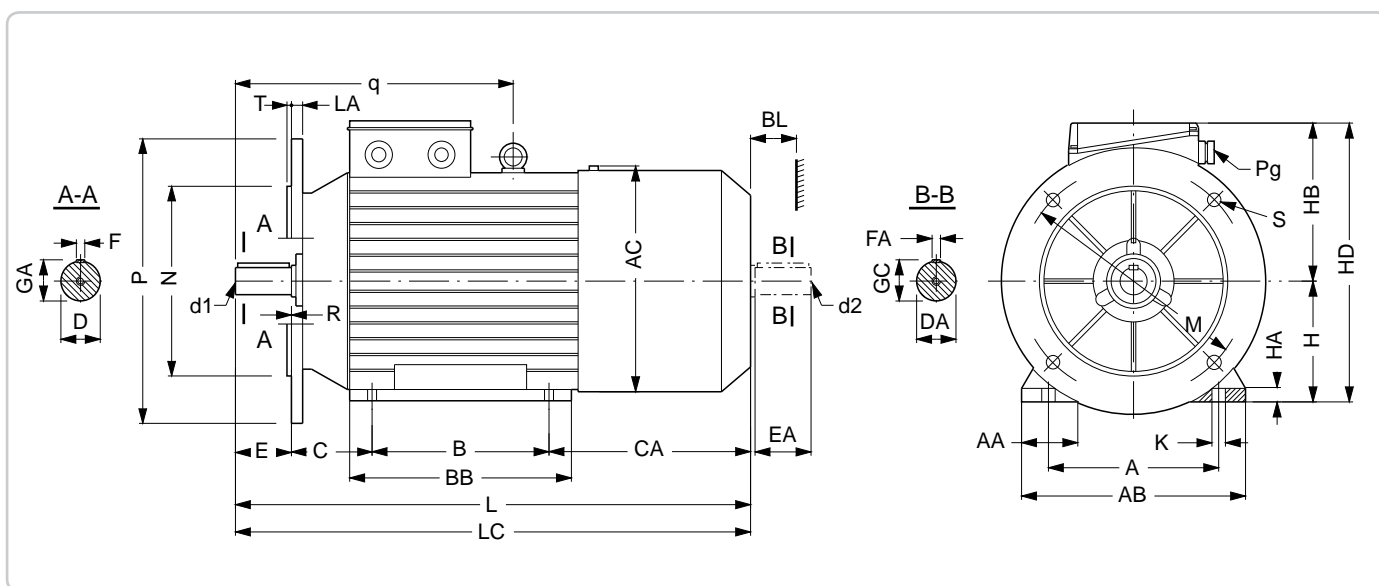
VTB - VDV Series

Size of frame: from 132 to 180.

Flange and support-foot mounted motors as per UNEL 13113/13117

B3/B5, V1/V5, V3/V6 as per DIN 42950

IM2001, IM2011, IM2031 as per IEC.



Motor type	Number of poles	Power KW	Assembly values in mm																Dimensional values in mm																		
			A	B	C	H	K	Shaft				Normal flange								Pg	AA	AB	AC	BB	BL	CA	HA	HD	L	LC	q						
									D	E	F	GA	d1	M	N	P	LA	R	S	T																	
S	2A	5,5																																			
	2B	7,5																																			
	4	5,5		140																					182												
	6	3																																			
132	8	2,2	216		89	132	12		38k6	80	10h9	41	M12	265	230j6	300	12	0	15	4	4	M25x1,5	56	278	274		40	160	16	310	501	587	284				
	4	7,5				-0,5																															
	6A	4		178																					220												
	6B	5,5																																			
M	8	3																																			
	2A	11																																			
	2B	15																																			
	4	11		210																					256							620	738				
160	6	7,5																																			
	8A	4																																			
	8B	5,5	254		108	160	15		42k6	110	12h9	45	M16	300	250j6	350	13	0	19	4	5	M40x1,5	60	305	323		40	200	20	370			350				
	2	18,5				-0,5																															
L	4	15		254																					300								664	782			
	6	11																																			
	8	7,5																																			
	8	11																																			
180	2	22																																			
	4	18,5		241																																	
	4	22	279		121	180	15		48k6	110	14h9	51,5	M16	300	250j6	350	13	0	19	4	5	M40x1,5	70	350	360	320	40		26	408	705	825	358				
	6	15		279		-0,5																															
8	11																																				

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