VR

SPEED VARIATORS
DRY FRICTION TYPE

MVR - Variable speed drive
FVR - Variator with input IEC
The variators series VR have a continuous and adjustable speed range of 5:1 performed without backlash and vibrations by a patented motor sliding mechanism on cylindrical ways.

An unique inner fully-sealed arrangement prevents foreign matter from entering the variator housing allowing the protection grade IP56 as standard, and IP66 on demand.

The generously sized friction ring is made of long life operation graphite to the utmost overload reliability and lifetime of the unit.

The speed ratio can be changed whether the motor is running or not and, on the contrary of other types of variators, no “tracking” or wearing of cone surface occur also when the ratio is kept constant, even 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, lubricant type is marked on name.

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

### GENERAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
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<tbody>
<tr>
<td><strong>Range</strong></td>
<td>4 sizes VR 63, 71, 80, 90,</td>
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<tr>
<td><strong>Helical gearboxes to couple Series RD</strong></td>
<td>7 sizes 28 reduction ratios 2500 Nm max. torque</td>
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<tr>
<td><strong>Worm gearboxes to couple Series RS and RT</strong></td>
<td>9 sizes (RS) - 7 sizes (RT) 34 reduction ratios 3020 Nm max. torque</td>
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<tr>
<td><strong>Housing, Covers</strong></td>
<td>Aluminium die cast AlSi12Cu2Fe for VR63 and VR71 Cast iron G25 for VR80 and VR90</td>
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<tr>
<td><strong>Toothed parts</strong></td>
<td>Helical gears of steel 20MnCr5 case hardened, involute ground or shaved. Worm screws of steel 20MnCr5 case hardened, profile ZK ground. Wormwheels of bronze CuSn12 cast on cast iron hub.</td>
</tr>
<tr>
<td><strong>Shafts &amp; Keys</strong></td>
<td>Alloyed steel C43 Tolerances: Shafts h6 - Bores E8 Keys according to DIN6885 B1</td>
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<tr>
<td><strong>Bearings</strong></td>
<td>Ball or roller according to size and technical specifications.</td>
</tr>
<tr>
<td><strong>Oil seals</strong></td>
<td>Type NB - nitrile-butadiene with second dust proof lip according to DIN 3760</td>
</tr>
<tr>
<td><strong>Painting</strong></td>
<td>VR63 e VR71: aluminium cast unpainted VR80 e VR90: epoxy powders, colour RAL 7012</td>
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</table>
Operating principle
The cone A) is driver 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 1 (output speed = input speed) and position 2 (output speed = 0.2 times the input speed).

Directive 94/9/CE (ATEX)
The variators series VR are validated according to Directive ATEX for operations in
- Areas of Group II
- Category 2
- Gases 2G or 3G
- Dusts 2D or 3D
- Constructional Safety "c"
- Protection Class IP66
- Temperature $T_{\text{max}}=185^\circ\text{C}$ (or $T_{\text{max}}=135^\circ\text{C}$ and $T_{\text{amb}} = -20 / +55^\circ\text{C}$)

ATEX validation needs the mandatory installation of inner probe device to monitoring speed slipping (A).
Ask for specific information to operate in environments subjected to ATEX prescriptions.
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Electric motors
The electric motors are supplied with voltage 230/400V, three-phase, frequency 50Hz, 4 poles, temperature class F at ambient temperature 40 Celsius, protection IP55, in flanged execution B5.
On request, motors according to different specifications, high torque single-phase, brake-motors, explosion proof, dual-speed motors.
The terminal box is located as standard on the left side when looking from motor fan side.

Speed ratios
MVR drives are available with or without fixed reduction.
The incorporation of 2 or 3 stages helical or worm gearboxes both with input flange and hollow shaft according to IEC metric sizes, give a large number of speed ranges.
The output speeds listed in the selection tables are rounded off and speeds refer to an input speed of 1500 rpm.
Actual figures depend however on the real reduction ratio, the size and the load of the motor, and the conditions of AC main supply.

Selection and torque limitations
The torque values as listed in the selection tables are worked out on the assumption that
- the torque given by the variator mechanism is limited by the max. value transmissible by the friction ring;
- the torque given by variator/gearbox unit matches the uniform load conditions throughout the variation ratio;
- in any case, the max. transmissible torque \( M_{t_{\text{max}}} \) must be assumed same as the transmissible one at max. speed following the formula:
  \[
  M_{t_{\text{max}}} \ [Nm] = 9550 \times \frac{kW_{\text{max}}} {rpm_{\text{max}}}
  \]
- the variator works at full load only at max. speed and that the transmissible power at the other speeds is lower as follows
  \[
  kW_{\text{min}} = kW_{\text{max}} \times \frac{rpm_{\text{min}}}{rpm_{\text{max}}}
  \]

The selection can be made according to the following graph:
- (A) - three values of torque and speeds
  \[
  \begin{align*}
    M_{t_{\text{min}}} &= \text{max. torque value at the lowest speed (same value as } M_{t_{\text{lim}}}) \\
    M_{t_{\text{lim}}} &= \text{max. limit torque at top speed (a torque limiter set to } M_{t_{\text{lim}}} \text{ should be provided for enhanced safety purposes)} \\
    M_{t_{\text{max}}} &= \text{max. torque value at top speed} \\
    rpm_{\text{min}} &= \text{lowest speed} \\
    rpm_{\text{lim}} &= \text{speed giving the limit value of the torque} \\
    rpm_{\text{max}} &= \text{top speed}
  \end{align*}
  \]
  Torque value is increasing from \( M_{t_{\text{max}}} \) and \( M_{t_{\text{lim}}} \) only and kept constant from \( M_{t_{\text{lim}}} \) and \( M_{t_{\text{min}}} \) as soon as speed is decreasing.
- (B) - two values of torque and speed
  \[
  \begin{align*}
    M_{t_{\text{min}}} &= \text{max. torque value at the lowest speed} \\
    M_{t_{\text{max}}} &= \text{max. torque value at top speed} \\
    rpm_{\text{min}} &= \text{lowest speed} \\
    rpm_{\text{max}} &= \text{top speed}
  \end{align*}
  \]
  Torque value is increasing all over the variation ratio from \( M_{t_{\text{max}}} \) to \( M_{t_{\text{min}}} \) as soon as speed is decreasing.
It is recommended to select the max. speed of the variator matching the max. one of the driven machine.

All the reduction ratios of the selection tables of helical gearboxes RD and worm boxes RS and RT are available to get lower speed ratios and it is recommended to check the speed value rpm\textsubscript{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.
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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 flange mounting for coupling to a helical or worm gearbox.

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

The position - for the variators only, with any fixed reduction fitted - can be easily modified by 90° rotation of the variator to either sides.

A worm servo motor fitted to the variator, including limit switches for speed ratio control, provides a convenient alternative at little extra cost.
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Output loads
The listed loads refer to the variator only without any gearbox fitted.
In case of variator+gearbox, please defer to adequate gearbox catalogue.

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<tr>
<th></th>
<th>300 rpm</th>
<th>1500 rpm</th>
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<tr>
<td>MVR063</td>
<td>25 daN</td>
<td>15 daN</td>
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<tr>
<td>MVR071</td>
<td>35 daN</td>
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<td>30 daN</td>
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<tr>
<td>MVR090</td>
<td>80 daN</td>
<td>50 daN</td>
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Service factors
Service factor FS1.0 is meant as typical of 8-10 hours/day operation, with uniform load, starts/stops lower than 6 per hour and ambient temperature between 15 e 35 °C.
For other service conditions, the appropriate factors of the following tables must be multiplied as follows

FS = F₁ x F₂

<table>
<thead>
<tr>
<th>F₁</th>
<th>Uniform load</th>
<th>Variable load</th>
<th>Shock load</th>
<th>Starts/ stops per hour</th>
<th>F₂</th>
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<tr>
<td>3 - 4 h</td>
<td>0.8</td>
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<td>10 - 24 h</td>
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<td>1.6</td>
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## VARVEL - VR
### SPEED VARIATORS

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<tr>
<th>kW motor 1400 rpm</th>
<th>Type</th>
<th>Output speed rpm min + max</th>
<th>Output torque Nm min + max</th>
<th>Efficiency η min + max</th>
<th>Weight MVR kg</th>
<th>Weight FVR kg</th>
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<td>0.09</td>
<td>MVR063</td>
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## VARVEL - VR
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Please ask for individual catalogues of helical gearboxes RD and worm gearboxes RS and RT to select the reduction ratios and output torques for available coupling of the groups motor-variator-gearbox

- MVR / FRD
- MVR / FRS
- MVR / FRT