

VR

SPEED VARIATORS
with dry friction ring



CONTENTS		
Description	2-3	
Service factors	3	
Torque selection.....	4	
Mounting positions	5	
External loads	5	
Selection tables		
Versions.....	6-7	
MVR, FVR.....	8	
Dimensions		
FVR-B5	9	
FVR-B3	10	
General information		
Component parts.....	11	
Gearbox coupling	12	
Operation and Maintenance	12	

VR Variators

Description



The variators series VR have a continuous and adjustable 5:1 speed range performed by a patented motor sliding mechanism on cylindrical ways avoiding backlash and vibrations.

A unique fully-sealed inner arrangement prevents foreign matter from entering the variator housing and allowing the protection grade IP66 as standard.

The speed ratio can be changed whether the motor is running or not.

On the contrary of other types of variators, no “tracking” or wearing of cone surface occurs also when speed is kept constant over a long period of time.

The variator mechanism is dry running (pack greased cam and roller bearings), while gearboxes coupled to the variator are oil filled before despatch, the lubricant type is marked on name plate.

All Varvel products are guaranteed for 12 months from delivery date against manufacturing defects.

Speed ratios

VR variators are manufactured without fixed reduction as standards but all the types of Varvel gearboxes can be directly plugged in.

Incorporation of 2 or 3 stage helical, parallel shaft, bevel/helical (in-line or right-angle) and worm gearboxes is easily done with input flange to match IEC motors giving a wide choice of speed ranges.

Output speeds listed in selection tables are rounded and referred to the input speed of 1500 rpm.

Actual values are depending on real reduction ratio, motor size and load, and mains conditions.

Variator operation

The speed is adjusted by a manually operated hand wheel, fitted on the top of the casing.

Versions with fixed reduction: the hand wheel position can be easily set to either sides by a 90° rotation of the variator on its centre line.

A two-stage worm-servomotor fitted to the variator, including limit switches for speed ratio control, provides a convenient alternative at little extra cost.

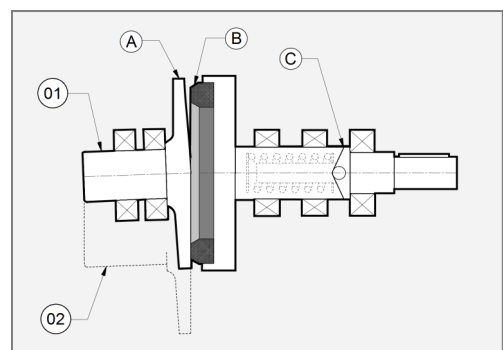
Working principle

The cone (A) is driven by the input shaft at constant speed and held in contact with the graphite ring (B) by the spring force when idling or starting up.

The force between the two parts is then adjusted, smoothly and automatically, by the cam (C) as soon as the load torque requirements at output shaft are modified.

To vary the speed, the cone (A) is moved between position (01)

- output speed = input speed
and position (02)
- output speed = 0.2 times the input speed.



Variators VR

Description, Service factors

	General specifications
Range	4 sizes VR 63, 71, 80, 90
Gearboxes RD	7 sizes - 28 reduction ratios - 2300 Nm max. torque
Gearboxes RN	6 sizes - 42 reduction ratios - 3400 Nm max. torque
Gearboxes RO/RV	6 sizes - 33 reduction ratios - 3400 Nm max. torque
Gearboxes RS/RT	RS - 9 sizes and RT - 7 sizes - 55 reduction ratios - 3020 Nm max. torque
Housing Covers	Pressure die cast aluminium AlSi12Cu2Fe till size VR071 and cast iron from VR080.
Friction ring	Graphite
Toothed parts	Helical gears: case hardened, ground or shaved. Wormshafts: case hardened with ground ZI profile. Bronze gears: CuSn12 on cast iron hub.
Shafts Keys	Steel C43 Shafts h7 - Bores E8 Keys according to DIN6885 B1
Bearings	Ball or roller bearings according to sizes and technical requirements
Oil seals	Type NB - nitril-butadiene with additional anti-dust lip according to DIN 3760
Lubricant	- SHELL Retinax Grease: variator's cam zone. - SHELL Omala S4 WE320: gearboxes.
Powder coating	VR63 and VR71: real aluminium, not painted. VR80 and VR90: Epoxy powder paint, RAL7012

Service Factors

Service factor FS1.0 is meant as typical of 8-10 hours/day operation, with uniform load and starts/ stops lower than 6 per hour and ambient temperature between 15 and 35 Celsius.

The ratio between the drive's maximum output torque M_2 and application torque $M_{(app)}$ defines the drive's Duty Factor that must be equal or bigger than the Service Factor SF.

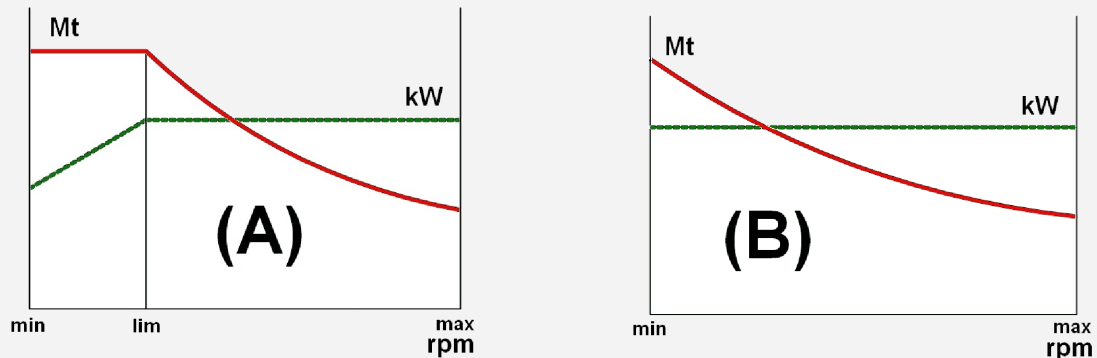
For max. ambient temperature exceeding 40 °C or below 0 °C, please ask our Customer Service.

For other operation conditions, the service factors of the two tables have to be multiplied accordingly.

Type of Load				Start-Stops per hour		Service Factor $SF = SF_1 \times SF_2$
hours	uniform SF_1	variable SF_1	with shocks SF_1	number	SF_2	
< 8	0.8	1.0	1.5	6	1.0	
8 - 16	1.0	1.3	1.8	60	1.2	
24	1.4	1.6	2.0	120	1.4	

VR Variators

Torque selection



Selection and torque limitations

The values as listed in the selection tables are worked out considering that

- the torque given by the variator is limited by the max. value transmissible by the friction ring;
- the torque delivered by variator-gearbox matches the uniform load conditions throughout the variation range.
In any case, the max. transmissible torque [$M_{t_{max}}$] must be assumed as the transmissible torque at max. speed according to the formula

$$M_{t_{max}} \text{ [Nm]} = \frac{9550 \cdot kW_{max}}{rpm_{max}}$$

- the variator works at full load only at max. speed and that the transmissible power at other speeds is lower as follows

$$kW_{min} = \frac{kW_{max} \cdot rpm_{min}}{rpm_{max}}$$

Graph (A): Selection with three values of torque/speeds

$M_{t_{min}}$ = max. torque value at the lowest speed ($M_{t_{lim}}$)

$M_{t_{lim}}$ = top speed max. limit torque (a torque limiter set to $M_{t_{lim}}$ should be provided for enhanced safety purposes)

$M_{t_{max}}$ = top speed max. torque value

rpm_{min} = lowest speed

rpm_{lim} = speed giving the limit value of the torque

rpm_{max} = top speed

On speed decreasing, torque is increasing from $M_{t_{max}}$ and $M_{t_{lim}}$ and constant from $M_{t_{lim}}$ and $M_{t_{min}}$.

Graph (B): Selection with two values of torque and speed

$M_{t_{min}}$ = lowest speed max. torque

$M_{t_{max}}$ = top speed max. torque

rpm_{min} = lowest speed

rpm_{max} = top speed

On speed decreasing, torque is increasing all over the variation range from $M_{t_{max}}$ to $M_{t_{min}}$.

It is recommended the max. speed selection of the variator matches the max. speed of the driven machine.

All the reduction ratios of the selection tables of

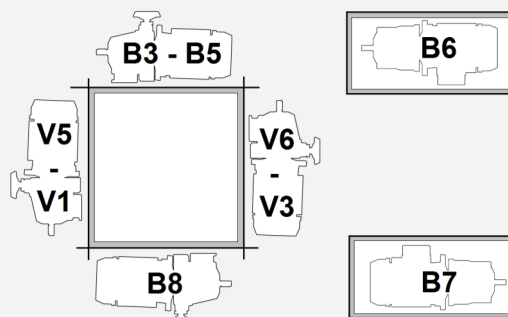
- helical gearboxes RD,
- parallel shaft RN,
- bevel/helical RO, RO-2 and RV,
- and worm boxes RS and RT

are available to get lower speed ratios and it is recommended to check the speed value rpm_{lim} if needed.

The max. torque available may in some cases be limited by the capacity of gears to transmit it. It is then essential to check the required torque against the figures given in the performance tables.

Variators VR

Mounting and External loads



Manufacturing forms

Two constructions are available for all the sizes and manufacturing forms:

- MVR
variable speed drive with electric motor
- FVR
variator ready to IEC-B5 electric motor coupling.

Unless differently stated at order, the variators are manufactured for horizontal operation and with B5 flange mounting for coupling to a helical or worm gearbox.

Variator only output loads

The listed output radial loads (OHL) refer to the variator only without any gearbox fitted.

No axial load can be admitted at the output shaft, to avoid damages to the bearings and to the torque adjusting cam.

In case of variator/gearbox unit, please refer to relative gearbox catalogue.

Just the variator	Radial loads (OHL)		Axial loads
	300 rpm	1500 rpm	
MVR063	250 N	150 N	No axial load allowed
MVR071	350 N	200 N	
MVR080	500 N	300 N	
MVR090	800 N	500 N	

VR Variators

Versions

MRV

- Variable speed motors without fixed reduction
- Powers: 0.09 kW to 1.5 kW, 4 poles
- Output speed: 300 rpm to 1500 rpm

MVR/FRS

- Variable speed motors with worm speed reducer (conventional type)
- Output torques: 1.6 ± 0.5 Nm to 25 ± 8 Nm
- Reduction ratios: 5:1 to 50:1

MVR/FRT

- Variable speed motors with worm speed reducer (universal type)
- Variator only output torques: 1.6 ± 0.5 Nm to 25 ± 8 Nm
- Reduction ratios: 5:1 to 50:1

MVR/FRD

- Variable speed motors with helical speed reducer
- Variator only output torques: 1.6 ± 0.5 Nm to 25 ± 8 Nm
- Reduction ratios: 2.25:1 to 630:1 (2 and 3 stages)



Variators VR

Versions

MRV/FRN

- Variable speed motors with parallel shaft gearbox (2 and 3 stages)
 Variator only output torques: 1.6÷0.5 Nm to 25÷8 Nm
 Reduction ratios: 6.3:1 to 630:1

MVR/FRO

- Variable speed motors with bevel helical gearbox (in-line version, 3 stages)
 Variator only output torques: 1.6÷0.5 Nm to 25÷8 Nm
 Reduction ratios: 6.3:1 to 315:1

MVR/FRO-2

- Variable speed motors with bevel helical gearbox (right angle version, 2 stages)
 Variator only output torques: 1.6÷0.5 Nm to 25÷8 Nm
 Reduction ratios: 5:1 to 54.7:1

MVR/FRV

- Variable speed motors with bevel helical gearbox (right angle version, 3 stages)
 Variator only output torques: 1.6÷0.5 Nm to 25÷8 Nm
 Reduction ratios: 6.3:1 to 315:1



VR Variators

Selection table

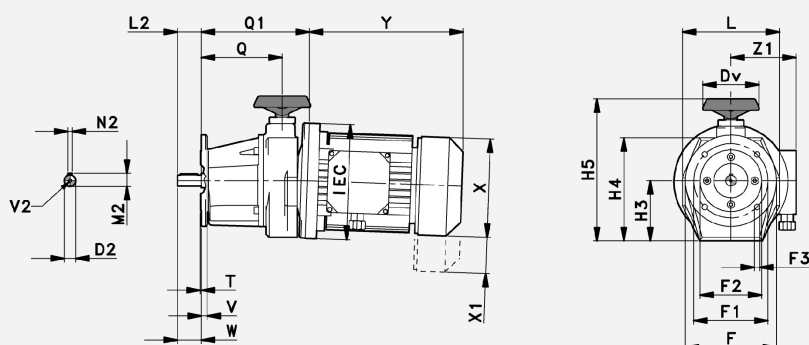


Motor [kW]	Type	Output speed [rpm] min ÷ max	Output torque [Nm] min ÷ max	Efficiency [η] min ÷ max	Weight MVR [kg]	Weight FVR [kg]
MVR063	0.09	300 ÷ 1500	1.6 ÷ 0.5	0.55 ÷ 0.82	6.5	3.0
	0.12	300 ÷ 1500	2.3 ÷ 0.8	0.55 ÷ 0.82	6.5	3.0
	0.18	300 ÷ 1500	3.3 ÷ 1.0	0.55 ÷ 0.82	7.0	3.0
MVR071	0.25	300 ÷ 1500	4.3 ÷ 1.4	0.55 ÷ 0.82	11.3	5.3
	0.37	300 ÷ 1500	6.5 ÷ 2.0	0.55 ÷ 0.82	12.5	5.3
MVR080	0.55	300 ÷ 1500	9.5 ÷ 3.0	0.55 ÷ 0.82	21	12
	0.75	300 ÷ 1500	12 ÷ 4.0	0.55 ÷ 0.82	23	12
MVR090	1.1	300 ÷ 1500	19 ÷ 6.0	0.55 ÷ 0.82	35	23
	1.5	300 ÷ 1500	25 ÷ 8.0	0.55 ÷ 0.82	37	23

4-poles motor powers

Variators VR

Overall dimensions

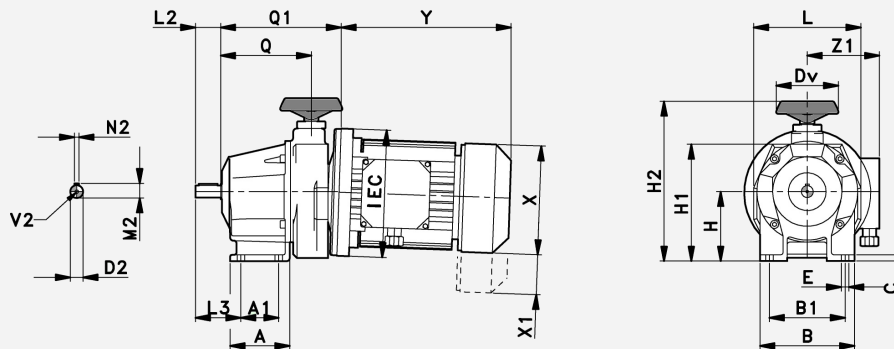


MVR - B5	063 IEC56/B5	063 IEC63/B5	071 IEC71/B5	080 IEC80/B5	090 IEC90/B5
D2	11	11	14	19	24
Dv	80	80	80	100	100
F	140	140	160	200	200
F1	115	115	130	165	165
F2	95	95	110	130	130
F3	9	9	10.5	11	11
H3	70	70	87.5	105	133.5
H4	118	118	150	180	225
H5	188	188	216	255	312
L	120	120	130	170	215
L2	23	23	30	40	50
M2	12.5	12.5	16	21.5	27
N2	4	4	5	6	8
Q	101	101	123	146	176
Q1	136	136	164	195	239
T	2.5	2.5	2.5	2.5	2.5
V	10	10	10	11	12
V2	M4x10	M4x10	M6x15	M6x15	M8x20
W	23	23	30	40	50
X	108	122	137	158	177
X1	26	26	31	38	50
Y	166	185	210	230	270
Z1	93	97	107	118	149
IEC	56	63	71	80	90
n	8.8	8.8	10.3	9.5	12.5

Not binding dimensions and weights

VR Variators

Overall dimensions

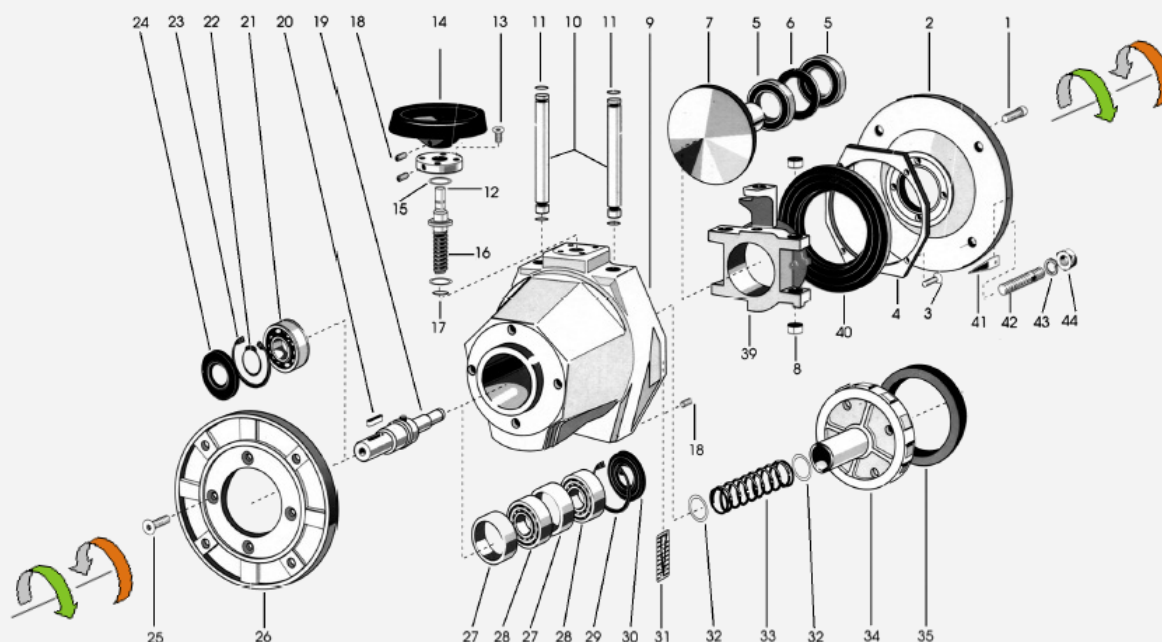


MVR - B3	063	063	071	080	090
A	60	60	80	95	120
A1	40	40	50	60	80
B	90	90	110	140	180
B1	70	70	90	110	140
C	8	8	10	12	16
D2	11	11	14	19	24
Dv	80	80	80	100	100
E	9	9	11	14	16
H	71	71	90	110	140
H1	118	118	150	185	230
H2	189	189	219	258	316
L	120	120	130	170	215
L2	23	23	30	40	50
L3	41	41	52	68	85
M2	12.5	12.5	16	21.5	27
N2	4	4	5	6	8
Q	101	101	123	146	176
Q1	136	136	193	236	286
V2	M4x10	M4x10	M6x15	M6x15	M8x20
X	108	122	137	158	177
X1	26	26	31	38	50
Y	166	185	210	230	270
Z1	93	97	107	118	149
IEC	56	63	71	80	90
n	8.8	8.8	10.3	9.5	12.5

Not binding dimensions and weights

Variators VR

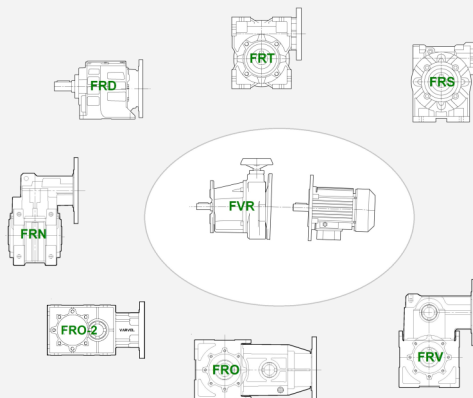
Component parts



01	Screw	22	Seeger ring
02	Flange	23	Seeger ring
03	Screw	24	Oil seal
04	Seal plate	25	Screw
05	Bearing	26	Output flange
06	Spacer	27	Spacer
07	Cone	28	Bearing
08	Bush	29	Seeger ring
09	Housing	30	Oil seal
10	Cylindrical slide	31	Index scale
11	Oil seal	32	Washer
12	Washer	33	Spring
13	Screw	34	Driving flange
14	Hand wheel	35	Friction ring
15	Control lock	39	Cone support
16	Control shaft	40	Bellow seal
17	Oil seal	41	Index
18	Screw	42	Screw
19	Output shaft	43	Washer
20	Key	44	Nut
21	Bearing		

VR Variators

Gearbox fitting



Please ask for the individual catalogues of the gearboxes

- RD helical,
- RN parallel,
- RO and RO2 in-line bevel/helical,
- RV right-angle bevel/helical,
- RS original worm,
- RT universal worm

to select the needed reduction ratios and torques of the motor-variator-gearbox combinations:

Abstract of

OPERATION AND MAINTENANCE INSTRUCTIONS

(complete manual on www.varvel.com)

Under the terms of the Machine Directive 2006/42/EC and relevant Guidelines, the speed gearboxes and variators are considered as "machines" separate elements not having a specific application and meant for being incorporated onto the machine. The complete machine and equipped with such components must comply with the essential and relevant requisites for safety and health preservation" of the mentioned Directive.

Installation

Check if the unit to be installed. is properly selected to perform the required function and that its mounting position complies with the order.

The nameplate reports such information.

Check mounting stability to ensure the unit runs without vibrations or overloads.

Running

The unit may be connected for clockwise or counter-clockwise rotation.

The unit must be stopped as soon as defective running or unexpected noise occur. remove the faulty part or return the unit to the factory for checking.

If the faulty part is not replaced. other parts can also be affected. causing more severe damage and making the identification of initial cause more difficult.

Maintenance

Although the units are no-load run tested in the factory before despatch. it is recommended not to run them at maximum load for the first 20-30 running hours to allow the proper running in.

The gearboxes are delivered already filled with long-life synthetic oil and. in case of replacement or topping. do not mix with mineral lubricants.

Handling

When hoisting. use relevant housing locations or eyebolts if provided. or foot or flange holes

Never hoist on any moving part.

Painting

Carefully protect oil seals. coupling faces and shafts when units are re-painted.

Long-term storage

For storages longer than three months. apply anti-oxidants onto shafts and machined surfaces. and protective grease on oil seal lips.

Product's Environmental Management

In conformity with Environmental Certification ISO 14001. we recommend the following to dispose of our products:

- scraped components of the units to be delivered to authorized centres for metal object collection;
- oils and lubricants drained from the units to be delivered to Exhausted Oil Unions;
- packages (pallets. carton boxes. paper. plastic. etc..) to lead into regeneration/recycling circuits as far as possible. by delivering separate waste classes to authorized companies.

D00-VR-STD-EN-ED01-REV00