VAR-SPE SPEED VARIATORS: TORQUE-SPEED REGULATORS
VAR-SPE VARIATORS

HOW CAN WE SEE THE VAR-SPE VARIATOR?

AS A SIMPLE VARIATOR, LIKE MECHANICAL ONE, FOR MOST APPLICATIONS (MANUFACTURING MACHINE)

AS AN AUTOMATION SYSTEM, LIKE INVERTER, BUT FOR HEAVY AND DIFFICULT APPLICATIONS
VAR-SPE AS SIMPLE VARIATOR

- SIMPLE metric INPUT/OUTPUT FLANGE (available also for Nema)
- FLEXIBLE: 3 modular sizes (0,37-4 kW) for K series
- SIMPLE SPEED CONTROLS

THE REASONS TO PREFER VAR-SPE

BETTER PERFORMANCES THAN MECHANICAL

- WIDE SPEED RANGE (HIGH SPEED RANGE 1/30 INSTEAD OF 1/6)
- VERY LOW SPEED (50 RPM) WITH TORQUE
- ZEROING WITH MOTOR ON
- SIMPLE TORQUE LIMITER (TORQUE-PRESSURE SEE IN NEXT PAGES)
- SPEED ADJUSTMENT WITH MOTOR OFF
- BOTH OUTPUT DIRECTIONS; ALSO ON INPUT FOR K SERIES
- FINE SPEED ADJUSTMENT IN THE TIME
VAR-SPE CATALOGUES

K2-K4-K5  variators  0,37 - 4 kW

15-17B  variators  4 - 22 kW

Pumps and Motors  0,37 - 4 kW
Technical features

- Zero output rpm with motor rotating at 1400 rpm.
- Fine adjustment of speed, even after long running life.
- Speed setting is possible with motor off.
**Variator size K2**  
**Variatore tipo K2**

- Input/Entrata: 71 B14, 71 B5
- Output/Uscita: 71 B5
- Oil q.ty/Q.tà olio: 0.5 lt. (position V5: 0.7 lt)
- Weight/Peso: 9.4 Kg, 20.7 lbs (Without motor/Senza motore), 15.4 Kg, 34 lbs (With motor/Con motore 0.37 kW)

For dimensions, see pag.23/Per le dimensioni, vedi pag.23

**Motor-Variator**  
**Moto-Variatore**

P₁ = 0.37 kW  \( n₁ = 1430 \text{ min}^{-1} \)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1430</td>
<td>1.9</td>
<td>13.2</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2/3</td>
<td>14</td>
<td>71 B5</td>
<td>71 B14</td>
<td>15.4/34</td>
<td>23</td>
</tr>
</tbody>
</table>
WE CAN SEE:

- THE WORKING TORQUE INCREASES WHILE THE SPEED GOES DOWN => VERY IMPORTANT TO SELECT RIGHT SIZE
- STARTING TORQUE: 2-3 TIMES NOMINAL TORQUE

LESS POWER INSTALLED THAN INVERTER
### THE CATALOGUE: variator with gearbox

**With gear box**  
**Con riduttore**

- Motor Data: Dati motore
- Gear box type: Tipologia riduttore

**A**  
Shaft mounted / Assi paralleli

**C**  
Coaxial / Coassiale

**M**  
Single stage / Monostadio

**V**  
Worm / Vite senza fine

**Q**  
Square worm / V.s.f. quadrato

---

#### Speed range

<table>
<thead>
<tr>
<th>Speed range (rpm)</th>
<th>M₂</th>
<th>M₃</th>
<th>n₂max (Nm)</th>
<th>Gear box size</th>
<th>Gear box type</th>
<th>i</th>
<th>f₂</th>
<th>Atex Cat.</th>
<th>Ø</th>
<th>Reducer Input Flange</th>
<th>Reducer Output Flange</th>
<th>Weight</th>
<th>Dimen.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1100</td>
<td>2.4</td>
<td>18</td>
<td>38</td>
<td>402A</td>
<td>C</td>
<td>1.3</td>
<td>2/3</td>
<td></td>
<td>28 *</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>27/60</td>
</tr>
<tr>
<td>0-911</td>
<td>2.9</td>
<td>21</td>
<td>32</td>
<td>311</td>
<td>M</td>
<td>1.57</td>
<td>2/3</td>
<td></td>
<td>14 *</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>25/55</td>
</tr>
<tr>
<td>0-584</td>
<td>4.6</td>
<td>34</td>
<td>20</td>
<td>511</td>
<td>M</td>
<td>2.45</td>
<td>2</td>
<td></td>
<td>28 *</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>27/60</td>
</tr>
<tr>
<td>0-503</td>
<td>5.3</td>
<td>39</td>
<td>18</td>
<td>311</td>
<td>M</td>
<td>2.84</td>
<td>2/3</td>
<td></td>
<td>14 *</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>25/55</td>
</tr>
<tr>
<td>0-435</td>
<td>6.1</td>
<td>45</td>
<td>15</td>
<td>311</td>
<td>M</td>
<td>3.29</td>
<td>2</td>
<td></td>
<td>14 *</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>25/55</td>
</tr>
</tbody>
</table>

**Motor Data**: Dati motore
**Gear box type**: Tipologia riduttore

---

**Output torque at max speed**  
**Coppia uscita alla max velocità**

**Starting torque**  
**Coppia allo spunto**

**Minimum speed with stable torque**  
**Minima velocità con coppia stabile**

---

**Input flange of reducer**  
**Flangia entrata riduttore**

**Input flange of variator**  
**Flangia entrata variatore**

---

**For Atex zone 2**  
**Per ambienti ATEX**

If the unit is not available for Atex, select the greater size of the same gear box.
So l'unità selezionata non è disponibile in versione Atex, selezionare la taglia superiore dello stesso tipo di riduttore.

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**VAR-SPE**  
VARIATORI DI DINAMICI DI VELOCITÀ
HOW TO SELECT A VARIATOR

The best it's to have torque and speed values (M and n)
For ex. **8 Nm @ 260 rpm**

- if the **maximum speed** is low, if the requested torque is high it's necessary to add a gearbox; we can use only the variator if the max speed is a middle value (600-700 rpm) but the torque is low.

- check the output power \( P=M\times n \) (ex. 0.22 kW) => this is the output, considering efficiency of reducer and variator => 0.3 kW input power => size K2

- on the table look at max speed 260 rpm; you can find 0-262 rpm for 202A reducer. check the torque: 9.9 Nm => it's ok

<table>
<thead>
<tr>
<th>Speed range [rpm]</th>
<th>( M_2 ) [Nm]</th>
<th>( M_s ) [Nm]</th>
<th>( n_{2\text{min}} ) [rpm]</th>
<th>Gear box size</th>
<th>Gear box type</th>
<th>( i )</th>
<th>( f_s )</th>
<th>Atex Cat.</th>
<th>Ø [mm]</th>
<th>Variator Input Flange</th>
<th>Reducer input flange</th>
<th>Weight Peso [kg/lbs]</th>
<th>Dimens. [Pag.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-285</td>
<td>9.1</td>
<td>68</td>
<td>10</td>
<td>452A</td>
<td>C</td>
<td>5.01</td>
<td>2</td>
<td>2/3</td>
<td>30</td>
<td>•</td>
<td>•</td>
<td>24/53</td>
<td>26</td>
</tr>
<tr>
<td>0-285</td>
<td>9.1</td>
<td>68</td>
<td>10</td>
<td>502A</td>
<td>C</td>
<td>5.01</td>
<td>2</td>
<td>2/3</td>
<td>30</td>
<td>•</td>
<td>•</td>
<td>27/59</td>
<td>27</td>
</tr>
<tr>
<td>0-271</td>
<td>9.8</td>
<td>73</td>
<td>9.5</td>
<td>511</td>
<td>M</td>
<td>5.27</td>
<td>2</td>
<td>2/3</td>
<td>28</td>
<td>•</td>
<td>•</td>
<td>20/45</td>
<td>25</td>
</tr>
<tr>
<td>0-262</td>
<td>9.9</td>
<td>74</td>
<td>9.2</td>
<td>202A</td>
<td>C</td>
<td>5.45</td>
<td>2</td>
<td>2/3</td>
<td>16</td>
<td>•</td>
<td>•</td>
<td>19/42</td>
<td>26</td>
</tr>
<tr>
<td>0-257</td>
<td>10.1</td>
<td>75</td>
<td>9.0</td>
<td>402A</td>
<td>C</td>
<td>5.55</td>
<td>2</td>
<td>2/3</td>
<td>25</td>
<td>•</td>
<td>•</td>
<td>21/46</td>
<td>27</td>
</tr>
<tr>
<td>0-235</td>
<td>11.1</td>
<td>82</td>
<td>8.2</td>
<td>452A</td>
<td>C</td>
<td>6.07</td>
<td>2</td>
<td>2/3</td>
<td>30</td>
<td>•</td>
<td>•</td>
<td>24/53</td>
<td>26</td>
</tr>
<tr>
<td>0-235</td>
<td>11.1</td>
<td>82</td>
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<td>C</td>
<td>6.07</td>
<td>2</td>
<td>2/3</td>
<td>30</td>
<td>•</td>
<td>•</td>
<td>27/59</td>
<td>27</td>
</tr>
<tr>
<td>0-230</td>
<td>11.3</td>
<td>84</td>
<td>8.1</td>
<td>F62C</td>
<td>A</td>
<td>6.21</td>
<td>2</td>
<td>2/3</td>
<td>40</td>
<td>•</td>
<td>•</td>
<td>37/82</td>
<td>31</td>
</tr>
</tbody>
</table>
HOW TO SELECT A VARIATOR

VARIATOR + GEARBOX

IMPORTANT: if together with the variator you select a gearbox not of ours, please check if it can resist to max torque of variator at starting (multiply variator torque for ratio and efficiency)

Pay attention to the rotation: the reducer can reverse or not the sense of rotation of the variator (it depends on the number of stage); this is important with single-direction application or speed control
INSTALLATION

• The plugs depend on the working position

• The breather plug is important: it's on the top, it avoids the seal getting off

IMPORTANT the position with foot on the ceiling is not possible
Pay attention not to put water on the breather plug, for ex. to cool the variator

VARIATOR TEMPERATURE: the housing can reach 60°C + ambient temperature (you cannot keep there your hand)

AMBIENT TEMPERATURE is important (concerning oil)
LUBRICATION

OIL HAS TWO FUNCTIONS

lubrication

the means for power transmission

Type of oil depends on the VARIATOR SIZE and AMBIENT TEMPERATURE

The viscosity must be constant when the ambient temperature changes; it’s possible to use synthetic car engine oil, like ex. 5w40

For high temperature (more than 40°C) => OIL COOLER (code R + oil cooler), check with var-Spe Technical Dept.

For low temperature (less than -15°C) => pre-heater (code P) or special oil
Working principle

Var-Spe infinitely variable hydraulic gears work according to the principle of hydrostatic transmission. They essentially consist of an hydraulic, radial piston variable displacement pump (primary pump) and a constant displacement pump (secondary pump).

Both units, primary and secondary, are housed in the same case, and they are mounted on a fixed shaft. The latter serves as a distributor of the fluid, there are some lines (pressure line and return line), for the flow from the primary unit to the secondary and vice versa, forming a closed circuit. An auxiliary pump is connected to the primary pump, and supply oil (from oil reservoir) to the hydraulic circuit, through some valves. The variator transmits mechanical power from the driving motor, allowing it to rotate always at the max speed, while the output shaft can be adjusted from max speed to zero rpm, for both output directions.

Speed regulation is accomplished by adjusting the eccentricity of the primary unit and, therefore, the oil flow sent to secon-day unit. The latter, connected to the output shaft, will drive a speed directly proportional to the received oil flow. The maximum eccentricity of the primary pump, will correspond to the output shaft max speed, and a smaller eccentricity will correspond to a lower output speed. When the primary pump eccentricity is nil, the output shaft will be at zero rpm.
WORKING PRINCIPLE

INTO the VARIATOR

2 CIRCUITS

MAIN CIRCUIT

AUXILIARY CIRCUIT
MAIN CIRCUIT

Electric motor

Primary pump
- Adjustable eccentric ring
- Suction (5-8 bar)
- Compression (50-150 bar)
- Work

Secondary pump
- Fixed eccentric ring
- Return oil

lp low pressure
hp high pressure

oil

lp
hp
MAIN CIRCUIT

- increasing θ, we increase piston stroke => more oil suction, more oil sending => speed increasing
- with θ=zero, no oil suction, no oil sending => no output speed

TO ADJUST SPEED => MOVE THE RING=> you can move it in different way, with manual control or by remote system
AUXILIARY CIRCUIT

There is a secondary circuit, with a feed pump (auxiliary pump) => it supplies oil to the main circuit.

FEEDER PUMP

MAIN CIRCUIT

Non return valves

Auxiliary pump relief valve
SYNTHESIS OF CIRCUITS

**MAIN CIRCUIT**: (p=50 bar)
- oil gets power transmission, p=50 bar at max speed; p=150 bar at starting

**AUXILIARY CIRCUIT**: (p=5 - 8 bar)
- Oil suction for starting
- It keeps full of oil the internal pipings of main circuit
- supply oil to hydraulic speed control (when there are)

The **OIL PRESSURE** (MAIN CIRCUIT) IS **PROPORTIONAL** TO the **LOAD** => we have a **SIMPLE TORQUE LIMITER**, or use a **MANOMETER OR PRESSURE SWITCH** (MOTOR OFF) OR **PRESSURE GAUGE** (SIGNAL)

\[
p \text{ (bar)} \approx M \text{ (Nm)} \quad \text{in main circuit}
\]
INSTALLATION

Before starting, CHECK:

• mounting position
• type and quantity of oil
• For 15-17B the motor rotation (see the arrow on input flange of variator); normal is clockwise

Minimum input speed 600-700 rpm (less rpm, no oil suction)
Maximum input speed: 2000 rpm

MOUNTING AFTER LONG STOCKING PERIOD

If you are mounting a variator that has been in stock for long time (more than 10 months), run the variator at low speed without load for half an hour.
Checking for selection

In case of high room temperature (more than +40°C) or low (less than -15°C), check the directions at pag 72 or contact Technical Dept. of Var-Spe.

Specify in the order if levels for noiseless are particular demands. See the directions at pag.72.

DON'T use 2 poles motor.

If you need to use 60 Hz motor, contact Technical Dept. of Var-Spe to check service factor.

See other directions on the catalog.
Starting

The variator is supplied WITHOUT OIL; before running, fit to level using the recommended oil (for type and for quantity, referring to mounting position)

Fill with oil

When starting a new variator (or a variator after a long stocking), run the unit for 15/20 minutes without load at low speed.

INPUT ROTATION
For K series: the input rotation can be clockwise and counter-clockwise. For 15-17B the input rotation is clockwise (see the arrow on input flange)
TROUBLESHOOTING

If there is a problem on starting a variator, first of all, check these simple points:

• type of oil

• quantity of oil, referring to the mounting position

• rotation of electric motor (only for for sizes 15-17B)

• check the ampere of motor: it’s proportional to load, when the unit runs at middle-high output speed

• bleed the air in the circuit by unscrew relief valve plug, you will have nr.3 pcs. connected togher: plug+spring+little hollow cylinder; clean the cylinder, screw all them on the variator without fixing; now switch on and off the motor 2-3 times to bleed the air, then fix the plug.

At the end try to separate the variator from the machine, see if the problem exists also without load

If all this points are right, **contact Var-Spe with type and serial number of the variator.**
CHANGING MOUNTING POSITION

If you need to change mounting position, it depends on type of variator:

- if it's a K series variator, you have only to change the position of the plugs (breather, oil, drain) according to the mounting position table; pay attention to the vertical positions, you have to use an oil charging piping

- for 15-17B it's necessary to order the units for the right mounting position, as the changing needs to open the variator

Pay attention to the quantity of oil when change the mounting position.
Maintenance

Check periodically the oil level, eventually refill with prescribed oil types. Don't mix synthetic and mineral lubricants.

**First change of oil.**
The first time, change the oil after 200 operating hours.

**Change of oil.**
After the first change, every 2000 operating hours for mineral oils, 4000 for synthetic ones.

**Filters.**
With oil changing, replace existing filters on speed controls:
- type Fran 2839 for speed control cod.37
- type 50301 at draw. 95.00267 for other hydraulic speed controls (31, 67).

**Cleaning.**
Check that the fan cowl of variator and motor are not clogged with dust, fibres or other.
STOCKING

In order to preserve the efficiency of the variators in stock, it's necessary to observe the following indications for stocking:

• Stock the variators in appropriate environments with a low humidity level.

• Place them possibly onto shelves.

• For extended stocking periods (more than 2-3 months), lubricate the external parts which could be subjected to oxidation (shafts and machined parts).

• The variators SHOULD BE COMPLETELY FILLED UP WITH OIL (to avoid internal rust); reset the level oil during installation.

• When installing after long stocking period, run the variator at low speed without load for half an hour.
REPAIRING

Here is how we usually proceed with the repairing of a variator:

• 0-4 years old: only what it’s necessary
• 5-8 years old: all bearings, seals, gaskets
• 9-x years old: hydraulic units, all bearings, seals, gaskets

This way let us to make a preventive offer before receiving the variator (a lot of customer need it); naturally, what is extra (ex shafts, flange damaged), is not foreseeable, so this will appear in the definitive final balance offer.
VAR-SPE AS AUTOMATION SYSTEM

**Starting torque:** VAR-SPE is able to supply – for the time required by the application – a starting torque which is about 250% higher than the nominal one.

In a lot of cases, if you use an inverter type V/Hz this must be oversized to get enough starting torque.

**Speed range:** VAR-SPE speed range is 1/35. This wide speed range is fully exploited by the VAR-SPE drive and cannot be covered by an similar power inverter, even though used till frequency of 100 Hz! (and only in such speed range is 1/10).

**Dynamic Braking:** A further advantage of VAR-SPE variator is the capacity of developing a dynamic braking. Every inverter didn't have it, unless it integrates the apparatus with a resistive net of dissipation => added cost.
**Environment.** In inverter catalogues, the manufacturers themselves, advice against the use (or limit it) of their products in following conditions:

- In the environments with high temperature
- In wet environments
- In dusty environments
- In brackish environments

**Electromagnetic Compatibility.** With inverter to avoid it, it's necessary to install some devices (screened cables, dynamic filter, etc) that increase cost of machine. Often, customers look at cost of inverter forgetting cost of this devices.

**Vibes.** Electronics, being installed directly on the motor, is subject to more mechanical stress (vibes), deleterious for reliability
Technical comparison between Var-spe variator, mechanical variator and frequency inverter.

<table>
<thead>
<tr>
<th></th>
<th>Var-Spe K variator</th>
<th>Mechanical variator</th>
<th>Frequency inverter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Speed range</strong></td>
<td>High 1/35</td>
<td>Low 1/6</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Zeroing</strong></td>
<td>Yes</td>
<td>Only with differential</td>
<td>Only with motor off</td>
</tr>
<tr>
<td><strong>Torque at low speed</strong></td>
<td>High torque</td>
<td>High torque</td>
<td>Low torque</td>
</tr>
<tr>
<td><strong>Fast reverse</strong></td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Torque limiter</strong></td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Adjustment with motor off</strong></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Starting with load from 0 rpm</strong></td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Bi-directional output</strong></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Suitable for explosion proof environment (Atex)</strong></td>
<td>Yes</td>
<td>No</td>
<td>No on standard inverter</td>
</tr>
<tr>
<td><strong>Finespeed adjustment after long time</strong></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Suitable for dusty/dirty aggressive environment</strong></td>
<td>Yes - superior</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Life and reliability</strong></td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Suitable for wash down environment (IP65 rated)</strong></td>
<td>Yes - superior</td>
<td>Low level</td>
<td>No</td>
</tr>
<tr>
<td><strong>Ease of maintenance</strong></td>
<td>Yes - superior</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Level required of technical expertise for installation</strong></td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td><strong>Ease of replacement if failure occurs</strong></td>
<td>Easy</td>
<td>Easy</td>
<td>Difficult</td>
</tr>
<tr>
<td><strong>Resilience to over load</strong></td>
<td>Very resilient</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Load monitoring</strong></td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Close feed back loop speed control</strong></td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Remote control away from drive</strong></td>
<td>Yes</td>
<td>Minimal</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Speed indicator</strong></td>
<td>Yes</td>
<td>Minimal</td>
<td>Yes</td>
</tr>
</tbody>
</table>
WHEN CAN WE BE SURE VAR-SPE IS REALLY COMPETITIVE?

In this cases:

• when a wide speed range is needed
• in hard environment
• when high torque at starting is needed, and you must adjust the speed with motor off
• when a simple torque control is needed
• when electronics cannot be used
• when space is a problem
• when you need an Atex (Ex-proof) solution
WHEN AMBIENT IS A PROBLEM
QUANDO L’AMBIENTE È UN PROBLEMA

innovative speed variators

VAR-SPE SpA
Via Consolata, 81 - 36077 Asolo VICENZA (VI) - Tel. (0444) 30501 - Fax (0444) 30678
www.varspe.com - info@varspe.com - amm@varspe.com
When the need is a simple torque control
Quando un controllo economico della coppia è necessario

Innovative speed variators

VAR-SPE Spa
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WHEN ELECTRONICS CAN'T BE USED, BUT THE PERFORMANCE IS A NEED

Also available in split form
Disponibili anche in versione separata

innovative speed variators

VAR-SPE SpA
Via C. Develi, 8 - 36077 Asolo (VI) - Tel. 0444.271311 - Fax 0444.271312
www.var-spe.com - info@var-spe.com - marketing@var-spe.com

VAR-SPE
VARIATORI ODOSTATICI DI VELOCITÀ
When space is a problem
Quando lo spazio è un problema

Innovative split speed variator

VAR-SPE SpA
WHEN ATEX IS A PROBLEM
QUANDO L’ATEX È UN PROBLEMA

innovative speed variators

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