Brusatori

Synchronous reluctance motors
VR Series

Italian technology since 1953

brusatori.eu

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2. General

2.1 Informations

Brusatori offers the VR series of synchronous reluctance motors with square frames, developed to be connected to frequency converters.
VR motors are 4-pole three-phase asynchronous motors with squirrel cage windings and are available with **IP23, IP54 or IP55** protection ratings with direct and indirect cooling systems.
Four mechanical sizes are available (160 - 180 - 225 - 280) to cover a power range from 12,8 kW to 511 kW.
VA series motors are also available with liquid cooling in 4 mechanical sizes (160 - 180 - 225 - 280) that can satisfy a power range from 17,3 kW to 426 kW.
VA series motors are designed exclusively for connection to inverters and satisfy the IE4 efficiency class.

ATTENTION!
All operations relating to transport, connection, commissioning and regular maintenance must be carried out by qualified responsible personnel, familiar with the appropriate safety regulations, and wearing the necessary protective equipment.
Read the entire manual carefully before carrying out any operation.

This manual is available to the user and is valid for all Brusatori electric motors belonging to the VA series.
Non-compliant behavior can cause serious damage to people or things.
In case of uncertainty, misunderstanding or doubts, stop operations immediately and contact our technical service.
Follow national, local, and plant-specific requirements and standards.

ATTENTION!
The special executions and constructive variants may deviate in some technical details from the motors described in the manual.
In case of difficulty, please contact the manufacturer indicating its code and serial number.

Brusatori Srl reserves the right to make changes to this document without notice.
The constructive variations agreed with the customer take precedence over the contents of the manual.

The manufacturer of the machine in which the motor will be incorporated must include the necessary safety guidelines in the instructions intended for the end user.

2.2 Symbols used

	DANGER ATTENTION WARNING
	ELECTRIC DANGER
	DANGER SUSPENDED LOADS
	DANGER HOT SURFACE

2.3 Intended use

The electric motors in this manual comply with the LOW VOLTAGE DIRECTIVE 2014/35/EU, and are intended for use in a standard industrial environments.
They also comply with Directive 2011/65/EU (RoHS Directive) and EMC Directive 2014/30/EU.
Each motor is built to be incorporated into a machine or to be assembled with other machinery to form a machine covered by the MACHINERY DIRECTIVE 2006/42/EC.
If used for other purposes, it is necessary to take the necessary precautions to make the motor safe in the environment in which they are intended.

ATTENTION!
The motor cannot be put into service before the machinery in which it is incorporated is declared compliant with the MACHINERY DIRECTIVE 2006/42/CE.
The manufacturer of the machinery must also verify that the machine complies with the EMC DIRECTIVE 2014/30/EU.

This document is intended for the machine manufacturer, not for the end user.
The manufacturer of the machine in which the motor will be incorporated is responsible for providing the installation, use and maintenance manual to the end user.

2.4 European directives

LOW VOLTAGE DIRECTIVE (LVD) 2014/35/EU	Compliant
HAZARDOUS SUBSTANCES DIRECTIVE 2011/65/EU (RoHS) and subsequent Delegated Directives	Compliant
MACHINERY DIRECTIVE 2006/42/CE	Responsibility of the machine manufacturer
EMC DIRECTIVE 2014/30/UE	Compliant (if electronic components are present) Responsibility of the machine manufacturer

2.5 Harmonized standards

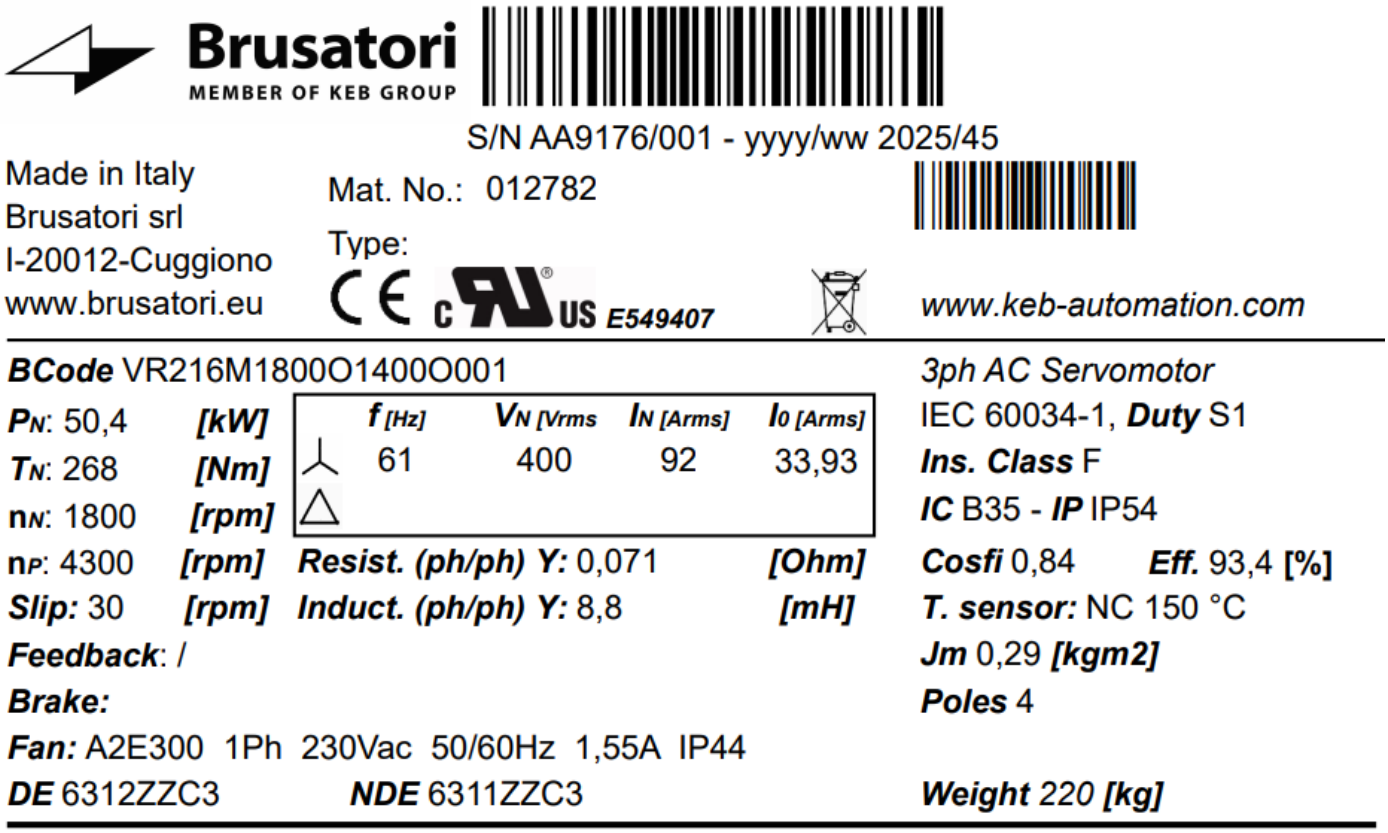
CEI EN 60034-1: 2011	Part 1: Nominal and operating characteristics
CEI EN 60034-2:	Part 2: Methods for losses determining
CEI EN 60034-5: 2021	Part 5: Degrees of protection of rotating machinery enclosures (integral design) (IP Code)
CEI EN 60034-6: 1997	Part 6: Cooling Methods (IC Code)
CEI EN 60034-7: 1997 / A1:2001	Part 7: Classification of construction forms and types of installation as well as location of terminal boxes (IM code)
CEI EN 60034-8: 2008 / A1:2015	Part 8: Marking of terminals and direction of rotation
CEI EN 60034-9	Part 9: Noise limits
CEI EN 60034-14	Part 14: Mechanical vibrations of rotating machines
CEI EN 60034-18 41	Part 18: Electrical insulation systems
CEI EN 60034-25	Part 25: Inverter power supply
CEI EN 60034-30-1/2	Part 30: Energy efficiency classes
UNI 9321	Drive shaft ends
ISO 22081	General tolerances
UNI ISO 8015	Technical drawings and tolerances
CEI EN 60204-1: 2018	Machinery safety - Electrical equipment of machines Part 1: General rules

2.6 Available sizes

Mechanical size		Motor length				
VR	160	S	M	L	P	-
	180	S	M	L	P	-
	225	S	M	L	P	X
	280	S	M	L	P	-

2.7 Identification plate

Each motor is equipped with its own unique identification plate.
The plate is affixed to the motor in the form of an adhesive label, and indicates the nominal values and operating conditions. Before commissioning, check that the data corresponds to the expected values.
The plate must always be visible on the motor and must NOT be removed.



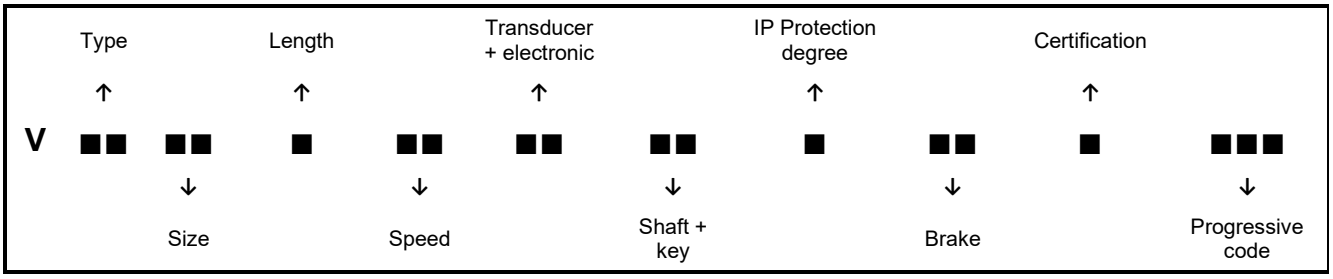
Note:
The appearance of the plates shown in this manual may differ from the real one.

Plate legend

Mat. No	Customer article code
Type	Secondary customer article code
BCode	Brusatori motor code
S/N	Motor serial number
yyyy/ww	Year / week of production
P_N	Nominal power
f	Nominal frequency
V_N	Nominal voltage
I_N	Current at nominal speed
I_0	Stall current
T_N	Coppia alla velocità nominale
nn	Nominal speed
np	Speed at costant power
Slip	Scroll
Resist	Phase-to-phase resistance
Induct.	Phase-to-phase inductance
IEC	Reference standard
Duty	Type of service
Ins. class	Winding insulation class
IC	Cooling index
IM	Construction form
IP	Protection degree
Cosfi	Power factor
Eff. %	Efficiency
T. sensor	Temperature sensor
Jm	Rotor moment of inertia
Poles	Number of poles
Feedback	Transducer type + transducer data
Brake	Type of brake (only if present)
Fan	Fan features
DE	Drive end side bearing
NDE	Non Drive End side bearing
Weight	Motor weight

2.8 Order key

The configuration of a VR series motor is described using the following coding system:



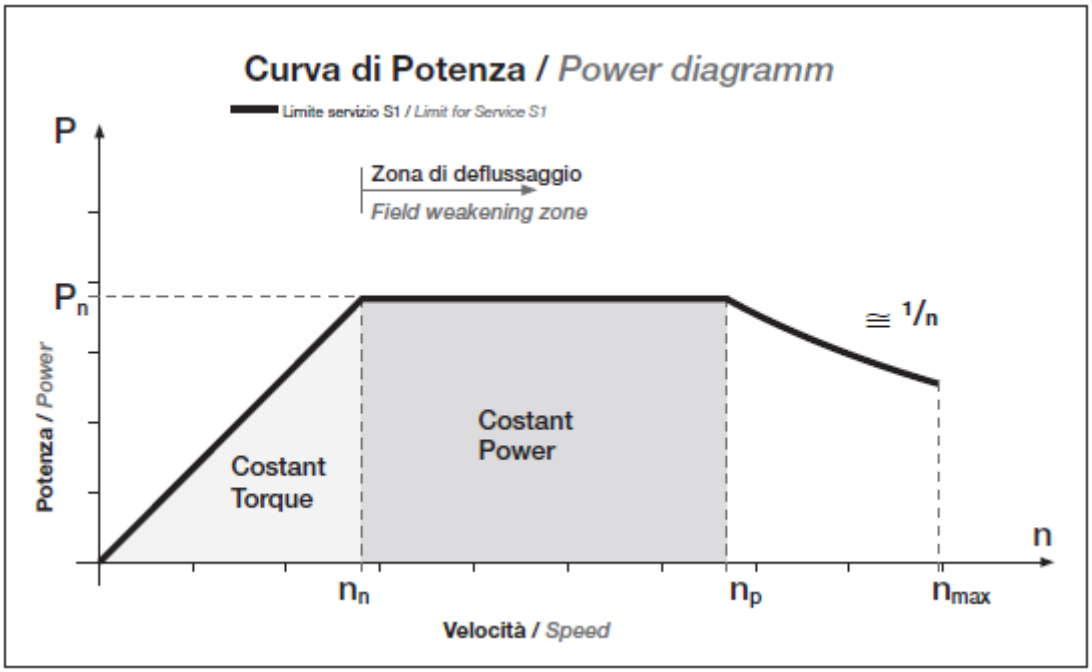
Type	V■■□□□□□□□□□□□□□□□□
R1 R2 R3	Motor VR direct cooling (open) Motor VR indirect cooling (close) Motor VR liquid cooling
Size	V□□■■□□□□□□□□□□□□□□
16 18 22 28	Size 160 Size 180 Size 225 Size 280
Length	V□□□□■□□□□□□□□□□□□□
A S M L P X	Length A Length S Length M Length L Length P Length X
Speed	V□□□□□■■□□□□□□□□□□□
5X 10 12 15 18 22 26	580 rpm 1000 rpm 1200 rpm 1500 rpm 1800 rpm 2200 rpm 2600 rpm
Transducer + electronic	V□□□□□□□■■□□□□□□□□□
00 01 2W U1 V1 V2 V3 V4 V5 V6	No transducer, no predisposition No transducer, predisposition encoder Sick VFS60 Resolver TS2640N1901E64 Encoder Sick VFS60 SinCos Encoder Sick VFS60 1024 TTL Encoder Sick VFS60 1024 HTL Encoder Sick VFS60 2048 TTL Encoder Sick VFS60 2048 HTL Encoder Sick VFS60 4096 TTL Encoder Sick VFS60 4096 HTL

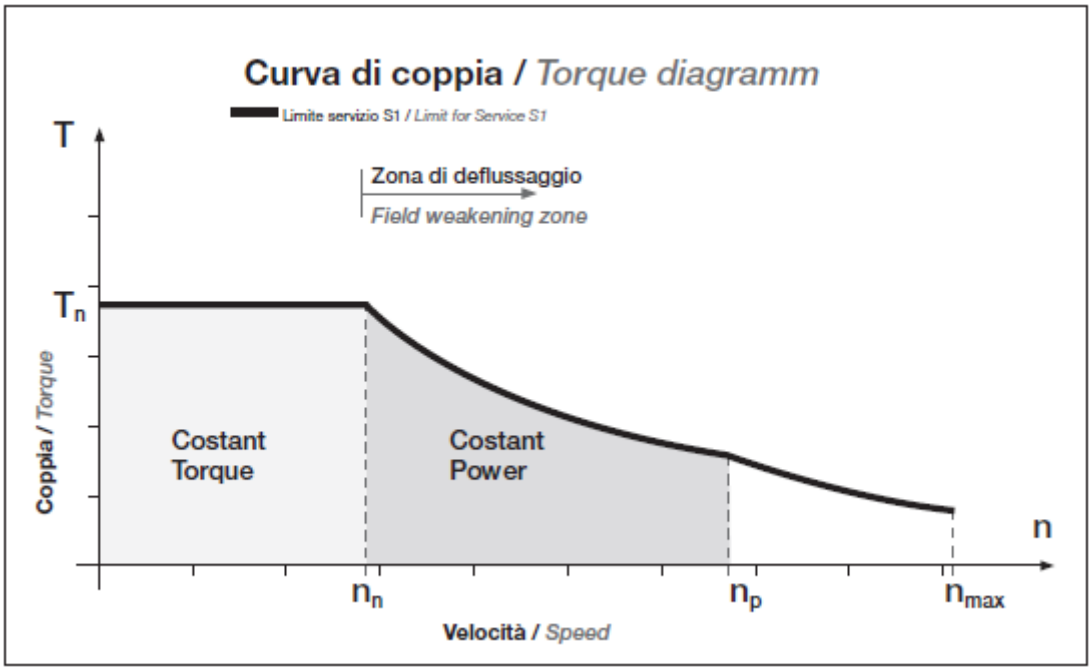
Shaft + Key		V□□□□□□□□□■■□□□□□□□			
	N1	48x110	with key	Optional	VR 160 S-M
	N2	48x110	without key	Optional	VR 160 S-M
	O1	55x110	with key	Standard	VR 160
	O2	55x110	without key	Optional	VR 160
	P1	60x140	with key	Standard	VR 180 S
	P2	60x140	without key	Optional	VR 180 S
	Q1	65x140	with key	Standard	VR 180 M-L-P
	Q2	65x140	without key	Optional	VR 180 M-L-P
	R1	75x140	with key	Standard	VR 225 S-M-L
	R2	75x140	without key	Optional	VR 225 S-M-L
	S1	85x170	with key	Standard	VR 225 P-X
	S2	85x170	without key	Optional	VR 225 P-X
	T1	100x210	with key	Standard	VR 280
	T2	100x210	without key	Optional	VR 280
	U1	120x210	with key		
	U2	120x210	without key		
	V1	70x140	with key		
	V2	70x140	without key		
IP proection degree		V□□□□□□□□□□■□□□□□□			
	0	IP 00			
	3	IP 23			
	4	IP 54			
	5	IP 55			
	6	IP 65			
Brake		V□□□□□□□□□□□■■□□□□			
	00	No brake			
	xx	Brake type Rif. capitolo 3.9 Freno di stazionamento			
Certification		V□□□□□□□□□□□□□■□□□			
	C	CE		Standard	
Progressive code		V□□□□□□□□□□□□□□■■■			

Last 3 digits represent a progressive code, that defines other variants of the motor, such as:

- Connections
- Flange dimensions
- Connection box position
- Cable outlet direction
- Thermal protection
- Ventilation
- Bearings type
- Inertia
- Painting
- Other customizations…

2.9 Torque / Power Curve





3. Technical data

3.1 Standard features

Winding	Reinforced three-phase for inverter application
Insulation	Class F according to CEI EN 60034-1
Overtemperature	Class F according to CEI EN 60034-1
Sizing	Class F according to CEI EN 60034-1
Type of service	S1 - Continuous
Protection degree (CEI EN 60034-5)	IP23 according to CEI EN 60034-5 IP54 according to CEI EN 60034-5
Room temperature	From -20 to +40 °C
Environmental conditions	Maximum altitude: 1000m above sea level Humidity: ≤90% (non-condensing) Transport / storage temperature: -20 to +70 °C
Color	Black RAL 9005
Cooling (CEI EN 60034-6)	VR160-225 IC 416 One-phase fan axial mounting for IP54 VR280 IC 416 Three-phase fan radial mounting for IP54 IC 06 Three-phase fan radial mounting with filter per IP23 IC 9W7 Liquid cooling
Ventilation	Direct starting of the fan when the power is switched on
Vibration degree (CEI EN 60034-14)	Grade A Half key balancing
Thermal protection	Thermal protector with normally closed contact 150°C (Tensione max 250 Vac, corrente max 6 Aac)
Construction form (CEI EN 60034-7)	B35 IM 2001 VA 160 - 280** B3 IM 1001 VA 355**
Bearings	Ball bearings lubricated for life
Position sensor	Encoder predisposition (Shaft D.12 mm i isolier peek 12 - 14mm)
Service position	See paragraph 3.6
Power connection	Three-phase terminal block in terminal box
Signal connection	M23 Connector
Terminal box position	Up

* Operations at higher temperatures or altitudes are possible with derating (see paragraph 3.10).
** See paragraph 3.6 for the recommended mounting positions

ATTENTION!
The motor may only be used in the applications for which it was designed.
The rated values and operating conditions are indicated on the motor plate, check before putting into service that the data correspond to those foreseen.

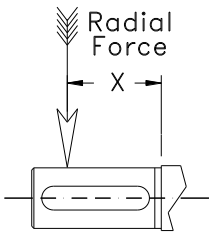
Motor size		VR160	VR180	VR225	VR280
Stator	Material	Magnetic lamination			
	Stator winding	Copper winding with special insulation for use with inverters			
Rear shield	Material	Alluminium + steel compass	Cast iron		
Ball bearings (standard)	D-End (spheres)	6312 ZZ C3	6314 ZZ C3	6318 ZZ C3	6222 C3
	ND-End (spheres)	6311 ZZ C3	6214 ZZ C3	6315 C3	6222 C3
	Lubrication	Ingrassati a vita			
	Axial locking	-	D-End side		
Rollers bearings (optional)	D-End (roller)	NU 312 EC	NU 314 C3	NU 318	NU 222 EC
	ND-End (roller)	-	-	-	-
	Lubrication	Periodically lubricated by grease nipple			
	Axial locking	ND-End side			
Terminal box		Alluminium	Steel		
Flange		Alluminium + steel compass	Cast iron		
Ventilation carter		Galvanized steel			
Rotor		Magnetic lamination			

3.2 Standard transducer (encoder)

Sizes it is available on	160 - 180 - 225 - 280
Supply voltage	5 - 32 V
Output circuit	HTL / TTL
Resolution	65.536 imp./rot.
Maximum current with load	Max 30 mA
Maximum frequency of use	820 kHz
Maximum rotation speed	9000 rpm
Protection	IP65 acc. IEC 60529
Working temperature	-30 +100 °C
Maximum relative humidity	90%
Connector	M23

3.3 Permissible radial loads

The tables give the allowable radial loads in Newtons, assuming zero axial force.
Radial force is applied to the center of the shaft for a bearing life of **20000** hours.
The motors are mounted in IM B3 construction in a horizontal position.
Warning: avoid axial shocks on the shaft during assembly.



3.3.1 Ball bearings VR160

Motor	***VR160***	***Maximum radial load on the shaft:***				***9800 N***
Quote X *(mm)*	***Velocità rotore***					
	580 rpm	***1000 rpm***	***1500 rpm***	***2200 rpm***	***3750 rpm***	***5300 rpm***
0	*6700*	*5600*	*4700*	*3800*	*3100*	*2400*
20	*6600*	*5400*	*4600*	*3700*	*3050*	*2350*
30	*6500*	*5300*	*4500*	*3600*	*3000*	*2300*
40	*6300*	*5200*	*4400*	*3500*	*2950*	*2275*
50	*6200*	*5100*	*4300*	*3400*	*2900*	*2225*
60	*6100*	*5000*	*4200*	*3350*	*2850*	*2200*
70	*6000*	*4900*	*4100*	*3300*	*2800*	*2175*
80	*5800*	*4800*	*4050*	*3200*	*2700*	*2150*
90	*5700*	*4700*	*4000*	*3100*	*2600*	*2125*
100	*5500*	*4600*	*3900*	*3000*	*2500*	*2000*
110	*5400*	*4400*	*3800*	*2950*	*2400*	*1950*

3.3.2 Rollers bearings VR160

Motor	***VR160***	***Maximum radial load on the shaft:***				***9800 N***
Quote X *(mm)*	***Velocità rotore***					
	580 rpm	***1000 rpm***	***1500 rpm***	***2200 rpm***	***3500 rpm***	***4800 rpm***
0	*11000*	*9200*	*7600*	*6000*	*5000*	*4000*
20	*10800*	*9000*	*7500*	*5800*	*4900*	*3950*
30	*10600*	*8800*	*7400*	*5700*	*4800*	*3900*
40	*10400*	*8600*	*7300*	*5600*	*4700*	*3850*
50	*10200*	*8400*	*7200*	*5500*	*4600*	*3800*
60	*10000*	*8200*	*7000*	*5400*	*4500*	*3750*
70	*9800*	*8000*	*6900*	*5300*	*4400*	*3700*
80	*8800*	*7800*	*6600*	*5200*	*4300*	*3600*
90	*7600*	*7600*	*6400*	*5100*	*4200*	*3500*
100	*6700*	*6700*	*6200*	*5000*	*4100*	*3400*
110	*5800*	*5800*	*5800*	*4900*	*4000*	*3300*

3.3.3 Ball bearings VR180

Motor	VR180	Maximum radial load on the shaft:				N
Quote X (mm)	Rotor speed					
	580 rpm	1000 rpm	1500 rpm	1800 rpm	3050 rpm	4300 rpm
0	10200	8300	7400	6200	4600	4000
20	10100	8200	7200	6100	4500	3900
30	10000	8100	7000	6000	4400	3800
50	9800	8000	6800	5900	4300	3750
60	9600	7900	6600	5800	4200	3700
70	9400	7800	6500	5700	4100	3650
90	9200	7600	6400	5600	4050	3600
100	9000	7400	6300	5400	4000	3500
120	8600	7200	6100	5200	3950	3400
130	8400	7000	5900	5000	3850	3300
140	8200	6800	5800	4800	3700	3200

3.3.4 Rollers bearings VR180

Motor	VR180	Maximum radial load on the shaft:				N
Quote X (mm)	Rotor speed					
	580 rpm	1000 rpm	1500 rpm	1800 rpm	2800 rpm	3800 rpm
0	15600	12600	10800	9300	6800	5900
20	15400	12300	10600	9100	6650	5800
30	15200	12000	10400	8800	6500	5700
50	14800	11800	10200	8600	6400	5550
60	14400	11600	10000	8450	6300	5400
70	14000	11400	9800	8350	6200	5250
90	13600	11200	9600	8200	6100	5100
100	12200	10800	9400	8000	6000	5000
120	11000	10500	9200	7750	5850	4900
130	9400	9400	8800	7500	5700	4800
140	8000	8000	8000	7300	5600	4700

3.3.5 Ball bearings VR225

Motor	VR225	Maximum radial load on the shaft:				N
Quote X (mm)	Rotor speed					
	580 rpm	1000 rpm	1500 rpm	1800 rpm	2600 rpm	3400 rpm
0	11000	8800	7600	6600	5000	4200
20	10800	8600	7400	6500	4900	4150
40	10600	8400	7300	6400	4800	4100
60	10400	8300	7200	6250	4700	4075
70	10200	8200	7100	6100	4600	4050
90	10000	8100	7000	5900	4500	4000
110	9750	7950	6800	5700	4400	3950
120	9500	7800	6600	5500	4300	3875
140	9250	7600	6400	5400	4200	3800
160	9000	7400	6200	5300	4100	3750
170	8600	7200	6050	5200	4000	3700

3.3.6 Rollers bearings VR225

Motor	VR225	Maximum radial load on the shaft:				N
Quote X (mm)	Rotor speed					
	580 rpm	1000 rpm	1500 rpm	1800 rpm	2300 rpm	2800 rpm
0	18800	15300	13300	11500	8200	7750
20	18600	15000	13000	11200	8100	7600
40	18300	14800	12750	10800	8050	7400
60	17700	14500	12500	10600	8000	7200
70	17400	14300	12250	10400	7900	7000
90	17000	13800	12000	10200	7800	6900
110	16600	13600	11700	10000	7600	6800
120	15200	13300	11500	9750	7350	6600
140	13200	13000	11200	9500	7200	6400
160	11500	11500	10800	9250	7000	6200
170	9800	9800	9800	9000	6800	6000

3.3.7 Ball bearings VR280

Motor	VR280	Maximum radial load on the shaft:				N
Quote X (mm)	Rotor speed					
	580 rpm	1000 rpm	1500 rpm	1800 rpm	2400 rpm	3000 rpm
0	12000	9700	8200	6700	5500	4800
30	11750	9500	8100	6600	5400	4750
50	11500	9400	8000	6500	5300	4700
70	11250	9200	7800	6300	5200	4600
90	11000	9000	7600	6200	5000	4500
110	10750	8800	7400	6000	4850	4400
130	10500	8600	7250	5950	4750	4300
150	10250	8400	7150	5800	4600	4200
170	10100	8200	7000	5600	4500	4100
190	9800	8000	6750	5500	4400	4000
210	9500	7800	6500	5350	4300	3950

3.3.8 Rollers bearings VR280

Motor	VR280	Maximum radial load on the shaft:				N
Quote X (mm)	Rotor speed					
	580 rpm	1000 rpm	1500 rpm	1800 rpm	2300 rpm	2800 rpm
0	23500	18750	16500	13500	10500	9500
30	23150	18500	16100	13150	10350	9350
50	22850	18250	15800	12850	10200	9200
70	22500	18000	15500	12500	10000	9000
90	22250	17750	15250	12200	9850	8850
110	22000	17500	15000	11900	9700	8700
130	21500	17150	14500	11600	9500	8500
150	19000	16850	14200	11350	9350	8350
170	16500	16500	13850	11100	9100	8100
190	14500	14500	13500	10800	8800	7800
210	12500	12500	12500	10500	8500	7500

3.4 Optional Features

Size	160	180	225	280
Variants and accessories				
Air filter (for motors with radial fan)	S	S	S	S
Temperature probes PT1000, PT100, PTC, KTY84/130	x	x	x	x
Others temperature probes	R	R	R	R
Special shaft (diameter, without keyway)	x	x	x	x
Drive shaft side oil seal	x	x	x	x
Vibration class B	x	x	x	x
Drive shaft side roller bearing (for belt pull)	x	x	x	x
Insulated bearing opposite drive shaft side	x	x	x	x
Motor Brake	x	x	x	x
Special paint (RAL colours)	R	R	R	R
Reinforced insulation	S	S	S	S
Special anti-corrosion protection	x	x	x	x
Terminal box position on the right	x	x	x	x
Terminal box position on the left	x	x	x	x
Motors with UL insulation system (OBJY2/8)	-	-	-	-
Special realizations on customer specifications	R	R	R	R
Encoder				
Sinusoidal encoder 1Vpp – 1024 pul./turn	x	x	x	x
Absolute single-turn encoder	x	x	x	x
Multiturn absolute encoder	x	x	x	x
Resolver 2 poles-7Vrms - rapp. Transformation 0.5	x*	x*	x*	x*

S: standard x: possible R: on request

* Not available for motors with brake
** Recommended for motors with power higher than 75 kW

3.5 Construction forms

Motor size	160	180	225	280
Standard	IM B35	IM B35	IM B35	IM B35

3.6 Recommended mounting positions

		VR160	VR180	VR225	VR280
Mounting position	**Coupling (shaft coupling / pulley + belt)***	S - M - L - P - X			
B35	SHAFT COUPLING	ALL	ALL	ALL	ALL
	PULLEY + BELT	ALL	ALL	ALL	ALL
B3	SHAFT COUPLING	ALL	ALL	ALL	ALL
	PULLEY + BELT	ALL	ALL	ALL	ALL
B5	SHAFT COUPLING	S - M	NONE	NONE	NONE
	PULLEY + BELT	S - M	NONE	NONE	NONE
B5 + SUPPORT	SHAFT COUPLING	ALL	ALL	ALL	ALL
	PULLEY + BELT	ALL	ALL	ALL	ALL
V36	SHAFT COUPLING	ALL*	ALL*	ALL*	ALL*
	PULLEY + BELT	ALL*	ALL*	ALL*	ALL*
V15	SHAFT COUPLING	ALL	ALL	ALL	ALL
	PULLEY + BELT	ALL	ALL	ALL	ALL
V6	SHAFT COUPLING	ALL*	ALL*	ALL*	ALL*
	PULLEY + BELT	ALL*	ALL*	ALL*	ALL*
V5	SHAFT COUPLING	ALL	ALL	ALL	ALL
	PULLEY + BELT	ALL	ALL	ALL	ALL
V3	SHAFT COUPLING	S - M*	S - M*	S - M*	S - M*
	PULLEY + BELT	S - M*	S - M*	S - M*	S - M*
V1	SHAFT COUPLING	ALL	ALL	ALL	ALL
	PULLEY + BELT	ALL	ALL	ALL	ALL

* vertical mounting must be indicated in the order

3.7 Ventilation

VR160, 180 e 225 motors with IP54 protection are equipped with an electric fan axial mounted on the back of the motor.

VR280 motors with IP54 protection and VR160, 180, 225 e 280 motor with IP23 protection are equipped with a centrifugal electric fan radial mounted on the back of the motor.

3.7.1 Standard single-phase axial fan data for sizes 160, 180 e 225 IP54:

Motor size	VR160	VR180	VR225	Unit
Certification	CE / UL	CE / UL	CE / UL	-
Motor protection	IP54	IP54	IP54	IP
Number of phase	1	1	1	N
Supply voltage	220 ÷ 230	220 ÷ 230	220 ÷ 230	V
Frequency	50 ÷ 60**	50 ÷ 60**	50 ÷ 60**	Hz
Power	350	660	750	W
Current consumption	1,55	2,9	3,3	A
Minimum distance from the back for air inlet / outlet	80	120	120	mm
Minimum distance from the side for air inlet / outlet	60	80	100	mm
Flow	3420	3420	5160	m^3/h
Prevalence	160	850	700	Pa
Thermal overload protection	Thermal	Thermal	Thermal	-
Fan protection degree	IP44	IP55	IP55	IP
Capacitor	8	-	-	µF

** for 60Hz power supply, a reduction bushing for the section inlet is required.

3.7.2 Three phase axial fan data (optional) for the size 160, 180 e 225 IP54:

Taglia motore	VR160	VR180	VR225	Unità
Certification	CE / UL	CE / UL	CE / UL	-
Motor protection	IP54	IP54	IP54	IP
Number of phase	3	3	3	N
Supply voltage	400	400	400	V
Frequency	50 ÷ 60**	50 ÷ 60**	50 ÷ 60**	Hz
Power	715	1180	1100	W
Current consumption	1,1	1,8	1,7	A
Minimum distance from the back for air inlet / outlet	80	120	120	mm
Minimum distance from the side for air inlet / outlet	60	80	100	mm
Flow	1395	2405	3600	m^3/h
Prevalence	950	1042	663	Pa
Thermal overload protection	Thermal	Thermal	Thermal	-
Fan protection degree	IP55	IP55	IP55	IP
Capacitor	-	-	-	µF

** for 60Hz power supply, a reduction bushing for the section inlet is required.

3.7.3 Radial fan data standard for all IP23 motors and for VR280 IP54

Motor size	VR180	VR225	VR280	Unità
Certification	CE / UL	CE / UL	CE / UL	-
Motor protection	IP23 / IP54	IP23 / IP54	IP23 / IP54	IP
Number of phase	3	3	3	N
Supply voltage	400 ÷ 460	400 ÷ 460	400 ÷ 460	V
Frequency	50 ÷ 60**	50 ÷ 60**	50 ÷ 60**	Hz
Power	1500	2200	4000	W
Current consumption	3,15	4,5	7,9	A
Minimum distance from the back for air inlet / outlet	140	140	170	mm
Minimum distance from the side for air inlet / outlet	80	100	120	mm
Flow	2100	2880	4500	m^3/h
Prevalence	1600	1800	2200	Pa
Thermal overload protection	Impedence	Thermal	Thermal	-
Fan protection degree	IP23	IP23	IP23	IP
Capacitor	-	-	-	µF

** for 60Hz power supply, a reduction bushing for the section inlet is required.

3.8 Liquid cooling

Liquid cooling is available for VR series motors; this technology allows for increased performance while reducing the overall size of the motor.

Liquid-cooled motors are provided with a steel cooling circuit placed inside the housing of the motor.

The motor coolant pass through the circuit.

Always observe the coolant flow rate and pressure values given in section 7 and on the motor nameplate.

The recommended coolant temperature depends on the ambient temperature and relative humidity; refer to Chapter 3.8.4 to identify the correct one.

Excessively high coolant temperatures will cause a drop in performance (refer to section 3.8.3 regarding power derating as a function of coolant temperature).

Too low coolant temperatures can cause condensation inside the motor, the correct coolant temperature should be identified as can be seen in the graph in section 3.8.4.

3.8.1 Type of coolant

The type of coolant is very important for the life of the motor; a liquid rich of impurities can impair the operation of the entire system. The application of a filter at the inlet of the circuit is recommended to keep the cooling channels clean.

Plain water with the addition of anti-rust, anti-corrosion and anti-algae additives should be used.

The coolant should have the following characteristics:

Conditions	Unit	Value
Maximum allowable pressure (non-continuous)	Bar	5
Coolant temperature	°C	18 – 22
Ph Value (at 20°C)	Ph	6 – 9
Water hardness	Mmol/l	1.43 – 2.5
Chloridium – Cl	mg/l	< 200
Sulfate – SO_4^{2-}	mg/l	< 200
Oil	mg/l	< 10
Size of particles allowed for foreign bodies*	mm	< 0.1*

* value to be taken into consideration when choosing the filter to be applied on the circuit

When installing the motor in environments where the temperature may drop below 5°C, an antifreeze liquid must be added to prevent freezing of the coolant and consequently damage to the circuit.

3.8.2 Cooling system

The cooling system should be closed-loop equipped with a pump for recirculation and temperature and pressure control, an industrial chiller should be used.

WARNING!

Do not use an open-loop cooling system!
This is in order to protect the environment and avoid obstruction and/or serious damage to the cooling circuit and consequently to the motor.

WARNING!

Coolant should be circulated before starting the motor and should continue to circulate as long as the motor is running. If problems occur related to the operation of the cooling system, stop motor operation immediately.

WARNING!

After the motor is turned off, it is a good idea to leave the cooling system switched on for a few minutes so that motors temperatures can drop and to prevent high-pressure vapors from forming in the circuit.

It is recommended to use an automatic system that stops motor operation in the absence of coolant to avoid motor damage.

WARNING!

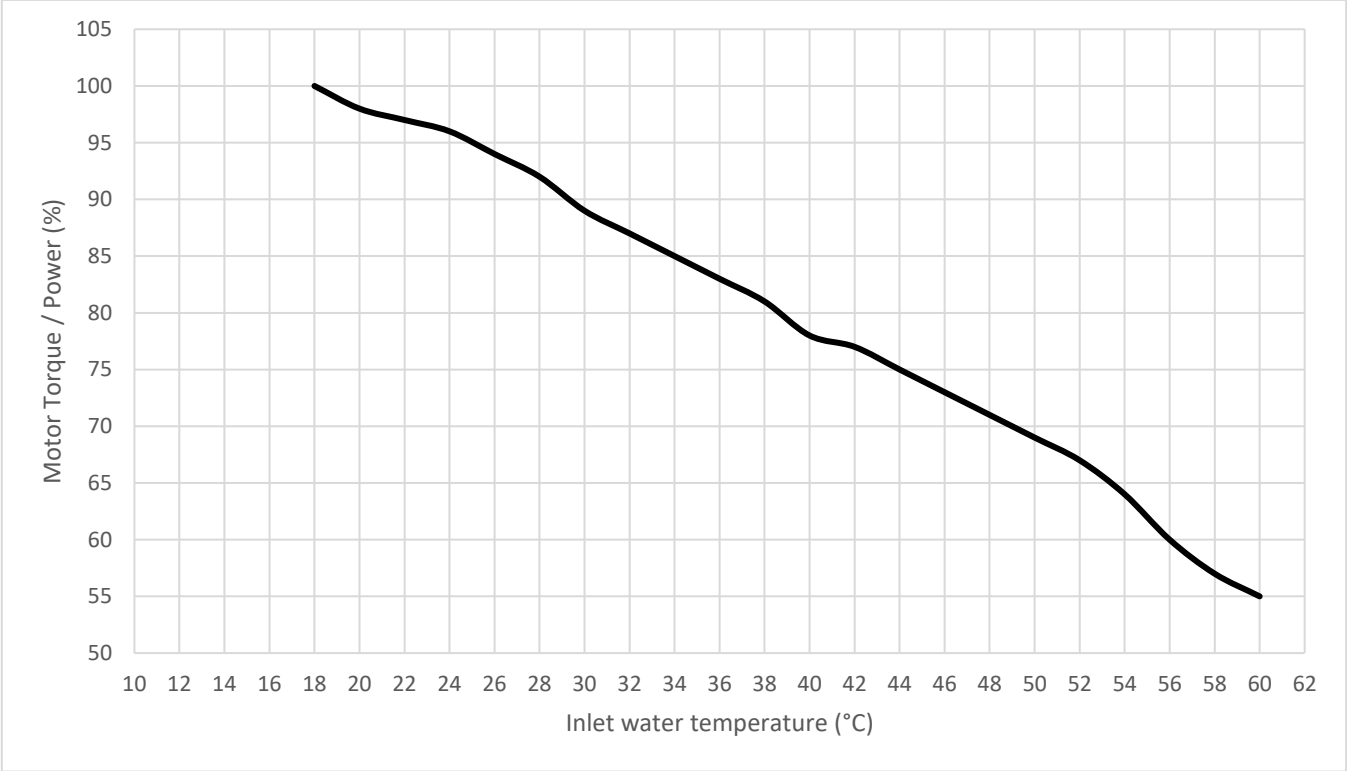
Never exceed the maximum coolant pressure indicated on the nameplate or in Section 5.4.9, provide a system to monitor it to avoid damage to the motor or people in the area around the motor.

WARNING!

It is recommended to apply a temperature sensor that monitors the coolant temperature and intervenes when it exceeds the maximum temperature.

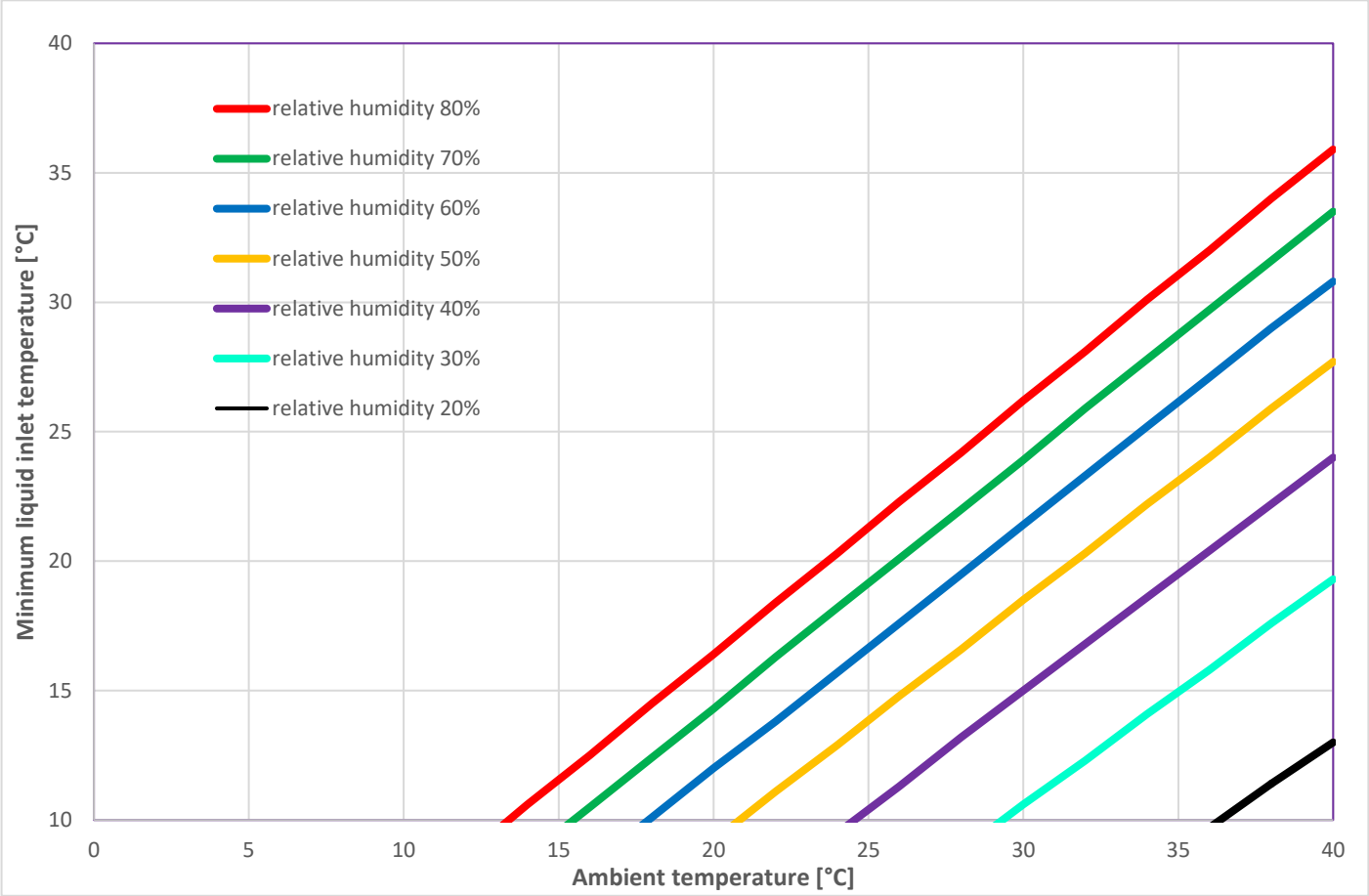
3.8.3 Derating of torques as a function of liquid temperature

Motors performance drops if the coolant inlet temperature increases, this after 20° C, proportionally as shown in the graph below:



3.8.4 Temperatura del liquido di raffreddamento in funzione della temperatura ambiente e dell'umidità relativa

Per selezionare la temperatura del liquido di raffreddamento in relazione alla temperatura ambiente e all'umidità, è necessario osservare il seguente grafico:



First we need to identify the value of the ambient temperature (X-axis), then we need to move vertically upward and trace the colored sloping line that identifies the relative humidity, consequently we will find on the Y-axis the minimum coolant temperature to be used (follow the example shown with the yellow line).

3.9 Motor holding brake

Upon request, it is possible to mount a holding brake on the rear shield of the motor.

The brake is of the electromechanical type with springs with braking action without voltage.

The brake must be switched on and switched off with the rotor stopped.

Brake data:

Motor size	VR160	VR180	VR225	VR280	Unit
Order key code					-
Brake manufacturer	KEB	KEB	KEB	KEB	-
Brake series	Combistop 38 093811N	Combistop 38 103811N	Combistop 38 103811N	Combistop 38 113811N	-
Brake type	Spring brake	Spring brake	Spring brake	Spring brake	-
Static braking torque	330	665	1335	1335	Nm
Supply voltage +/- 5%	24	24	24	24	Vdc
Frequency	-	-	-	-	Hz
Absorbed power	80	130	130	180	W
Maximum intervention speed	1500	1500	1500	1500	rpm
Max. work with 1 intervention/hour					kJ
Brake inertia	73,8	205,4	1807	1807	Kgcm²
Additional mass	26	39	80	80	Kg

1) When the brake has not been run in, the value of the braking torque can deviate by +/- 20% from the nominal value
2) Others supply voltages are available upon request

3.10 Vibration and balance class

VR motors are built to meet vibration class A and are half key balanced.

The vibration level according to class B is available on request.

The vibration level is expressed in displacement and speed, using the suspension method and with no load applied.

Vibration degree	Shaft height (mm)	
	160 < H ≤ 355	
	Shift	Speed
	µm	mm/s
A	45	2,8
B	18	1,1

3.11 Motor derating in function of temperature / altitude

The motors are designed to operate at temperatures between -20°C and 40°C and at an altitude of 1000m above sea level.

If use takes place at altitudes or at higher temperatures, the motor must have a derating according to the indications given in the table below:

	Temperature (°C)			
Altitude (m)	30	40	50	60
1000	1	1	0,90	0,80
2000	1	0,95	0,86	0,75
3000		0,84	0,76	0,64
4000		0,73	0,65	0,50

3.12 Holes for cable entry in the terminal box

VR motors are supplied with the following holes on the terminal box (power / auxiliary)

Motor	Holes dimension
VR 160	1 x Ø51 + 1 x Ø41 + 1 x Ø21
VR 180	6 x Ø65 + 1 x Ø22
VR 225	6 x Ø65 + 1 x Ø22
VR 280	6 x Ø65

4. Electrical data IP54 version

4.1 Motor features VR 160 (S-M-L-P) IP54 / IP55 with axial fan

Protection degree	IP 54 / IP55**		Ventilation	IC 416	
Rotor inerzia J (kgm²)	S 0,223 - M 0,254 - L 0,298 - P 0,339				
Maximum mechanical speed nmax (rpm)	VR 160 S	3400	**Motor weight (kg)**	VR 160 S	201
	VR 160 M			VR 160 M	220
	VR 160 L			VR 160 L	247
	VR 160 P			VR 160 P	276
D-End side bearing	6312 ZZ C3		**ND-End side bearing**	6311 ZZ C3	
Vibration class	A		**Construction form**	IM 2001 (B35)	
Insulation class	H		**Overtemperature Class**	F	
Rated supply voltage (V)	400		**Thermal protection**	NC 150° C	

** Available on request

FAN FEATURES

Frequency (Hz)	50 / 60	**Current (A)**	1,55
Number of phases	1	**Mounting**	Axial
Voltage (V)	220 / 230	**Type of ventilation**	Forced air intake
Power (W)	350	**Protection degree (IP)**	IP44
Maximum flow (m3/min)	57	**Maximum pressure (Pa)**	160
Minimum distance for air inlet / outlet (mm)			90

VR 160 S

n_N Nominal speed	580	1000	1500	1800	2200	2600	rpm
P_N Nominal power	12,8	21	30	36	41,8	46,8	kW
T_N Torque at nominal speed	210	201	191	191	181	172	Nm
I_N Current at nominal power	32,2	51,5	72,5	86,8	101	113	A
n_p Max speed at costant power	1200	2000	3000	4000	4000	4000	rpm
T_{max} Max torque	400						Nm
Efficiency	90,8	93,6	94,9	95,2	94,9	95,1	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	86,6	Hz

VR 160 M

n_N Nominal speed	580	1000	1500	1800	2200	2600	rpm
P_N Nominal power	15,7	25,9	37	44,4	51,6	57,7	kW
T_N Torque at nominal speed	259	247	236	236	224	212	Nm
I_N Current at nominal power	39,5	63,2	89,1	107	124	139	A
n_p Max speed at costant power	1200	2000	3000	4000	4000	4000	rpm
T_{max} Max torque	500						Nm
Efficiency	91,3	94	95,2	95,4	95,2	95,4	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	86,6	Hz

VR 160 L

n_N Nominal speed	580	1000	1500	1800	2200	2600	rpm
P_N Nominal power	19,1	31,5	45	54	62,7	70,2	kW
T_N Torque at nominal speed	315	301	287	287	272	258	Nm
I_N Current at nominal power	47,8	76,6	108	130	151	168	A
n_p Max speed at costant power	1200	2000	3000	4000	4000	4000	rpm
T_{max} Max torque	600						Nm
Efficiency	91,8	94,3	95,4	95,6	95,4	95,6	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	86,6	Hz

VR 160 P

n_N Nominal speed	580	1000	1500	1800	2200	2600	rpm
P_N Nominal power	23,4	38,5	55	66	76,6	86	kW
T_N Torque at nominal speed	385	368	350	350	333	315	Nm
I_N Current at nominal power	58,2	93,4	132	158	184	205	A
n_p Max speed at costant power	1200	2000	3000	4000	4000	4000	rpm
T_{max} Max torque	730						Nm
Efficiency	92,2	94,6	95,7	95,8	95,7	95,8	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	86,6	Hz

4.2 Motor features VR 180 (S-M-L-P) IP54 / IP55 with radial fan

Protection degree	IP 54 / IP55**		Ventilation	IC 416	
Rotor inerzia J (kgm²)	S 0,429 - M 0,604 - L 0,709 - P 0,805				
Maximum mechanical speed nmax (rpm)	VR 180 S	3100	**Motor weight (kg)**	VR 180 S	415
	VR 180 M			VR 180 M	460
	VR 180 L			VR 180 L	515
	VR 180 P			VR 180 P	580
D-End side bearing	6314 ZZ C3		**ND-End side bearing**	6214 ZZ C3	
Vibration class	A		**Construction form**	IM 2001 (B35)	
Insulation class	H		**Overtemperature Class**	F	
Rated supply voltage (V)	400		**Thermal protection**	NC 150° C	

** Available on request

FAN FEATURES

Frequency (Hz)	50 / 60	**Current (A)**	2,9
Number of phases	1	**Mounting**	Axial
Voltage (V)	200 / 277	**Type of ventilation**	Forced air intake
Power (W)	660	**Protection degree (IP)**	IP 55
Maximum flow (m3/min)		**Maximum pressure (Pa)**	682
Minimum distance for air inlet / outlet (mm)			120

VR 180 S

n_N Nominal speed	580	1000	1500	1800	2200	rpm
P_N Nominal power	23,4	38,5	55	66	77	kW
T_N Torque at nominal speed	385	368	350	350	333	Nm
I_N Current at nominal power	58,8	93,4	132	158	184	A
n_p Max speed at costant power	1200	2000	3000	4000	4000	rpm
T_{max} Max torque	730					Nm
Efficiency	92,2	94,6	95,7	95,8	95,7	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	Hz

VR 180 M

n_N Nominal speed	580	1000	1500	1800	2200	rpm
P_N Nominal power	31,9	52,5	75	90	105	kW
T_N Torque at nominal speed	525	501	478	478	454	Nm
I_N Current at nominal power	78,8	127	179	215	250	A
n_p Max speed at costant power	1200	2000	3000	4000	4000	rpm
T_{max} Max torque	1000					Nm
Efficiency	92,8	95	96	96,1	96	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	Hz

VR 180 L

n_N Nominal speed	580	1000	1500	1800	2200	rpm
P_N Nominal power	38,3	63	90	108	125	kW
T_N Torque at nominal speed	630	602	573	573	544	Nm
I_N Current at nominal power	94,3	151,7	215	257	299	A
n_p Max speed at costant power	1200	2000	3000	4000	4000	rpm
T_{max} Max torque	1200					Nm
Efficiency	93,1	95,2	96,1	96,3	96,1	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	Hz

VR 180 P

n_N Nominal speed	580	1000	1500	1800	2200	rpm
P_N Nominal power	46,8	77	110	132	153	kW
T_N Torque at nominal speed	770	735	700	700	665	Nm
I_N Current at nominal power	115	185	262	314	365	A
n_p Max speed at costant power	1200	2000	3000	4000	4000	rpm
T_{max} Max torque	1450					Nm
Efficiency	93,5	95,5	96,3	96,4	96,3	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	Hz

4.3 Motor features VR 225 (S-M-L-P-X) IP54 / IP55 with radial fan

Protection degree	IP 54 / IP55**		Ventilation	IC 416	
Rotor inerzia J (kgm²)	S 1,30 - M 1,52 - L 1,74 - P 2,23 - X 2,84				
Maximum mechanical speed nmax (rpm)	VR 225 S	2400	**Motor weight (kg)**	VR 225 S	730
	VR 225 M			VR 225 M	810
	VR 225 L			VR 225 L	890
	VR 225 P			VR 225 P	970
	VR 225 X			VR 225 X	1050
D-End side bearing	6318 C3		**ND-End side bearing**	6315 C3	
Vibration class	A		**Construction form**	IM 2001 (B35)	
Insulation class	H		**Overtemperature Class**	F	
Rated supply voltage (V)	400		**Thermal protection**	NC 150° C	

** Available on request

FAN FEATURES

Frequency (Hz)	50 / 60	**Current (A)**	3,3
Number of phases	1	**Mounting**	Axial
Voltage (V)	200 / 277	**Type of ventilation**	Forced air intake
Power (W)	750	**Protection degree (IP)**	IP55
Maximum flow (m3/min)		**Maximum pressure (Pa)**	511
Minimum distance for air inlet / outlet (mm)			120

VR 225 S

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	46,8	77	110	132	kW
T_N Torque at nominal speed	770	735	700	700	Nm
I_N Current at nominal power	115	185	262	314	A
n_p Max speed at costant power	1200	2000	2400	2400	rpm
T_{max} Max torque	1450				Nm
Efficiency	93,5	95,5	96,3	96,4	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 225 M

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	56,1	92,4	132	158	kW
T_N Torque at nominal speed	924	882	840	840	Nm
I_N Current at nominal power	137	222	314	376	A
n_p Max speed at costant power	1200	2000	2400	2400	rpm
T_{max} Max torque	1750				Nm
Efficiency	93,8	95,7	96,4	96,6	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 225 L

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	61,7	102	145	174	kW
T_N Torque at nominal speed	1015	969	923	923	Nm
I_N Current at nominal power	151	243	345	416	A
n_p Max speed at costant power	1200	2000	2400	2400	rpm
T_{max} Max torque	1930				Nm
Efficiency	93,9	95,7	96,5	96,6	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 225 P

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	68,1	112	160	192	kW
T_N Torque at nominal speed	1121	1070	1019	1019	Nm
I_N Current at nominal power	166	268	380	456	A
n_p Max speed at costant power	1200	2000	2400	2400	rpm
T_{max} Max torque	2130				Nm
Efficiency	94	95,8	96,6	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 225 X

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	76,6	126	180	216	kW
T_N Torque at nominal speed	1261	1203	1146	1146	Nm
I_N Current at nominal power	186	301	427	512	A
n_p Max speed at costant power	1200	2000	2400	2400	rpm
T_{max} Max torque	2400				Nm
Efficiency	94,2	95,9	96,6	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

4.4 Motor features VR 280 (S-M-L-P) IP54 / IP55 with radial fan

Protection degree	IP 54 / IP55**		Ventilation	IC 416	
Rotor inerzia J (kgm²)	S 3,22 - M 3,80 - L 4,59 - P 5,03				
Maximum mechanical speed nmax (rpm)	VR 280 S	2000	**Motor weight (kg)**	VR 280 S	1230
	VR 280 M			VR 280 M	1420
	VR 280 L			VR 280 L	1680
	VR 280 P			VR 280 P	1830
D-End side bearing	6222 C3		**ND-End side bearing**	6222 C3	
Vibration class	A		**Construction form**	IM 1001 (B3)	
Insulation class	H		**Overtemperature Class**	F	
Rated supply voltage (V)	400		**Thermal protection**	NC 150° C	

** Available on request

FAN FEATURES

Frequency (Hz)	50 / 60	**Current (A)**	7,9
Number of phases	3	**Mounting**	Radial
Voltage (V)	400 / 460	**Type of ventilation**	Forced air intake
Power (W)	4000	**Protection degree (IP)**	IP54 / IP55
Maximum flow (m3/min)	75	**Maximum pressure (Pa)**	2200
Minimum distance for air inlet / outlet (mm)			170

VR 280 S

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	96	158	225	270	kW
T_N Torque at nominal speed	1576	1504	1433	1433	Nm
I_N Current at nominal power	232	376	534	640	A
n_p Max speed at costant power	1200	2000	2000	2000	rpm
T_{max} Max torque	3000				Nm
Efficiency	94,5	96,1	96,7	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 280 M

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	119	196	280	336	kW
T_N Torque at nominal speed	1961	1872	1783	1783	Nm
I_N Current at nominal power	288	467	664	797	A
n_p Max speed at costant power	1200	2000	2000	2000	rpm
T_{max} Max torque	3700				Nm
Efficiency	94,8	96,3	96,7	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 280 L

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	134	221	315	378	kW
T_N Torque at nominal speed	2206	2106	2006	2006	Nm
I_N Current at nominal power	324	525	747	897	A
n_p Max speed at costant power	1200	2000	2000	2000	rpm
T_{max} Max torque	4200				Nm
Efficiency	94,9	96,4	96,7	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 280 P

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	151	249	355	426	kW
T_N Torque at nominal speed	2486	2373	2260	2260	Nm
I_N Current at nominal power	364	591	842	1011	A
n_p Max speed at costant power	1200	2000	2000	2000	rpm
T_{max} Max torque	4700				Nm
Efficiency	95,1	96,5	96,7	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

5. Electrical data IP23 version

5.1 Motor features VR 160 (S-M-L-P) IP23 S

Protection degree	IP 23		Ventilation	IC 06	
Rotor inerzia J (kgm²)	S 0,22 - M 0,25 - L 0,30 - P 0,34				
Maximum mechanical speed nmax (rpm)	VR 160 S	3400	**Motor weight (kg)**	VR 160 S	208
	VR 160 M			VR 160 M	229
	VR 160 L			VR 160 L	260
	VR 160 P			VR 160 P	285
D-End side bearing	6312 ZZ C3		**ND-End side bearing**	6311 ZZ C3	
Vibration class	A		**Construction form**	IM 2001 (B35)	
Insulation class	H		**Overtemperature Class**	F	
Rated supply voltage (V)	400		**Thermal protection**	NC 150° C	

FAN FEATURES

Frequency (Hz)	50 / 60	**Current (A)**	2,31
Number of phases	3	**Mounting**	Radial
Voltage (V)	400 / 460	**Type of ventilation**	Forced air intake
Power (W)	1100	**Protection degree (IP)**	IP 54
Maximum flow (m3/min)	30	**Maximum pressure (Pa)**	1100
Minimum distance for air inlet / outlet (mm)			90

VR 160 S IP23S

n_N Nominal speed	580	1000	1500	1800	2200	2600	rpm
P_N Nominal power	16	26,3	37,5	45	52,3	58,5	kW
T_N Torque at nominal speed	263	251	239	239	226	215	Nm
I_N Current at nominal power	40,3	64,4	90,6	109	126	141	A
n_p Max speed at costant power	1200	2000	3000	3400	3400	3400	rpm
T_{max} Max torque	400						Nm
Efficiency	90,8	93,6	94,9	95,2	94,9	95,1	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	86,6	Hz

VR 160 M IP23S

n_N Nominal speed	580	1000	1500	1800	2200	2600	rpm
P_N Nominal power	19,6	32,4	46,3	55,5	64,5	72,1	kW
T_N Torque at nominal speed	324	309	295	295	280	265	Nm
I_N Current at nominal power	49,4	79	111	134	155	174	A
n_p Max speed at costant power	1200	2000	3000	3400	3400	3400	rpm
T_{max} Max torque	500						Nm
Efficiency	91,3	94	95,2	95,4	95,2	95,4	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	86,6	Hz

VR 160 L IP23S

n_N Nominal speed	580	1000	1500	1800	2200	2600	rpm
P_N Nominal power	23,9	37,8	54	64,8	75,2	84,2	kW
T_N Torque at nominal speed	394	361	344	344	326	310	Nm
I_N Current at nominal power	59,8	91,9	130	156	181	202	A
n_p Max speed at costant power	1200	2000	3000	3400	3400	3400	rpm
T_{max} Max torque	600						Nm
Efficiency	91,8	94,3	95,4	95,6	95,4	95,6	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	86,6	Hz

VR 160 P IP23S

n_N Nominal speed	580	1000	1500	1800	2200	2600	rpm
P_N Nominal power	26,9	44,3	63,3	75,9	88,1	98,9	kW
T_N Torque at nominal speed	443	423	403	403	383	362	Nm
I_N Current at nominal power	66,9	107	152	182	212	236	A
n_p Max speed at costant power	1200	2000	3000	3400	3400	3400	rpm
T_{max} Max torque	730						Nm
Efficiency	92,2	94,6	95,7	95,8	95,7	95,8	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	86,6	Hz

5.2 Motor features VR 180 (S-M-L-P) IP23 S

Protection degree	IP 23		Ventilation	IC 06	
Rotor inerzia J (kgm²)	S 0,429 - M 0,604 - L 0,709 - P 0,805				
Maximum mechanical speed nmax (rpm)	VR 180 S	3100	**Motor weight (kg)**	VR 180 S	385
	VR 180 M			VR 180 M	475
	VR 180 L			VR 180 L	530
	VR 180 P			VR 180 P	580
D-End side bearing	6314 ZZ C3		**ND-End side bearing**	6214 ZZ C3	
Vibration class	A		**Construction form**	IM 2001 (B35)	
Insulation class	H		**Overtemperature Class**	F	
Rated supply voltage (V)	400		**Thermal protection**	NC 150° C	

FAN FEATURES

Frequency (Hz)	50 / 60	**Current (A)**	3,15
Number of phases	3	**Mounting**	Radial
Voltage (V)	400 / 460	**Type of ventilation**	Forced air intake
Power (W)	1500	**Protection degree (IP)**	IP 54
Maximum flow (m3/min)	35	**Maximum pressure (Pa)**	1600
Minimum distance for air inlet / outlet (mm)			140

VR 180 S IP23S

n_N Nominal speed	580	1000	1500	1800	2200	rpm
P_N Nominal power	28,1	46,2	66	79,2	92,4	kW
T_N Torque at nominal speed	462	442	420	420	400	Nm
I_N Current at nominal power	69,8	112	158	190	221	A
n_p Max speed at costant power	1200	2000	3000	3100	3100	rpm
T_{max} Max torque	730					Nm
Efficiency	92,2	94,6	95,7	95,8	95,7	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	Hz

VR 180 M IP23S

n_N Nominal speed	580	1000	1500	1800	2200	rpm
P_N Nominal power	38,3	63	90	108	126	kW
T_N Torque at nominal speed	630	601	574	574	545	Nm
I_N Current at nominal power	94,6	152	215	258	300	A
n_p Max speed at costant power	1200	2000	3000	3100	3100	rpm
T_{max} Max torque	1000					Nm
Efficiency	92,8	95	96	96,1	96	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	Hz

VR 180 L IP23S

n_N Velocità nominale	580	1000	1500	1800	2200	rpm
P_N Potenza nominale	46	75,6	108	130	150	kW
T_N Coppia alla velocità nominale	756	722	688	688	653	Nm
I_N Corrente alla potenza nominale	113	182	258	308	359	A
n_p Velocità massima a potenza costante	1200	2000	3000	3100	3100	rpm
T_{max} Coppia massima	1200					Nm
Efficienza	93,1	95,2	96,1	96,3	96,1	%
f_N Frequenza nominale	19,3	33,3	50	60	73,3	Hz

VR 180 P IP23S

n_N Velocità nominale	580	1000	1500	1800	2200	rpm
P_N Potenza nominale	51,5	84,7	121	145	168	kW
T_N Coppia alla velocità nominale	847	809	770	770	732	Nm
I_N Corrente alla potenza nominale	127	204	288	345	402	A
n_p Velocità massima a potenza costante	1200	2000	3000	3100	3100	rpm
T_{max} Coppia massima	1450					Nm
Efficienza	93,5	95,5	96,3	96,4	96,3	%
f_N Frequenza nominale	19,3	33,3	50	60	73,3	Hz

5.3 Motor features VR 225 (S-M-L-P-X) IP23 S

Protection degree	IP 23		Ventilation	IC 06	
Rotor inerzia J (kgm²)	S 1,30 - M 1,52 - L 1,74 - P 2,23 - X 2,84				
Maximum mechanical speed nmax (rpm)	VR 225 S	2400	**Motor weight (kg)**	VR 225 S	740
	VR 225 M			VR 225 M	820
	VR 225 L			VR 225 L	900
	VR 225 P			VR 225 P	1030
	VR 225 X			VR 225 X	1185
D-End side bearing	6318 C3		**ND-End side bearing**	6315 C3	
Vibration class	A		**Construction form**	IM 2001 (B35)	
Insulation class	H		**Overtemperature Class**	F	
Rated supply voltage (V)	400		**Thermal protection**	NC 150° C	

FAN FEATURES

Frequency (Hz)	50 / 60	**Current (A)**	4,5
Number of phases	3	**Mounting**	Radial
Voltage (V)	400 / 460	**Type of ventilation**	Forced air intake
Power (W)	2200	**Protection degree (IP)**	IP 54
Maximum flow (m3/min)	48	**Maximum pressure (Pa)**	1800
Minimum distance for air inlet / outlet (mm)			140

VR 225 S IP23S

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	53,8	88,6	127	152	kW
T_N Torque at nominal speed	886	845	805	805	Nm
I_N Current at nominal power	132	213	301	361	A
n_p Max speed at costant power	1200	2000	2400	2400	rpm
T_{max} Max torque	1450				Nm
Efficiency	93,5	95,5	96,3	96,4	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 225 M IP23S

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	64,5	106	152	182	kW
T_N Torque at nominal speed	1063	1014	966	966	Nm
I_N Current at nominal power	158	255	361	432	A
n_p Max speed at costant power	1200	2000	2400	2400	rpm
T_{max} Max torque	1750				Nm
Efficiency	93,8	95,7	96,4	96,6	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 225 L IP23S

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	71	117	167	200	kW
T_N Torque at nominal speed	1167	1114	1061	1061	Nm
I_N Current at nominal power	174	279	397	475	A
n_p Max speed at costant power	1200	2000	2400	2400	rpm
T_{max} Max torque	1930				Nm
Efficiency	93,9	95,7	96,5	96,6	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 225 P IP23S

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	78,3	129	184	221	kW
T_N Torque at nominal speed	1289	1231	1172	1172	Nm
I_N Current at nominal power	191	308	437	524	A
n_p Max speed at costant power	1200	2000	2400	2400	rpm
T_{max} Max torque	2130				Nm
Efficiency	94	95,8	96,6	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 225 X IP23S

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	91,9	151	216	259	kW
T_N Torque at nominal speed	1513	1444	1375	1375	Nm
I_N Current at nominal power	223	361	512	614	A
n_p Max speed at costant power	1200	2000	2400	2400	rpm
T_{max} Max torque	2400				Nm
Efficiency	94,2	95,9	96,6	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

5.4 Motor features VR 280 (S-M-L-P) IP23 S

Protection degree	IP 23		Ventilation	IC 06	
Rotor inerzia J (kgm²)	S 3,22 - M 3,80 - L 4,59 - P 5,03				
Maximum mechanical speed nmax (rpm)	VR 280 S	2000	**Motor weight (kg)**	VR 280 S	1180
	VR 280 M			VR 280 M	1370
	VR 280 L			VR 280 L	1630
	VR 280 P			VR 280 P	1780
D-End side bearing	6222 C3		**ND-End side bearing**	6222 C3	
Vibration class	A		**Construction form**	IM 1001 (B3)	
Insulation class	H		**Overtemperature Class**	F	
Rated supply voltage (V)	400		**Thermal protection**	NC 150° C	

FAN FEATURES

Frequency (Hz)	50 / 60	**Current (A)**	7,9
Number of phases	3	**Mounting**	Radial
Voltage (V)	400 / 460	**Type of ventilation**	Forced air intake
Power (W)	4000	**Protection degree (IP)**	IP 54
Maximum flow (m3/min)	75	**Maximum pressure (Pa)**	2200
Minimum distance for air inlet / outlet (mm)			170

VR 280 S IP23S

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	115	190	270	324	kW
T_N Torque at nominal speed	1891	1805	1720	1720	Nm
I_N Current at nominal power	278	451	641	768	A
n_p Max speed at costant power	1200	2000	2000	2000	rpm
T_{max} Max torque	3000				Nm
Efficiency	94,5	96,1	96,7	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 280 M IP23S

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	143	235	336	403	kW
T_N Torque at nominal speed	2353	2246	2140	2140	Nm
I_N Current at nominal power	346	560	797	956	A
n_p Max speed at costant power	1200	2000	2000	2000	rpm
T_{max} Max torque	3700				Nm
Efficiency	94,8	96,3	96,7	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 280 L IP23S

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	161	265	378	454	kW
T_N Torque at nominal speed	2647	2527	2407	2407	Nm
I_N Current at nominal power	389	630	896	1076	A
n_p Max speed at costant power	1200	2000	2000	2000	rpm
T_{max} Max torque	4200				Nm
Efficiency	94,9	96,4	96,7	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 280 P IP23S

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	181	299	426	511	kW
T_N Torque at nominal speed	2983	2848	2712	2712	Nm
I_N Current at nominal power	437	709	1010	1213	A
n_p Max speed at costant power	1200	2000	2000	2000	rpm
T_{max} Max torque	4700				Nm
Efficiency	95,1	96,5	96,7	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

6. Electrical data liquid cooling version

6.1 Motor features VR 160 (M-L-P-X) IP54 / IP55 liquid cooling

Protection degree	IP 54		Cooling	IC 9W7	
Rotor inerzia J (kgm²)	M 0,254 - L 0,298 - P 0,339 - X 0,433				
Maximum mechanical speed nmax (rpm)	VR 160 M	3400	**Motor weight (kg)**	VR 160 M	215
	VR 160 L			VR 160 L	240
	VR 160 P			VR 160 P	265
	VR 160 X			VR 160 X	325
D-End side bearing	6312 ZZ C3		**ND-End side bearing**	6311 ZZ C3	
Vibration class	A		**Construction form**	IM 2001 (B35)	
Insulation class	H		**Overtemperature Class**	F	
Rated supply voltage (V)	400		**Thermal protection**	NC 150° C	

LIQUID COOLING CIRCUIT FEATURES

Liquid flow rate (l/min)	12	**Liquid type**	Water + anti-corrosive liquid / antifreeze max 20%
Max circuit pressure (Bar)	3	**Cooling circuit type**	Closed circuit with external chiller
Maximum pressure drop (Bar)	0,8	**Liquid temperature**	Recommended +18° C / Max +60° C with derating (se section 3.8.1)

VR 160 M LIQUID COOLING

n_N Nominal speed	580	1000	1500	1800	2200	2600	rpm
P_N Nominal power	17,3	28,5	40,7	48,8	56,8	63,5	kW
T_N Torque at nominal speed	285	272	260	260	246	233	Nm
I_N Current at nominal power	43,5	69,5	98	118	136	153	A
n_p Max speed at costant power	1200	2000	3000	3400	3400	3400	rpm
T_{max} Max torque	500						Nm
Efficiency	91,3	94	95,2	95,4	95,2	95,4	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	86,6	Hz

VR 160 L LIQUID COOLING

n_N Nominal speed	580	1000	1500	1800	2200	2600	rpm
P_N Nominal power	20,1	33,1	47,3	56,7	65,8	73,7	kW
T_N Torque at nominal speed	331	316	301	301	286	271	Nm
I_N Current at nominal power	50,2	80,4	113	137	159	176	A
n_p Max speed at costant power	1200	2000	3000	3400	3400	3400	rpm
T_{max} Max torque	600						Nm
Efficiency	91,8	94,3	95,4	95,6	95,4	95,6	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	86,6	Hz

VR 160 P LIQUID COOLING

n_N Nominal speed	580	1000	1500	1800	2200	2600	rpm
P_N Nominal power	23,4	38,5	55	66	76,6	86	kW
T_N Torque at nominal speed	385	368	350	350	333	315	Nm
I_N Current at nominal power	58,2	93,4	132	158	184	205	A
n_p Max speed at costant power	1200	2000	3000	3400	3400	3400	rpm
T_{max} Max torque	730						Nm
Efficiency	92,2	94,6	95,7	95,8	95,7	95,8	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	86,6	Hz

VR 160 X LIQUID COOLING

n_N Nominal speed	580	1000	1500	1800	2200	2600	rpm
P_N Nominal power	28,1	46,2	66	79,2	91,9	103	kW
T_N Torque at nominal speed	462	442	420	420	400	378	Nm
I_N Current at nominal power	69,8	112	158	190	221	246	A
n_p Max speed at costant power	1200	2000	3000	3400	3400	3400	rpm
T_{max} Max torque	880						Nm
Efficiency	92,2	94,6	95,7	95,8	95,7	95,8	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	86,6	Hz

6.2 Motor features VR 180 (M-L-X) IP54 / IP55 liquid cooling

Protection degree	IP 54		Cooling	IC 9W7	
Rotor inerzia J (kgm²)	M 0,604 - L 0,709 - X 0,805				
Maximum mechanical speed nmax (rpm)	VR 180 M	3100	**Motor weight (kg)**	VR 180 M	390
	VR 180 L			VR 180 L	440
	VR 180 X			VR 180 X	470
D-End side bearing	6314 C3		**ND-End side bearing**	6312 C3	
Vibration class	A		**Construction form**	IM 2001 (B35)	
Insulation class	H		**Overtemperature Class**	F	
Rated supply voltage (V)	400		**Thermal protection**	NC 150° C	

LIQUID COOLING CIRCUIT FEATURES

Liquid flow rate (l/min)	15	**Liquid type**	Water + anti-corrosive liquid / antifreeze max 20%
Max circuit pressure (Bar)	3	**Cooling circuit type**	Closed circuit with external chiller
Maximum pressure drop (Bar)	0,9	**Liquid temperature**	Recommended +18° C / Max +60° C with derating (se section 3.8.1)

VR 180 M LIQUID COOLING

n_N Nominal speed	580	1000	1500	1800	2200	rpm
P_N Nominal power	31,9	52,5	75	90	105	kW
T_N Torque at nominal speed	525	501	478	478	454	Nm
I_N Current at nominal power	78,8	127	179	215	250	A
n_p Max speed at costant power	1200	2000	3000	3100	3100	rpm
T_{max} Max torque	1000					Nm
Efficiency	92,8	95	96	96,1	96	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	Hz

VR 180 L LIQUID COOLING

n_N Nominal speed	580	1000	1500	1800	2200	rpm
P_N Nominal power	38,3	63	90	108	125	kW
T_N Torque at nominal speed	630	602	573	573	544	Nm
I_N Current at nominal power	94,3	152	215	257	299	A
n_p Max speed at costant power	1200	2000	3000	3100	3100	rpm
T_{max} Max torque	1200					Nm
Efficiency	93,1	95,2	96,1	96,3	96,1	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	Hz

VR 180 X LIQUID COOLING

n_N Nominal speed	580	1000	1500	1800	2200	rpm
P_N Nominal power	46,8	77	110	132	153	kW
T_N Torque at nominal speed	770	735	700	700	665	Nm
I_N Current at nominal power	115	185	262	314	365	A
n_p Max speed at costant power	1200	2000	3000	3100	3100	rpm
T_{max} Max torque	1450					Nm
Efficiency	93,5	95,5	96,3	96,4	96,3	%
f_N Nominal frequency	19,3	33,3	50	60	73,3	Hz

6.3 Motor features VR 225 (L-P-X) IP54 / IP55 liquid cooling

Protection degree	IP 54		Cooling	IC 9W7	
Rotor inerzia J (kgm²)	L 1,74 - P 2,23 - X 2,84				
Maximum mechanical speed nmax (rpm)	VR 225 L	2400	**Motor weight (kg)**	VR 225 L	680
	VR 225 P			VR 225 P	860
	VR 225 X			VR 225 X	960
D-End side bearing	6318 C3		**ND-End side bearing**	6315 C3	
Vibration class	A		**Construction form**	IM 1001 (B3)	
Insulation class	H		**Overtemperature Class**	F	
Rated supply voltage (V)	400		**Thermal protection**	NC 150° C	

LIQUID COOLING CIRCUIT FEATURES

Liquid flow rate (l/min)	18	**Liquid type**	Water + anti-corrosive liquid / antifreeze max 20%
Max circuit pressure (Bar)	3	**Cooling circuit type**	Closed circuit with external chiller
Maximum pressure drop (Bar)	0,9	**Liquid temperature**	Recommended +18° C / Max +60° C with derating (se section 3.8.1)

VR 225 L LIQUID COOLING

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	61,7	102	145	174	kW
T_N Torque at nominal speed	1015	969	923	923	Nm
I_N Current at nominal power	151	243	345	413	A
n_p Max speed at costant power	1200	2000	2400	2400	rpm
T_{max} Max torque	1930				Nm
Efficiency	93,9	95,7	96,5	96,6	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 225 P LIQUID COOLING

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	68,1	112	160	192	kW
T_N Torque at nominal speed	1121	1070	1019	1019	Nm
I_N Current at nominal power	166	268	380	456	A
n_p Max speed at costant power	1200	2000	2400	2400	rpm
T_{max} Max torque	2130				Nm
Efficiency	94	95,8	96,6	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 225 X LIQUID COOLING

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	76,6	126	180	216	kW
T_N Torque at nominal speed	1261	1203	1146	1146	Nm
I_N Current at nominal power	186	301	427	512	A
n_p Max speed at costant power	1200	2000	2400	2400	rpm
T_{max} Max torque	2400				Nm
Efficiency	94,2	95,9	96,6	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

6.4 Motor features VR 280 (S-M-L-P) IP54 / IP55 liquid cooling

Protection degree	IP 54		Cooling	IC 9W7	
Rotor inerzia J (kgm²)	S 3,22 - M 3,80 - L 5,59 - P 5,03				
Maximum mechanical speed nmax (rpm)	VR 280 S	2000	**Motor weight (kg)**	VR 280 S	1020
	VR 280 M			VR 280 M	1130
	VR 280 L			VR 280 L	1290
	VR 280 P			VR 280 P	1400
D-End side bearing	6222 C3		**ND-End side bearing**	NU 222 EC	
Vibration class	A		**Construction form**	IM 1001 (B3)	
Insulation class	H		**Overtemperature Class**	F	
Rated supply voltage (V)	400		**Thermal protection**	NC 150° C	

LIQUID COOLING CIRCUIT FEATURES

Liquid flow rate (l/min)	18	**Liquid type**	Water + anti-corrosive liquid / antifreeze max 20%
Max circuit pressure (Bar)	3	**Cooling circuit type**	Closed circuit with external chiller
Maximum pressure drop (Bar)	0,9	**Liquid temperature**	Recommended +18° C / Max +60° C with derating (se section 3.8.1)

VR 280 S LIQUID COOLING

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	96	158	225	270	kW
T_N Torque at nominal speed	1576	1504	1433	1433	Nm
I_N Current at nominal power	232	376	534	640	A
n_p Max speed at costant power	1200	2000	2000	2000	rpm
T_{max} Max torque	3000				Nm
Efficiency					%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 280 M LIQUID COOLING

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	119	196	280	336	kW
T_N Torque at nominal speed	1961	1872	1783	1783	Nm
I_N Current at nominal power	288	467	664	797	A
n_p Max speed at costant power	1200	2000	2000	2000	rpm
T_{max} Max torque	3700				Nm
Efficiency	94,8	96,3	96,7	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 280 L LIQUID COOLING

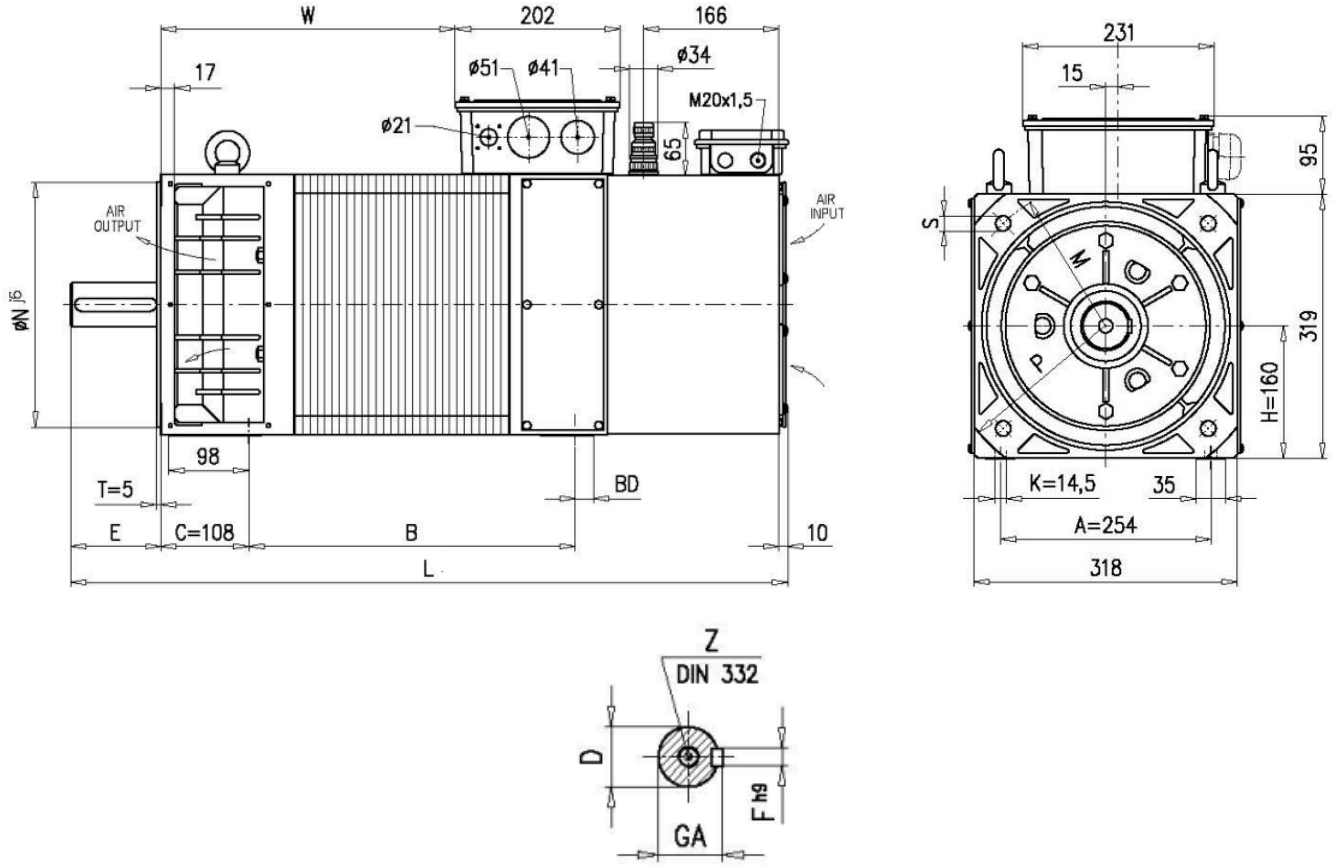
n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	134	221	315	378	kW
T_N Torque at nominal speed	2206	2106	2006	2006	Nm
I_N Current at nominal power	324	525	747	897	A
n_p Max speed at costant power	1200	2000	2000	2000	rpm
T_{max} Max torque	4200				Nm
Efficiency	94,9	96,4	96,7	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

VR 280 P LIQUID COOLING

n_N Nominal speed	580	1000	1500	1800	rpm
P_N Nominal power	151	249	355	426	kW
T_N Torque at nominal speed	2486	2373	2260	2260	Nm
I_N Current at nominal power	364	591	842	1011	A
n_p Max speed at costant power	1200	2000	2000	2000	rpm
T_{max} Max torque	4700				Nm
Efficiency	95,1	96,5	96,7	96,7	%
f_N Nominal frequency	19,3	33,3	50	60	Hz

7. Overall dimensions

7.1 Overall dimensions – VR 160 IP54 / IP55



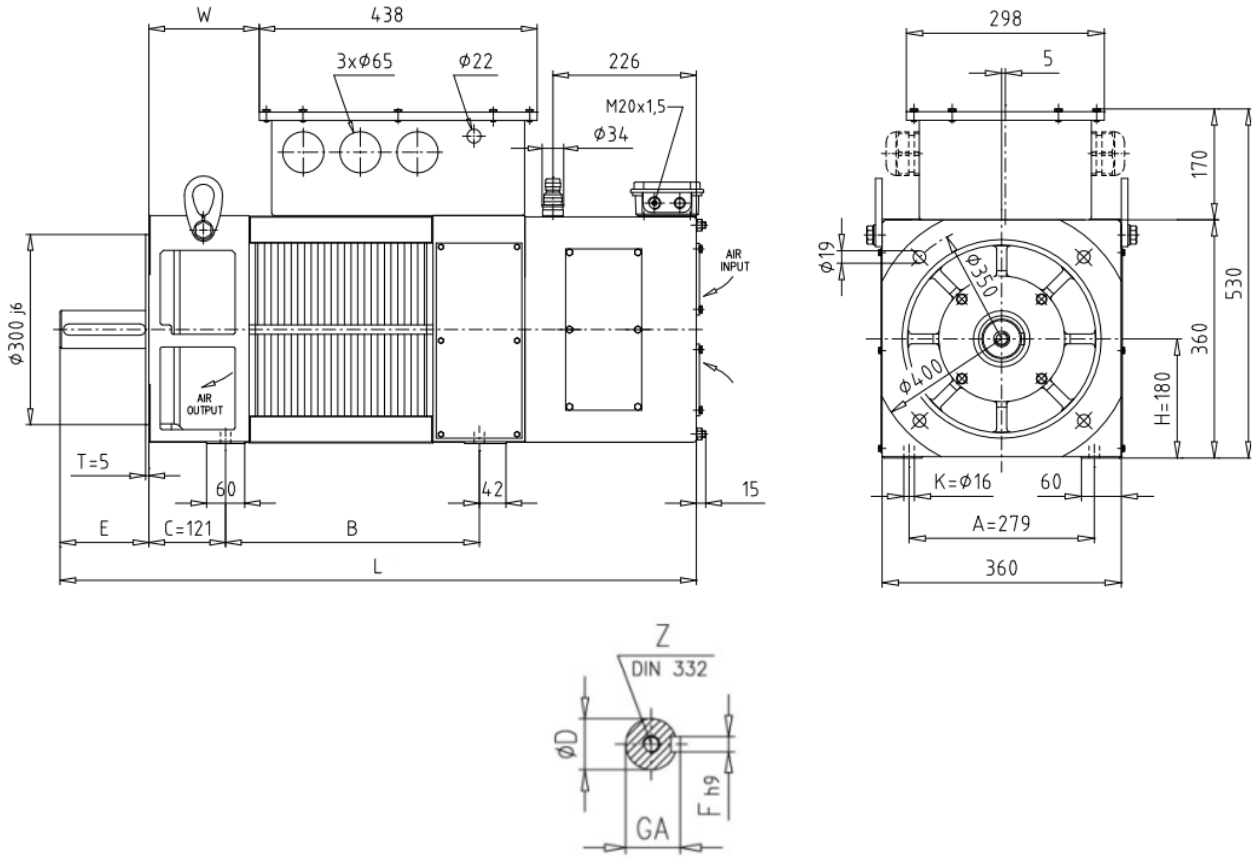
Type		Length					Shaft				
		B	BD	L	Lb*	W	D	E	GA	F	Z
VR 160	S	355	33	845	965	326	55 m6	110	59	16	M20
	M	400	23	880	1000	361					
	L	450	23	930	1050	411					
	P	500	18	975	1095	456					

*Lb = motor length with brake

Type		Flange						
		P **(1)**	P (2)	N **(1)**	N (2)	M **(1)**	M (2)	S **(1)**
VR 160	S	400	350	300	250	350	300	18,5
	M							
	L							
	P							

(1) Standard (2) On request

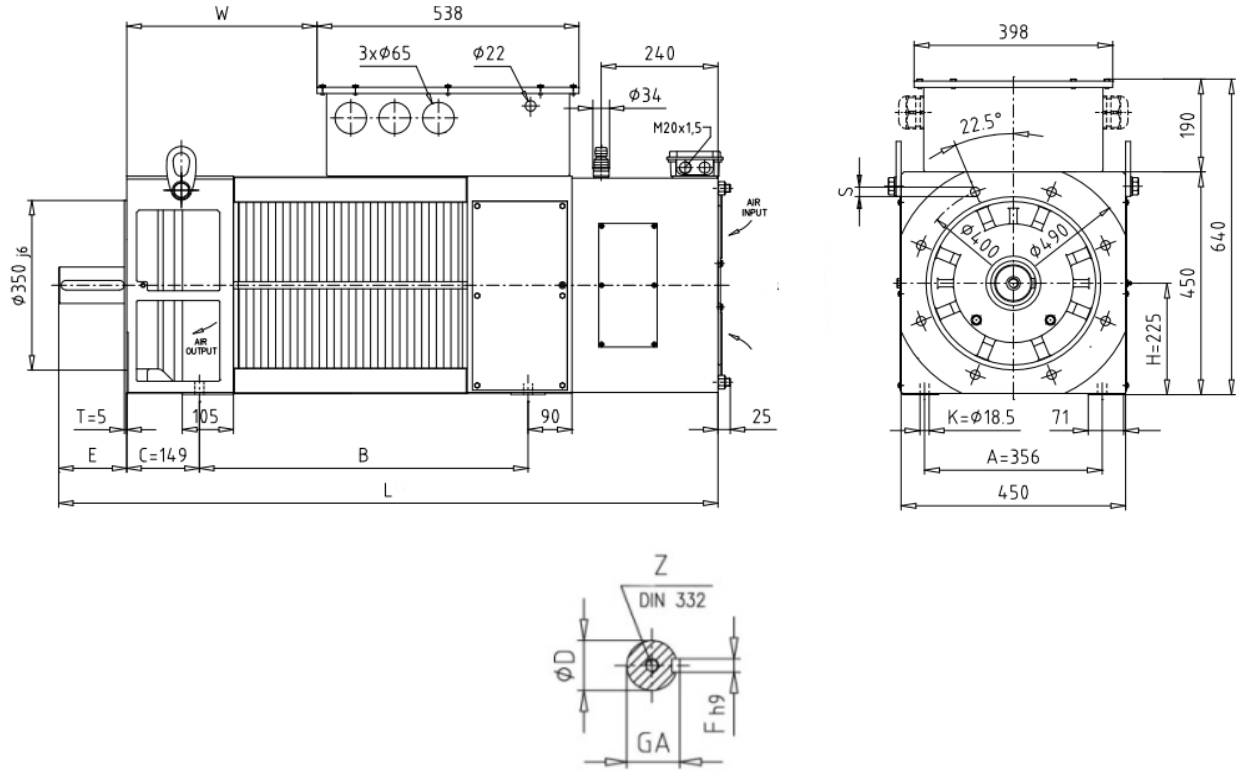
7.2 Overall dimensions – VR 180 IP54 / IP55



Type		Length				Shaft				
		B	L	Lb*	W	D	E	GA	F	Z
VR 180	S	400	1075	1205	174	60 m6	140	64	18	M20
	M	520	1195	1325	294	65 m6		69		
	L	590	1265	1395	364					
	P	640	1315	1445	414					

*Lb = motor length with brake

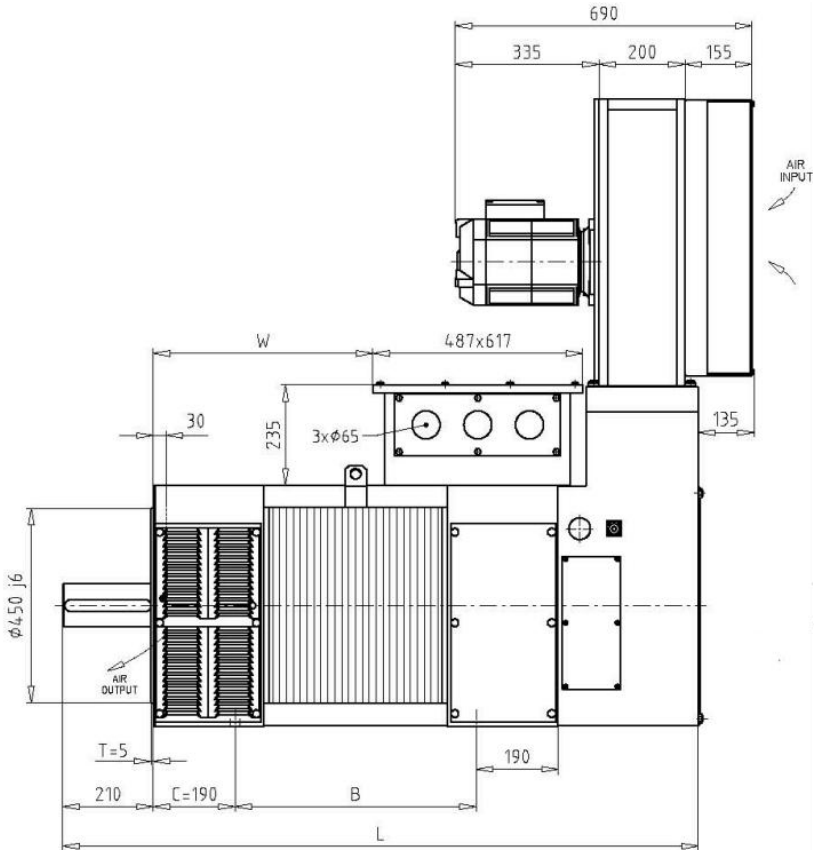
7.3 Overall dimensions – VR 225 IP54 / IP55

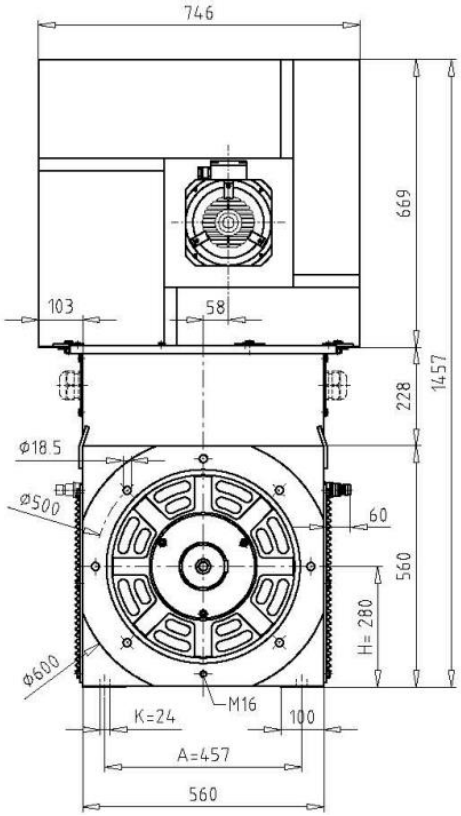


Type		Length						Shaft								
		B	L **(1)**	L (2)	Lb* **(1)**	Lb* (2)	W	D **(1)**	D (2)	E **(1)**	E (2)	GA **(1)**	GA (2)	F **(1)**	F (2)	Z
VR 225	S	555	1335	1365	1485	1515	330	75 m6	85 m6	140	170	79,5	90	20	22	M20
	M	615	1395	1425	1545	1575	330									
	L	675	1455	1485	1605	1635	390									
	P	803	1615	/	1765	/	518	85 m6	/	170	/	90	/	22	/	
	X	923	1735	/	1885	/	638									

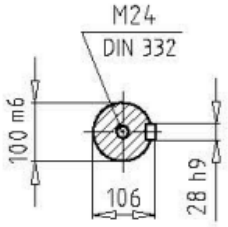
(1) Standard (2) On request *Lb = motor length with brake

7.4 Overall dimensions – VR 280 IP54 / IP55 WITH RADIAL FAN and VR 280 IP23

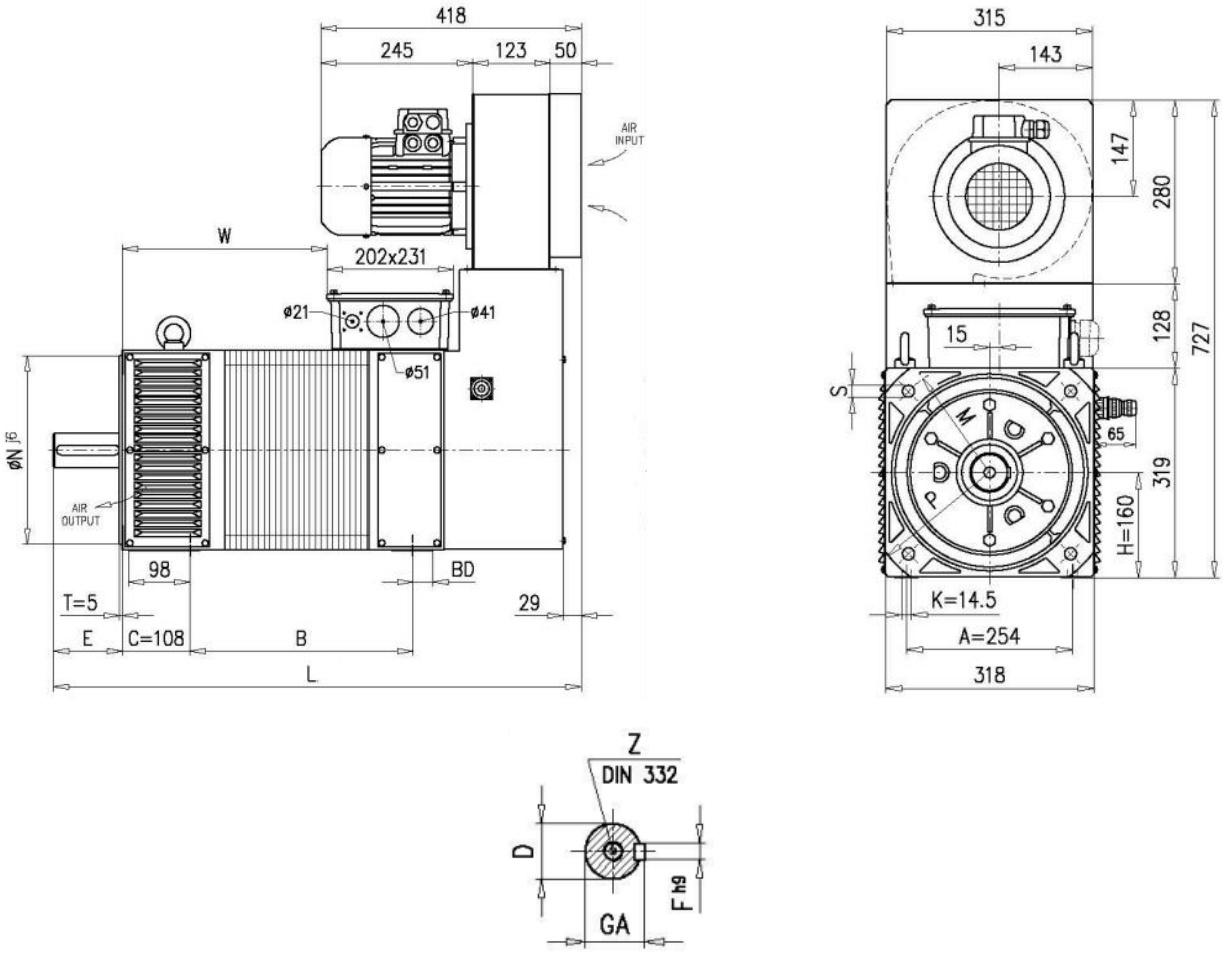




Type		Length		
		B	L	W
VR 280	S	560	1490	510
	M	640	1570	590
	L	750	1680	700
	P	810	1740	760



7.5 Overall dimensions – VR 160 IP23



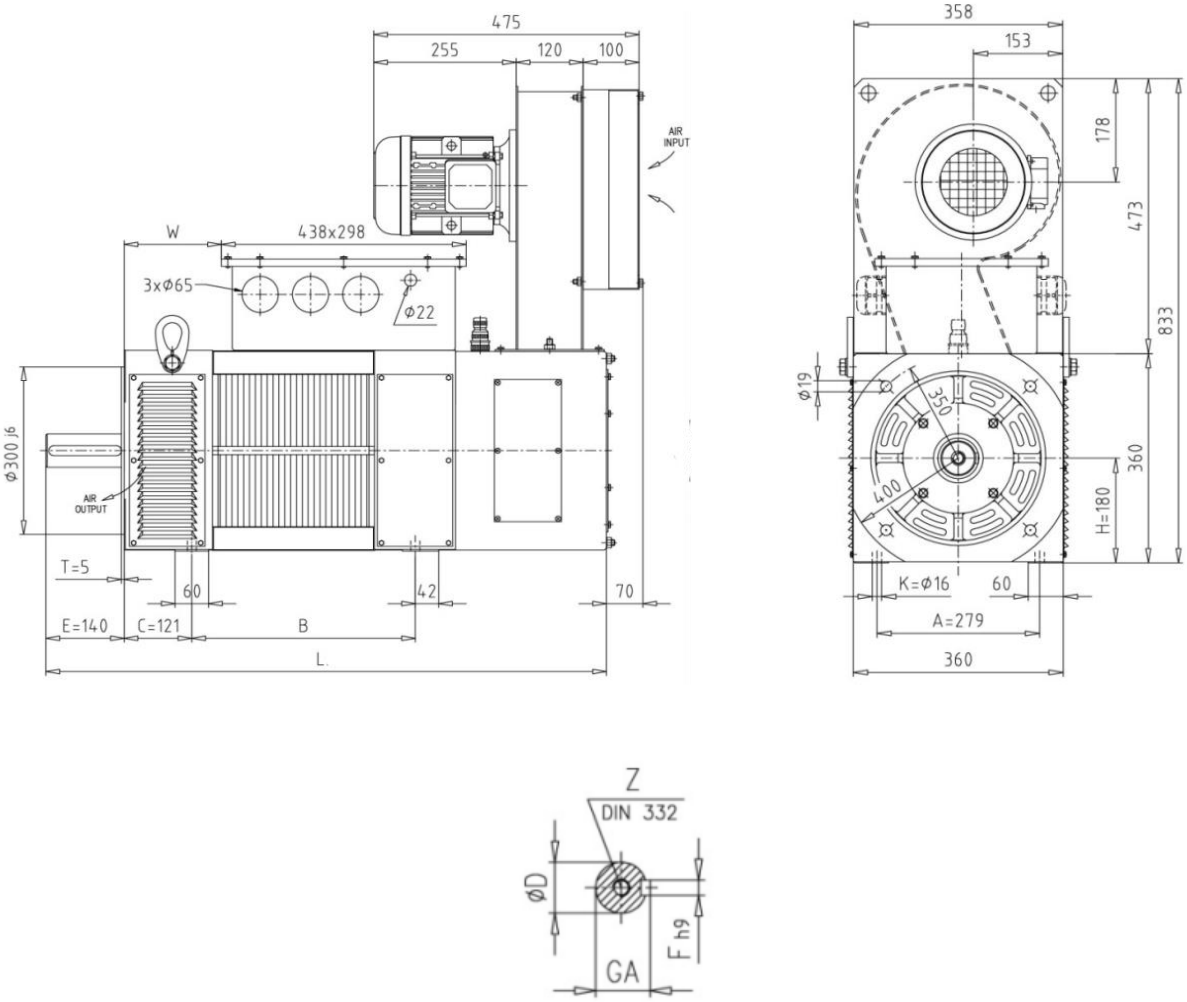
Type		Length					Shaft				
		B	BD	L	Lb*	W	D	E	GA	F	Z
VR 160	S	355	33	845	895	326	55 m6	110	59	16	M20
	M	400	23	880	930	361					
	L	450	23	930	980	411					
	P	500	18	975	1025	456					

*Lb = motor length with brake

Type		Flange						
		P **(1)**	P (2)	N **(1)**	N (2)	M **(1)**	M (2)	S **(1)**
VR 160	S	400	350	300	250	350	300	18,5
	M							
	L							
	P							

(1) Standard (2) On request

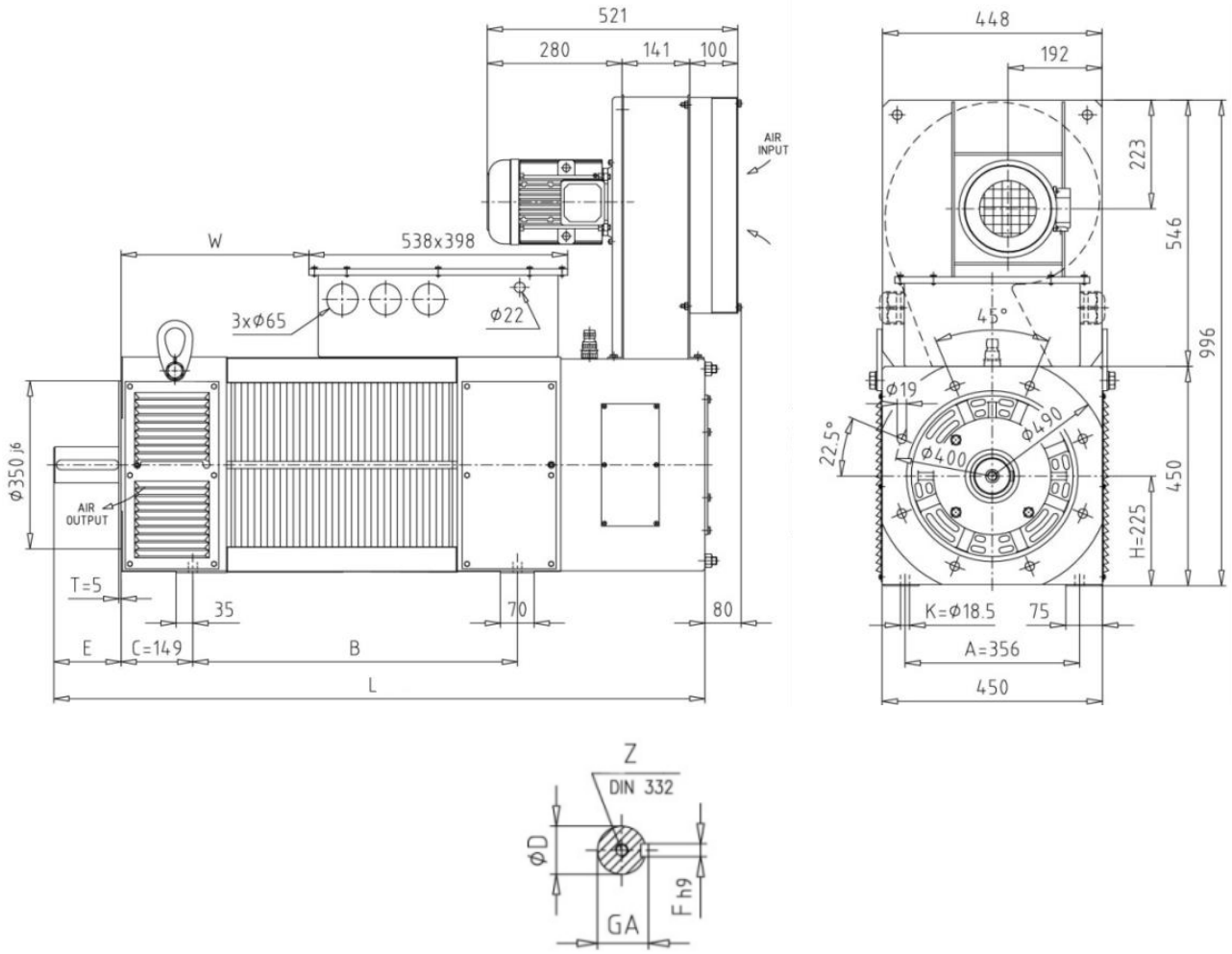
7.6 Overall dimensions – VR 180 IP23



Type		Length				Shaft				
		B	L	Lb*	W	D	E	GA	F	Z
VR 180	S	400	1070	1200	174	60 m6	140	64	18	M20
	M	520	1190	1320	294	65 m6		69		
	L	590	1260	1390	364					
	P	640	1310	1440	414					

*Lb = motor length with brake

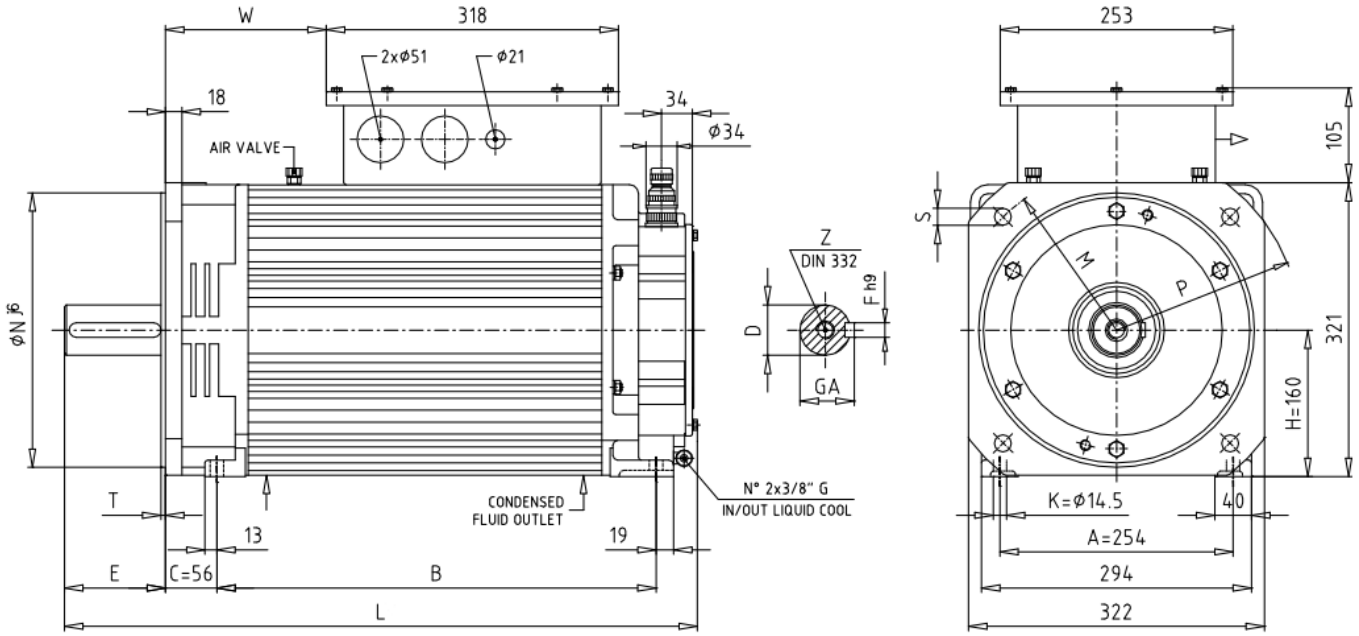
7.7 Overall dimensions – VR 225 IP23



Type		Length						Shaft								
		B	L **(1)**	L (2)	Lb* **(1)**	Lb* (2)	W	D **(1)**	D (2)	E **(1)**	E (2)	GA **(1)**	GA (2)	F **(1)**	F (2)	Z
VR 225	S	555	1335	1365	1485	1515	270	75 m6	85 m6	140	170	79,5	90	20	22	M20
	M	615	1395	1425	1545	1575	330									
	L	675	1455	1485	1605	1635	390									
	P	803	1615	/	1765	/	518	85 m6	/	170	/	90	/	22	/	
	X	923	1735	/	1885	/	638									

(1) Standard (2) On request *Lb = motor length with brake

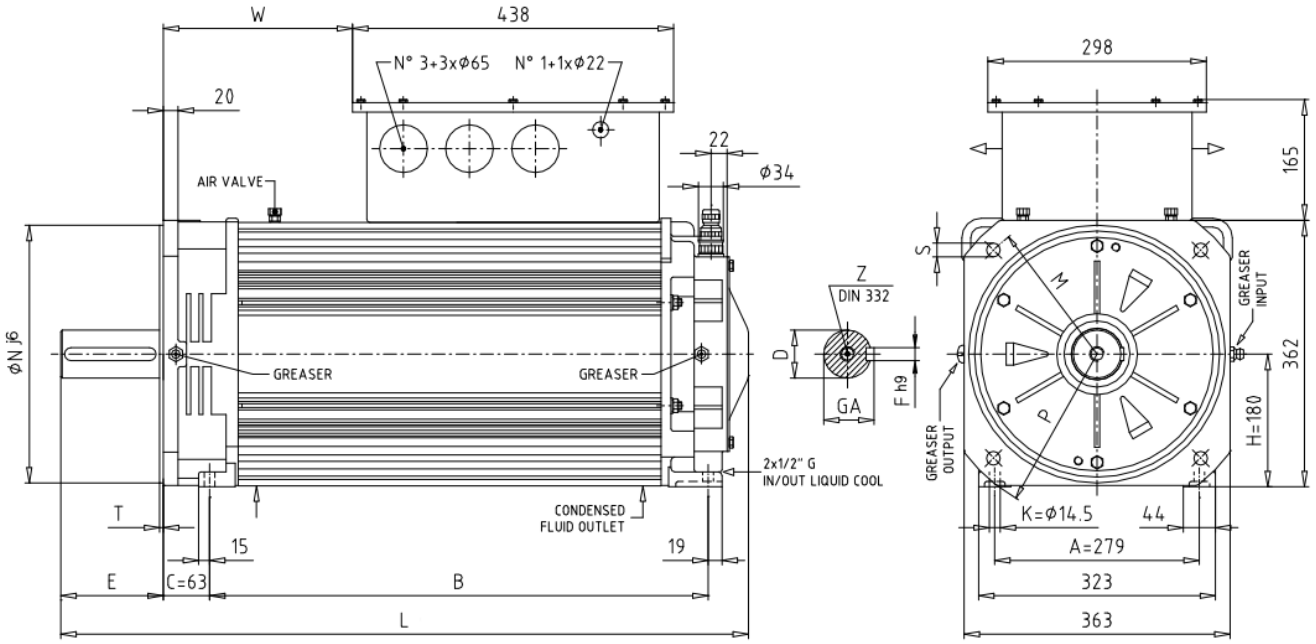
7.8 Overall dimensions – VR 160 IP54 / IP55 Liquid cooling



Type		Length				Shaft					Flange			
		B	L	Lb*	W	D	E	GA	F	Z	P	N	M	S
VR 160	M	513	725	925	204	55 m6	110	59	16	M20	400	300	350	18,5
	L	563	775	975	254									
	P	608	820	1020	299									
	X	735	947	1147	426									

*Lb = motor length with brake

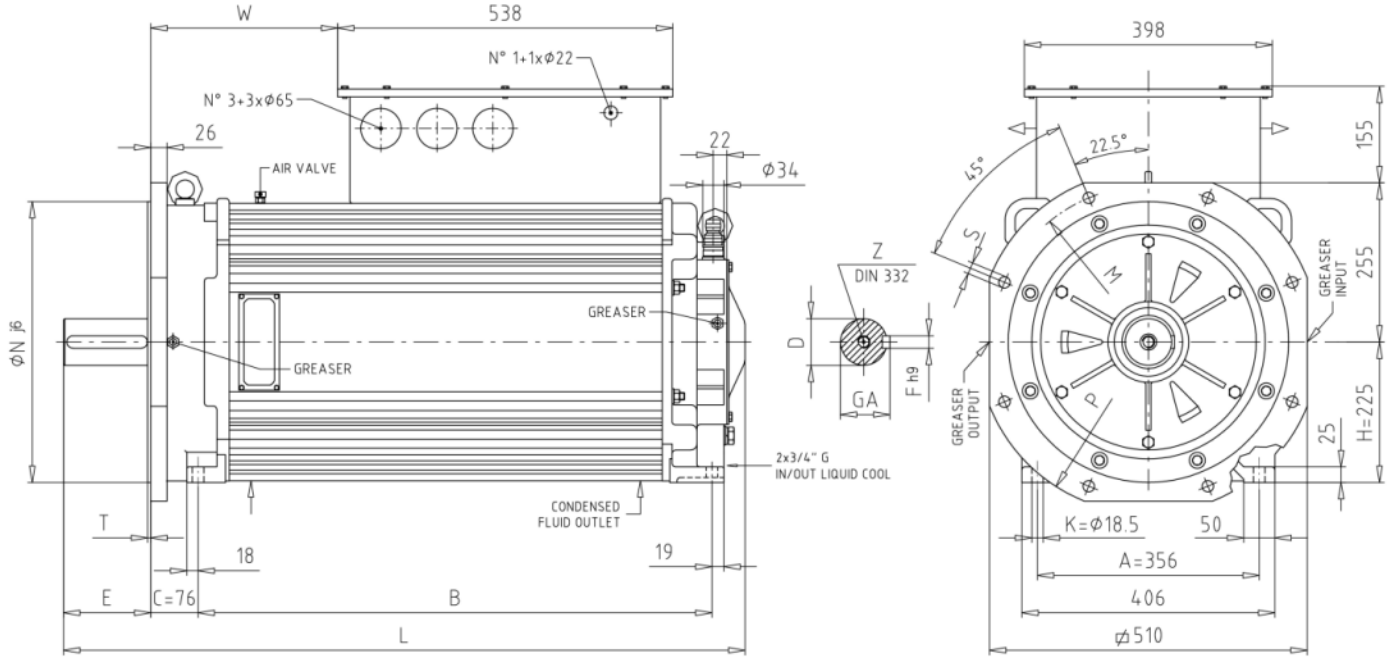
7.9 Overall dimensions – VR 180 IP54 / IP55 Liquid cooling



Type		Length				Shaft					Flange			
		B	L	Lb*	W	D	E	GA	F	Z	P	N	M	S
VR 180	M	680	940	1140	258	65 m6	140	69	18	M20	450	350	400	18,5
	L	750	1010	1210	328									
	X	870	1130	1330	448									

*Lb = motor length with brake

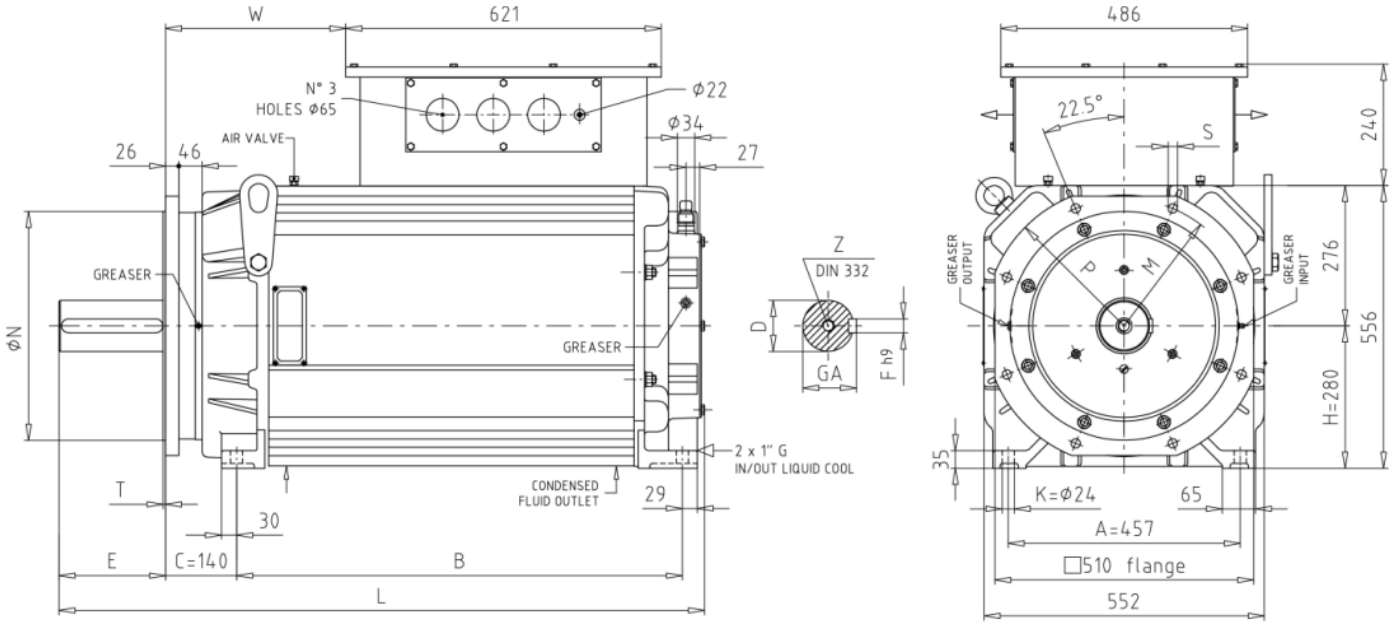
7.10 Overall dimensions – VR 225 IP54 / IP55 Liquid cooling



Type		Length				Shaft					Flange			
		B	L	Lb*	W	D	E	GA	F	Z	P	N	M	S
VR 225	L	825	1095	1295	300	75 m6	140	79,5	20	M20	550	450	500	18,5
	P	905	1205	1405	380	85 m6	170	90	22					
	X	1025	1325	1525	500									

*Lb = motor length with brake

7.11 Overall dimensions – VR 280 IP54 / IP55 Liquid cooling



Type		Length			Shaft					Flange			
		B	L	W	D	E	GA	F	Z	P	N	M	S
VR 280	S	798	1195	275	100	210	106	28	M24	550	450	500	18,5
	M	878	1275	355									
	L	988	1385	465									
	P	1048	1445	525									

8. Electrical connections

8.1 Safety Instructions

WARNING!
Do not perform work on the motor, connecting cables, frequency converters or accessories such as brakes, fans or thermal protection cables when voltage is present.

WARNING!
For cable entries, use cable glands and seals that conform to the type of protection and cable diameter.

WARNING!
The system manufacturer is responsible for proper installation.
Signal and power connectors must be shielded.

The motor must be connected as shown in the diagrams provided.
Observe the EMC instructions and the converter manufacturer's instructions.

When making the connection make sure that:

- The connecting conductors are suitable for the intended use, voltages and currents present.
- Properly sized connecting conductors, anti-twist, anti-kink and anti-thrust terminals as well as anti-kink protectors for the conductors themselves are provided.
- The protective conductor is grounded.
- Grounding is carried out in accordance with local regulations before connecting the motor to the power supply.

With connection by connectors make sure that:

- The signal and power connector ferrules are tightened securely in order to ensure good contact and tightness, and clicks the connector locking protection if provided.

With connection by terminal board make sure that:

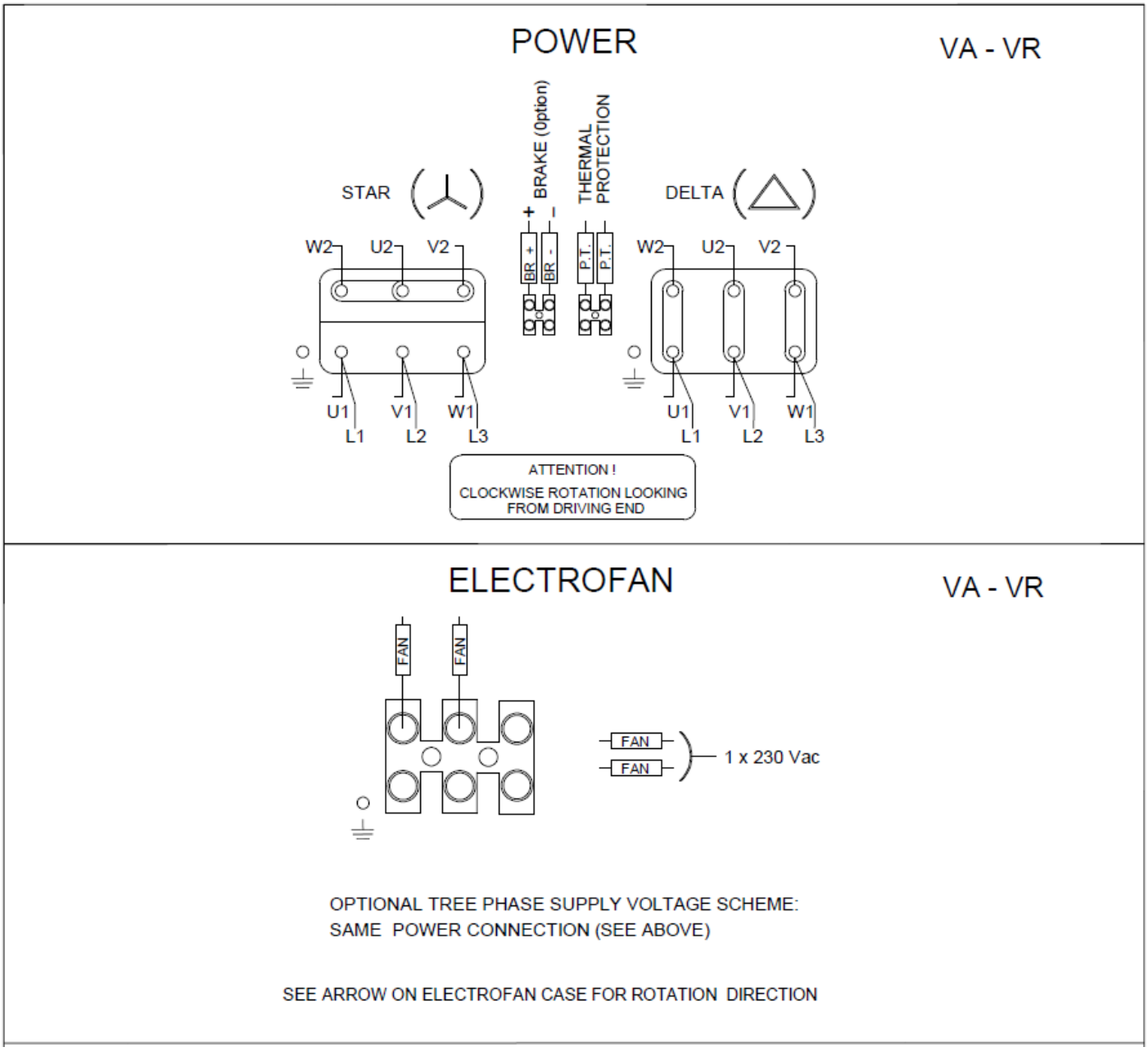
- Conductor ends should be stripped only to the lug or terminal block.
- The size of the lugs must be suitable for the terminals used on the terminal block.
- Comply with terminal tightening torque values.
- The protective conductor or grounding conductor must be connected.
- For large cross sections, the grounding conductor can be divided into three protective conductors, placed symmetrically around the power conductors.
- The inside of the terminal block should be clean and free of residual conductors.
- Avoid accidental dropping of nuts, washers, conductor residues inside the motor through the cable passage hole.
- Pay attention to wires protruding from conductors and observe minimum air gaps between live parts.
- Unused inlets must be closed and sealing elements must be screwed tight to ensure a dust- and water-tight seal.
- Terminal box seals must be properly inserted into their respective housings in order to ensure the correct IP class.

The required tightening torque according to the pin type is given below:

Pin size	Tightening torque [Nm]
M4	1.6
M5	2.5
M6	4
M8	8
M10	13
M12	20
M14	30
M16	40

WARNING!

Tighten the cables on the headstocks observing the tightening torques corresponding to the pin type. Tolerance +0% / -10%



8.2 Transducer (Encoder)

Normally, a hollow-shaft transducer is used on VR motors series.

The transducer body is attached to the rear cover of the motor and is made free to oscillate by means of a torque arm, which is responsible for absorbing any axial/radial misalignment. A 12-pin M23 male (panel or bulkhead feed-through) connector is used for the electrical connection. The female (flying) part with solder contacts is supplied with the transducer as standard.

Always ensure that the electrical data of the transducer is compatible with that of the inverter powering the motor, that the supply voltage is correct, and that the connections are respected.

WARNING!

Do not supply power to the transducer output channels and never run the motor if the transducer has output cables shorted to each other or to ground.

WARNING!

Do not perform the high voltage test on the transducer terminals.

Wiring instructions for the signal flying connector are shown on a sheet located inside the motor terminal box.

Always use a shielded cable for connection to the inverter.

When soldering the flying connector, do not overheat the contacts. Avoid short circuits between the connector contacts.

WARNING!

Failure to comply with any of the above warnings may result in immediate failure of the encoder.

The encoder connection diagram is either attached to the flying connector or placed inside the motor terminal box.

Normally the maximum mechanical rotation speed of the encoder is 9000rpm. Do not exceed this limit to avoid damage to the transducer.

Encoder SICK VFS60 connection:

MALE CONNECTOR:
INTERCONTEC
AKUA020MS06620203.000
(MOUNTED)

PLUG-IN FACE VIEW

FEMALE CONNECTOR:
SIZE M23 12 PINS (FREE)
INTERCONTEC
A ST A 013 FS 13 10 0035 000

PIN	SIGNAL TTL/HTL	EXPLANATION
1	B_	Signal line
2	N.C.	Not connected
3	Z	Signal line
4	Z_	Signal line
5	A	Signal line
6	A_	Signal line
7	N.C.	Not connected
8	B	Signal line
9	N.C.	Not connected
10	GND	Encoder ground connection
11	N.C.	Not connected
12	U_S	Supply voltage (volt-free to housing)
Screen	Screen	Connected to housing on encoder side Connected to ground on control side

8.3 Thermal protector

Thermal motor protection by means of a 150°C bimetallic thermal protector (maximum voltage 250Vac, maximum current 5Aac) built into the windings is provided as standard. The normally closed contact opens when the thermal protector reaches the trip temperature. The connection terminal is normally located inside the terminal box.

Do not perform the high voltage test on the terminals of the thermal protectors.

ATTENZIONE!

Il mancato collegamento delle sonde termiche fa decadere immediatamente la garanzia sul prodotto.

Other thermal protector (PT1000, PT100, PTC, KTY84/130) are available on request and located inside the terminal box.

9. Transportation and storage

9.1 Transport conditions

If present, use only the specially provided lifting hooks for transport.

WARNING!

Check before lifting that the hooks are tightly screwed in and the load is balanced.
The hooks are sized for the weight of the motor; do not add other weights.
Do not use the hooks if the temperature is below -20°C.

WARNING!

Do not lift the motor by grasping the shaft-the plastic shaft cover could slip off, causing the motor to fall, resulting in injury or damage.

All the motors manufactured by Brusatori leave the factory in optimal conditions after being inspected and tested.
Upon arrival, check the motor carefully to ensure that it has not been damaged during transport.
If you notice any abnormalities or damage, contact the manufacturer as soon as possible, and do not put the motor into service.

9.2 Storage conditions

For proper storage, the ambient temperature must be between -20°C and +50°C.
If the machines are stored, place them horizontally and pay attention that the environment is dry, dust-free and vibration-free.
Manually rotate the motor shaft every 2-3 months.
Measure the insulation resistance at a temperature between 20 and 30°C (maximum voltage 1000Vdc) before starting the motor for the first time, ensuring that it is at least 10 MΩ.
If not, dry the winding.
To dry the winding, the oven temperature must be 80°C for 10-15 hours.

10. Installation

10.1 Mounting

WARNING!
The motors are designed exclusively for installation in industrial environments.
Different installations are permitted only if all necessary precautions are taken by the machine/plant manufacturer to ensure safe operation.

Read the entire manual carefully before performing any operation.

Any installation operation must be carried out by qualified personnel, with tools appropriate to the type of operation.

Provide good fastening of feet and flanges.
For mounting IM B5 (IM 3001) flange motors, the motor support frame must be sized to prevent the transfer of vibration to the motor and the occurrence of vibration due to resonance.
For mounting IM B3 (IM 1001) and IM B35 (IM 2001) motors, the motor support frame must be sized to prevent the transfer of vibration to the motor and the occurrence of vibration due to resonance.

WARNING!
The motor should be mounted in such a way as to ensure adequate heat dissipation without impeding ventilation.
The opposite side of the flange should NOT be thermally insulated, as it is necessary for heat dissipation.

For all the motors, excluded VA160 S - M is mandatoru IM B35 (IM 2001) or IM B3 (IM 1001) mounting form to avoid bending and/or deformation of the flange/drive shaft. For mounting motors with IM B3 and IMB35 feet, the crankcase must be flat, rigid, and solid. When mounting some motors, it is necessary to remove the protective doors, which must then be positioned as originally. During the mounting stages be careful not to damage the windings. If IM B35 mounting for long motors is not possible, it would be strongly recommended to use a support placed at the back shield, which should not be rigid but provided with cup springs or compressible rubber supports. The thrust to be exerted by the support can be quantified at 50 percent of the total weight of the motor.

WARNING!
In the case of upright installations with the shaft facing upward make sure that no liquid of any kind can seep into the upper bearing.
In the case of direct coupling in oil bath make sure that the oil seal complete with spring is fitted.

WARNING!
In the case of direct coupling (shaft engaged), with gears and with a gearbox, it is absolutely essential to carry out exact alignment between the motor shaft and driven shaft and between the coupling flanges. Otherwise, severe vibrations, irregularities in motion, unwanted axial thrusts and breakage of the drive shaft may occur.

When coupling with belts, install the motor with the shaft perfectly parallel and aligned with that of the pulley to avoid axial thrusts on the supports. The belt pull must not exceed the maximum applicable load under any circumstances. The axial load must not exceed 20 percent of the maximum radial load indicated at the rated speed of the motor.

WARNING!
Excessive belt tension can cause rapid bearing wear and shaft failure.

Attach or remove drive elements (pulley, coupling, gear wheel, etc.) only with appropriate devices (for example, heating the drive element or using the threaded hole on the shaft end).

WARNING!
Never fit half couplings or pulleys using a hammer, or remove them using a lever infulcated against the motor body.
Before keying the transmission part, remove the anti-rust paint from the drive shaft and keyway using alcohol or appropriate solvents.
It is important that the solvent does not get inside the bearings.

Grease the shaft end and keyway before keying the transmission organ.
Observe the general safety measures for protecting the transmission organ against contact.

WARNING!

Absolutely avoid striking or exerting pressure on the shaft end.

WARNING!
The use of damaged or unsuitable components may result in personal injury or property damage.

The motor flange should be fastened directly to the machine using appropriate screws.
Observe the correct tightening torques, using the correct equipment.

10.2 Ventilation

The motors are equipped with a single-phase electric fan powered by 230Vac 50/60Hz or a three-phase electric fan powered by 400/460 Vac 50/60Hz.

Air flow can be supply or suction depending on the type of motor and fan chosen. The minimum distance between the machine structure and the motor hot air outlet should be at least 80 mm.

For installations in harsh environmental conditions due to the presence of a lot of dust, water, high humidity, mist, water-oil vapors, etc., it is necessary to use motors with IP54 protection rating. Under these operating conditions, periodic maintenance of the fan and motor is required to remove dirt deposits from the impeller/fan blades and fan channels.

For motors with IP23 protection, it is essential to ascertain the quality of the cooling air. Make sure that the air drawn in by the fan is always cool, clean and dry. An air filter is available for this type of motor and can be installed on the fan.

Shut-off doors should always be installed before starting the motor. Air sucked in/blown out by the fan should always pass completely through the stator in the longitudinal direction and out the other side.

10.3 Commissioning

The following points should be checked before commissioning:

- The rotor must be able to rotate freely (supply the brake if necessary).
- The correct installation of the drive elements must be checked.
- All electrical connections and connecting elements must be carefully made and tightened.
- The protective and grounding conductor must be properly connected.
- Any auxiliary devices must be working (brake, fan, etc.).
- It is opportune to take appropriate safety measures against contact with moving and live parts.

WARNING!
Make sure the brake (if provided) is working properly.
The brake is only suitable for a limited number of emergency braking.
Use as a working brake is not permitted.

WARNING!

Always use safety devices, even during testing operations.

WARNING!
Drives can cause high voltage stresses on the motor winding, so it is necessary to check with appropriate oscilloscope and trained personnel that the voltage values at the terminal box terminals are not too high due to long wiring and/or from the voltage and frequency of the inverter supply.

It should be noted that the cause of this phenomenon is external to the motor.

In such cases, it is recommended that suitable filters be inserted between the inverter and motor to reduce $\frac{dV}{dt}$ surges, and the use of symmetrical shielded cables.

WARNING!
This list of verifications may be incomplete, so additional verifications may be necessary.

11. Maintenance

11.1 Instructions on maintenance

WARNING!

Before starting any work on the motors and before opening any cover of active parts, be sure to:

- Cut the power to the motor.
- Blocking re-insertion.
- Verify that there is no voltage.
- Check for proper grounding.
- Cover or separate adjacent live parts.

In addition to the main circuits, any auxiliary or supplementary circuits must also be disconnected.
These safety measures can be abandoned only after maintenance work is completed and the motor has been completely reassembled.

All work should be carried out with the motor disconnected.

All standard motors mount pre-lubricated ball bearings for life, which require no maintenance.
Every 2000 hours of operation, it is good to check their temperature and vibration. However, it is recommended to replace the bearings after about 20000 operating hours, at the latest after three years.
The bearings and their greases should be suitable for a temperature range of -30° to +140°C.

For motors equipped with a grease nipple, it is necessary to comply with the re-lubrication intervals recommended by the manufacturer:

VR160 ROLLER BEARING LUBRICATION INTERVAL			
Bearing Type	RPM	Operation time (h)	Grease quantity (g)
NU 312 EC	580	6000	35
	1000	4500	
	1500	3500	
	2000	2700	
	2500	2000	
	3000	1500	

VR180 ROLLER BEARING LUBRICATION INTERVAL			
Bearing Type	RPM	Operation time (h)	Grease quantity (g)
NU 314 C3	580	6000	40
	1000	4500	
	1500	3500	
	2000	2700	
	2500	2000	
	3000	1500	

VR225 ROLLER BEARING LUBRICATION INTERVAL			
Bearing Type	RPM	Operation time (h)	Grease quantity (g)
NU 318	580	4000	75
	1000	2500	
	1500	2000	
	2000	1500	
	2500	1000	
	3000	1000	

VR280 ROLLER BEARING LUBRICATION INTERVAL			
Bearing Type	RPM	Operation time (h)	Grease quantity (g)
NU 222 EC	580	4000	100
	1000	2500	
	1500	2000	
	2000	1500	
	2500	1000	
	3000	1000	

In the case of ball bearings with grease nipple (option available on request), the quantities of grease for re-lubrication are the same as for roller bearings.

TYPES OF GREASE TO USE FOR ROLLER AND BALL BEARINGS			
Manufacturer	Grease type	Composition	Color
Petro-Canada	Peerless LLG	Mineral calcium sulfanato	Red
Petro-Canada	Precision XL EMB	Mineral lithium complex	Blue
Brugarolas	G.Beslux Komplex M-2	Mineral with polyurea	Cream
Lubcon	Turmogrease N 502	Mineral with polyurea	Yellow
Shell	Alvania R3	Mineral with lithium	Brown

The quantity of grease indicated in the table is valid only for re-lubricating bearings.
If the grease is compatible but not identical to the existing grease, double the quantity in order to replace all the grease in the bearing.

Ambient temperature, operating speed and the type of lubricant used can significantly affect the frequency of intervention. For further information, please contact our technical department.

For spare parts, specify in detail all nameplate data of the motor or accessory to which they relate, with any options requested in the order.

WARNING!

This manual, along with any additional safety information, must be kept!

Unless expressly authorized by the manufacturer, any repairs performed by the end user will void the manufacturer's responsibility for the conformity of the motor supplied.

We recommend that maintenance work be performed in our service center.

Unprotected machined surfaces (flanges and shaft ends) should be treated with anticorrosive products.
Cleaning the motor can damage it if done incorrectly.
Use only appropriate products.
Avoid contact of products with oil seals and gaskets to prevent damage.

11.2 Troubleshooting

Note:
This list cannot be considered complete. If you have any doubts consult our technical office.

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
Motor does not start	No power supply	Check power supply, Check drive connections
	No brake release	Check brake connection or if there are any faults
	Encoder/resolver malfunction	Check wirings and connections, look for any encoder/resolver faults
Motor runs slowly or not as intended	Inverter malfunctioning, wrong connection or wiring	Confront that displayed and nominal values corresponds, check the inverter settings and connection
	Encoder/resolver malfunction	Check wirings and connections, look for any encoder/resolver faults
Motor overheats	Abnormal operating values, cooling problems	Verify that the fan works correctly
	Thermal protection malfunctioning	Check that thermal protection works correctly
	Overload, abnormal power supplied, inverter fault	Confront nominal values and values displayed
	No brake release	Check that the brake works correctly
Brake does not work	Brake fault, wrong brake connection/wiring	Check connections, check if the brake is damaged
Vibrations	Abnormal balance, worn out bearings, fixing screws loose	Balance the motor correctly, tighten loosen screws, replace worn out bearings
High noise level	Foreign bodies inside the motor, wrong inverter settings	Verify the presence of any foreign bodies inside the motor, check inverter settings
Other problems not listed here	Instructions not followed or accidental fault	Immediately contact our technical office

12. Disposal

Refer to the nature of the material and current regulations regarding the dismantling and disposal of electrical equipment, so as to limit the impact on the environment and avoid ecological damage.

13. Certifications

13.1 RoHS directive

All motors in the present manual comply with Directive 2011/65/EU (RoHS Directive) and following Delegated Directives, on limitation of hazardous substances.

13.2 EMC directive

Electrical motors are not covered by Directive 2014/30/EU (EMC Directive) on Electromagnetic Compatibility.
All motors in the present manual comply with EMC Directive if said motors are equipped with electronic components, because the installed devices have been verified compliant to said Directive.

13.3 EU Declaration of Conformity

Most recent version of the Declaration of Conformity can be found on Brusatori website.

13.4 Quality management system ISO 9001: 2015

Most recent version of the document can be found on Brusatori website.

13.5 UL/CSA Certificate of compliance (optional)

Most recent version of UL and CSA certificates of compliance can be found on Brusatori website.

14. Contact

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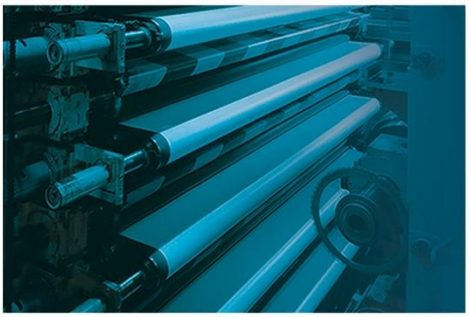
Note

Applications

TEXTIL

Ironers, dryers, vaporizers, calenders



PRINTING

Rotogravure printing machines, flexographic printing machines, converting lines, laminators, coating lines

PLASTICS

Extrusion lines, pipe machines, profile machines, stretch lines, tape lines, recycling

MACHINE TOOLS

Grinders, milling machines, machining centers, sawing machines

METALS

Winders-unwinders, loaders and stackers, tube lines, drawing lines, cable production lines, longitudinal and transverse cutting lines

PAPER

Winders-unwinders, cutters, rewinders, wrappers

Brusatori

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