

# SITI

SPA

SOCIETÀ ITALIANA TRASMISSIONI INDUSTRIALI



## K - MK



**INSTALLATION, OPERATION  
and MAINTENANCE MANUAL**

# 09.2008



We, at SITI S.p.A., would like to thank you for the confidence shown in choosing our products. Our dedication to quality and innovation have allowed us to develop highly efficient variators capable of satisfying even the most demanding requirements.

Carefully reading and becoming familiar with the contents of this manual is of prime importance for trouble-free operation.

If, after thoroughly reading this manual, some topics are not clear please do not hesitate to contact our Customer Service Department or Service centers for more detailed information.

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## MANUFACTURER'S DATA



## CONTACTING OUR SERVICE DEPARTMENT

When contacting our customer service department always quote the data indicated on the variator's identification plate.

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## 1 GENERAL INFORMATION

We, at SITI S.p.A., would like to thank you for choosing our products. Our dedication to quality and innovation have allowed us to develop highly efficient variator capable of satisfying even the most demanding requirements.

Installation personnel must thoroughly read and familiarize themselves with the contents of this entire manual.

If in doubt, please do not hesitate to contact our Customer Service Department or Service centers for more detailed information.

### 1.1 CONTENTS OF THE MANUAL

This manual contains a description of the variator, information about “intended use” and performance along with the specifications and installation, operation and maintenance instructions.

### 1.2 USERS OF THE MANUAL

This publication is aimed at:

- the factory supervisor/installation personnel
- operators
- maintenance personnel

The person performing the job must keep the manual nearby where it can be easily consulted and kept in good condition. If the manual is lost or ruined, contact the MANUFACTURER to obtain another copy quoting the serial number of the variator.

### 1.3 HOW TO CONSULT THE MANUAL

The instructions are accompanied by icons that aid in reading the manual. In fact, these icons indicate the type of information provided, more precisely:



**Danger!**

**This icon indicates: failure to heed the safety standards and follow the instructions given may cause accidents. Carefully read and follow the instructions provided with this icon, exercising extreme caution at all times.**

 **This icon indicates important information on how to properly handle, install, use and maintain the variator.**



**This icon indicates the order given must be followed.**

When necessary the text includes the numbers of the figures that identify the illustrations provided in the manual. The parts of the variator described in the text are identified with numbers.

E.g.: - 1 - (fig. 1) means part of component 1 in figure 1.



In reference to ATEX standards.

## **1.4 WORKING WITH THE USER**

The manufacturer is at the customer's disposal to answer any questions and provide any additional information needed. In addition we gladly accept any suggestions to improve this manual to make it more comprehensible and better satisfy the purposes it is designed for. If the equipment changes hands, please send the manufacturer the new owner's address so that he can receive any information, supplements and/or updates.

## **1.5 UPDATED VERSIONS OF THE MANUAL**

This manual deals with the state-of-the-art condition of the variator it is in at the time it is put on the market. The manual is to be considered a fundamental part of the variator and complies with all laws, directives and standards currently in force. It cannot be considered inadequate only because updated later on based on new information. If any modifications, changes, etc.. are made to variators sold later on the manufacturer shall not be held liable for modifying equipment previously supplied nor shall the variator and relative manual be considered incomplete and inadequate. Any supplements the manufacturer sends to the users should be kept along with the manual that is part of the variator.

**PROPER OPERATION AND TOP PERFORMANCE OF THE VARIATOR IS OBTAINED ONLY IF ALL THE INSTRUCTIONS GIVEN IN THIS MANUAL ARE CAREFULLY AND COMPLETELY FOLLOWED.**

## **1.6 SELECTING PERSONNEL AND PERSONNEL QUALIFICATION LEVELS**

The operators responsible for handling, installing and servicing the variators on their own must meet the requirements given below:

- minimum work age as specified by laws in force at the time of use
- well-educated and trained on how to properly and safely perform the jobs
- have completely read and become familiar with the contents of this manual
- have been instructed and fully understand the accident prevention laws in force at the time of use
- be physically able to carry out the jobs
- always wear certified personal safety gear

## **1.7 RESIDUAL RISKS**

Assessment of the risks the operators responsible for operating and maintenance may face was carried out during the design stage. All the necessary precautions have been taken to make the machine safe and reliable. Risk assessment has not shown any particular residual risks.

## **1.8 SALES CONDITIONS AND WARRANTY**

As regards all the commercial and legal aspects, consult the catalogue for the variator in question.

## 2 SAFETY INFORMATION

In compliance with Machinery Directive EEC 89/392 article 4.2 and annex 11/sub B, as the variators dealt with in this certificate are incorporated and/or assembled in other machines they are considered “components” therefore:

THEY CANNOT BE STARTED UP UNTIL THE MACHINE THEY ARE INSTALLED IN HAS BEEN CERTIFIED THAT IT COMPLIES WITH MACHINERY DIRECTIVES 89/392/CEE, 91/368/CEE, 93/44/CEE AND 93/68/CEE.

**Note:**  
The product included in this certificate meets the essential requirements given above and those of the catalogue in force as of the date of production. SITI S.p.A. reserves the right to modify them according to changes in technology and materials.

- The variator must not be modified unless duly authorized by the manufacturer.
- Carefully read the instructions given in this manual before attempting to move the variator, especially when it weighs more than 25 kg.

### Warning!

The variators type .../1 and .../2 are combined with gearboxes.  
In some size, the gearbox lubrication shall be done by the customer according to the indications of pag 16.



## 2.1 GUIDELINES FOR USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES



Ignition can occur when mixes of flammable gases or dusts come into contact with hot parts of the variators.



### Danger!

Only specially trained operators are authorized to install, connect, start up, carry out maintenance or repair the variators. In any case, the steps below must be closely followed:

- Follow the instructions provided by the manufacturer.
- Observe the warning and alert symbols given on the variators.
- Read and become familiar with the contents of the User's Manuals.
- Observe the specific standards for the plant.
- Observe the all standards currently in force (explosion protection, safety, risk prevention).

## 3 DESCRIPTION

### 3.1 OPERATION

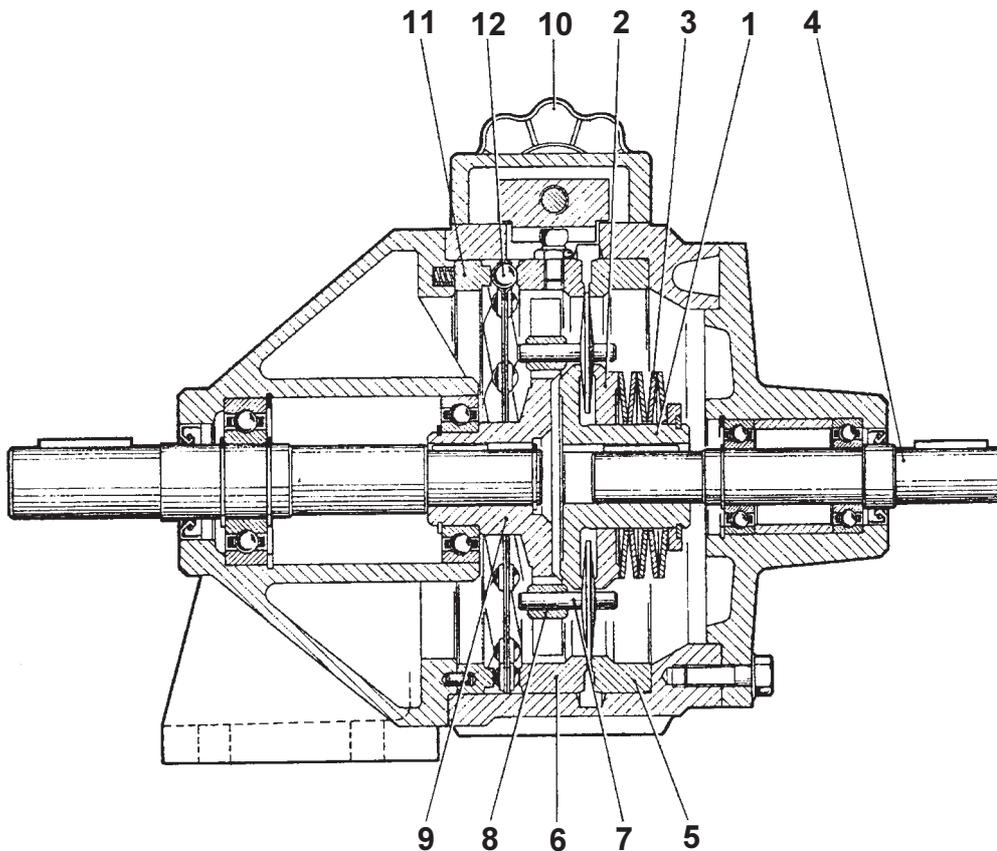
The SITI variable speed drive unit basically consists of two inner tracks **1** and **2** held together by a set of Belleville washers **3** and fitted to motor shaft **4** by two outer planetary tracks **5** and **6** secured to the frame. Three to six satellite gears **7** are held in place by bushes **8** which slide in a radial direction inside satellite gear holder **9** which receives motion.

Satellite gears **7** are in contact with inner tracks **1** and **2**, which set them in motion, and fixed outer planetary tracks **5** and **6**. With this set-up, the satellite gears perform a double movement: they rotate around their own axis and revolve around the outer planetary tracks. Motion is received by the satellite gear holder which is integral with the drive shaft.

Speed variation (with a 1:5 transmission ratio) is obtained by turning control handwheel **10**. The latter allows planetary track **6** to move to a certain angle. This is achieved thanks to ball-disk assembly **12** located on the back-track with metal cams **11**. This allows the user to increase or decrease the clearance between the outer planetary tracks so as to allow satellite gear **7** to move in a radial direction. The latter can change the motion of satellite gear holder **9** by varying the point of contact between the tracks.

#### Warning!

Changing the speed by using the control handwheel (or other means) must take place when the input shaft (or motor) is running.



## 3.2 INTENDED USE

The machine is designed for industrial use under normal environmental conditions specified by directive 94/9/EC (ATEX).

## 3.3 FORBIDDEN AND ERRONEOUS USE



The variator must not be used in areas whose environmental conditions are different from those specified below.

Group II

Category 2 G1/G2

Zone D 21-22

## 3.4 VARIATOR IDENTIFICATION DATA

All our variators come with one or more plates that have the identification data stamped on them.

### 3.4.1 HOW TO READ AND MAINTAIN THE PLATES

The data given on the plates must be legible at all times. Clean them on a regular basis. If a plate is worn and/or no longer legible, even if just one item, contact the manufacturer to obtain a replacement plate. When ordering, always quote the data given on the original plate.

Data contained on the nameplate:

- TYPE: Logo of the Variator.
- N° : Number
- RATIO: Reduction Ratio
- Cod: Gearbox code-description
- ATEX Area
- File: Technical File Number

<b>SITI</b> ®		MADE IN ITALY	
		www.sitriduttori.it	
TIPO TYPE	<input type="text"/>		
N°	<input type="text"/>	RAPP. RATIO	<input type="text"/>
COD.	<input type="text"/>		
	II2GD1-21;2-22 T4-Tmax125' ck file		<input type="text"/>

### Warning!

The plates must never be removed.

## 3.5 SPECIFICATIONS

### Variator dimensions and performance

See the relative manual.

### Airborne noise level

The airborne noise level when the variator running under full load under the most adverse operating conditions is still considerably lower than 85 dB.

## 4 INSTALLATION INSTRUCTIONS

The variators are delivered entirely factory assembled.  
Only specially trained personnel are authorized to install, assemble and start them up.

### 4.1 OPERATIONS TO BE PERFORMED BEFORE INSTALLING THE VARIATORS (BY THE CUSTOMER)

#### Preparation

In order to install the variator, carry out the operations given on the confirmation before hand:

- Make sure the structures are adequate in relation to the actions and reactions deriving from use of the variator.
- Make sure the installation site is adequate and enough space is available.
- Make sure that the mounting position indicated in the order confirmation corresponds to the requested one.

#### 4.1.1 VARIATOR SHIPMENT, UNLOADING AND HANDLING

Always check the goods to make sure they were not broken or damaged during shipment before handling the variator.



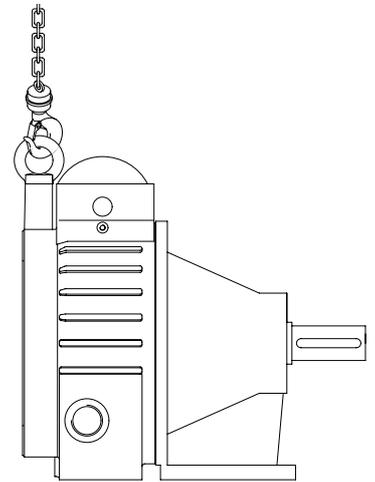
**The variator is delivered factory assembled and packed.**

**If the product is packed in cardboard cases, use lift equipment that complies with safety regulations to handle the product.**

To handle unpacked products, use lift equipment suitable for weights heavier than **30 kg**. In any case, pay careful attention not to accidentally bang surfaces and coupling parts. Use the eyebolt when needed (parts heavier than **30 kg**).

The eyebolt can lift just the variator and not the parts it will be attached to. Regarding variators that weigh more than **30 kg** not equipped with an eyebolt, a suitable eyebolt should be used to lift them in complete safety. Otherwise exercise extreme caution and use slings to lift the variators.

The types of eyebolts are given in the chart.



EYEBOLTS	
K 30	M12
K 50	M12
K 100	M12

### 4.2 DECOMMISSIONING AND DISPOSAL

When the variator has reached the end of its expected service life, it should be disassembled and disposed of. Drain the lubricant from the variator. Remember that oil greatly pollutes the environment.

Once decommissioned, dispose of the materials and oil in compliance with current environmental protection laws and standards.

Specialised companies should be contacted when disposing of materials. The user is responsible for assuring the company contracted is authorized and certified to handle toxic materials.

### 4.3 INSTALLATION INSTRUCTIONS

The position in which the variator is to be installed is given in the commercial catalogue.

## 5 VARIATOR OPERATING INSTRUCTIONS

### 5.1 IMPORTANT SAFETY INFORMATION

Make certain the following requirements are observed when installing the variator:

During installation the following must NOT be present: potentially explosive atmosphere, oils, acids, vapors, radiation.



**The position in which the variator is installed can be changed only after contacting the manufacturer. The variator shall not be considered in compliance with the ATEX directive if the manufacturer is not contacted.**

Plastic inserts should be placed between the variator and drive (connection between different metals) if there is risk of chemical corrosion.

In addition, use plastic washers with the bolts! The plastic used should have a  $< 10^9$ W capacity to withstand electric loss. Effectively ground the external structure. In addition use screws with motor earth for motorized variators. Make sure enough air flows to cool down the variator and that warm air does not flow back from other devices. The temperature of the cooling air should not exceed 40 °C.



**Danger!**

**Only specially-trained personnel are authorized to install and start up the variators. Incorrect installation may put the operator's safety at jeopardy and seriously or irreparably damage the equipment and machine it is connected to.**

Carefully follow the precautions given below:

Before attempting to carry out any operations, make certain the plant or drive motor is disconnected from the supply mains and that the machine is not energized.

Remember that the variator should never be operated without oil or when its parts are disconnected. In addition, do not put the variator in water or corrosive solutions.

Make sure the amount of lubricant, its viscosity index and position of the filler and drain plugs are adequate for the position in which the variator is installed and operating conditions present. In addition, do not use toxic oils and never mix two different types of oils together.

When installing the variator, always leave enough room free so that it can be periodically checked and maintenance can be conveniently performed. It is also important that air is able to flow freely to assure good ventilation and heat dispersion. The product should be installed in the position indicated on the order.



**Danger!**

**Make sure the variator is well-secured to the framework to assure vibration-free operation. In addition, it should be mounted on machined surfaces. Use systems that prevent the clamp screws from coming loose.**

Be extremely careful to perfectly align the variator with the motor and machine to be driven. Use flexible or self-aligning couplings where possible. If the variator risks being hit, overloaded for a prolonged time or blocked, install overload cut-outs, torque limiters, hydraulic couplings or other similar devices.

## 5.2 BEFORE STARTING THE VARIATORS



### Measure the oil and surface temperature

The highest allowable surface temperature given in this manual was determined under normal environmental conditions. Even slight changes in these conditions (example: with service factors = 1) may considerably affect the temperature. When starting the variator, the surface temperature must be measured under maximum load.

Off-shelf thermometers may be used to measure the temperature.

The surface temperature must be measured in the area between the variator and motor where the clamps do not allow adequate air flow to cool down the motor fan.

The highest allowable surface temperature is reached after approximately three hours of operation and **must not exceed 50 °C (differential value)** in relation to the room temperature.

If this temperature (differential value) is exceeded, immediately stop the variator and contact the manufacturer.

### Checks to be performed

The chart given below lists all the checks to be made before attempting to start the variator in potentially explosive atmospheres as specified by the **ATEX100a** directive.



CHECK

#### Before starting up

Inspect the packaging to check the goods upon delivery.

Make sure the following information given on the variator identification plate matches the approved values for use in an explosive atmosphere:  
anti-explosion category, anti-explosion zone, maximum surface temperature class.

Are you sure no oil, gas, acids, vapors, radiation will be present in the potentially explosive atmosphere when the variator is installed?

Does the environmental temperature correspond to the value given in the "Operating temperature" paragraph?

Make sure the variators are well-ventilated and that there are no external heat sources (example through fittings). The temperature of the cooling air must never exceed 40 °C.

Does the installation position match the value given in the variator manual?

#### Warning!

**The position in which the variator is installed can be changed only after contacting the manufacturer. The variator shall not be considered in compliance with the ATEX directive if the manufacturer is not contacted.**

Does the correct oil level in the installation position correspond to the amount of oil stated in the variator manual?

Can the oil drain (where provided) and inspection plugs along with the release valves be easily reached?

Have the parts at the inlet and outlet been installed in compliance with the ATEX directive?

For motors driven by inverters: make certain the motor is certified for use with an inverter.

The inverter parameters must be set to prevent the variator from overloading.

## 5.3 DURING OPERATION

### Checks to be made

The charts given below list all the operations that have to be checked **while a variator is running** in potentially explosive atmospheres as specified by the **ATEX100a** directive.



**CHECK**

### During operation

Measure the surface temperature after approximately three hours of operation.  
It **must not exceed 50 °C (differential value)** in relation to the room temperature.

If this temperature (differential value) is exceeded, immediately stop the variator and contact the manufacturer.

## 5.4 OPERATING TEMPERATURE

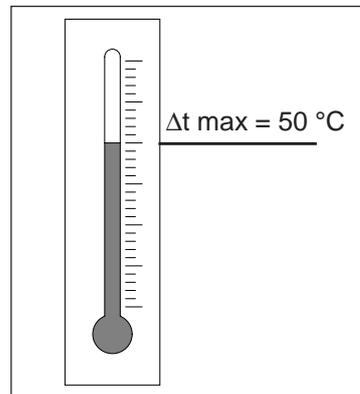
The speed variator is a piece of equipment which transmits power by means of friction therefore generates heat. The operating temperature largely depends on the following factors:

- 1) the size of the variator (MK2 - MK5 - MK10 - MK20 - MK30 - MK50 - MK100)
- 2) variator input speed
- 3) variator output speed
- 4) variator mounting position
- 5) ambient temperature
- 6) type of variator connected to it

The “actual operating temperature” is reached by the speed variator after a running in period of approx. 200-300 hours. During this period it quickly reaches the maximum temperature which then gradually decreases to the “actual operating temperature”.

The chart below indicates the average operating temperature increase  $t$  in relation to the ambient temperature and according to mounting position B3/1U, with a 4-pole motor and variator set to maximum speed.

Type of speed variator	$\Delta t$
MK2	20°C
MK5	20°C
MK10	25°C
MK20	25°C
MK30	40°C
MK50	40°C
MK100	50°C



During the running in period (first 200-300 hours), the temperature increase  $t$  may be even 25% higher.

In mounting positions V1-V5 (vertical position with the output shaft facing downwards), the temperature values may be even 10% higher than those measured in the B3/1U position. This is because of the increased amount of oil inside and the different way in which the coolant splashes around.

With a 2-pole motor (only up to size 20), the temperature values  $t$  may increase by 25% compared to the values indicated in the chart.

It should be noted that the data indicated refer to using the variable speed unit at maximum speed which is not recommended.

If the output speed of the variator is lowered, the temperature tends to decrease considerably.

### Note

**The data indicated refer to using the speed variator at the settings indicated in the manual.**

## 6 MAINTENANCE

The maintenance schedule includes routine and periodic operations. Routine maintenance refers to operations during which the operator and/or specially trained maintenance workers have to inspect and check the parts. When performing periodic maintenance the operators have to replace, adjust and lubricate parts. The manufacturer holds specific training courses and provides publications to fully instruct the maintenance staff on how to perform the jobs correctly and in complete safety.

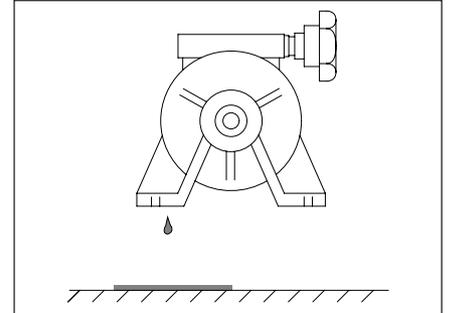
### 6.1 ROUTINE AND SCHEDULED MAINTENANCE

Periodically check the outer surfaces of the variator and the cooling air passages for cleanliness. Regularly make sure that no lubricant leaks through the seals, mounting flanges, mounting screws of the covers, caps etc..

#### **Warning!**

**If the variator is run without enough lubricant, it may be seriously and often irreparably damaged.**

Efficiency of the heat exchange process is notably affected if the oil inside the variator is too low. As heat dissipation and the cooling capacity are considerably reduced, the inside operating temperature increases above all at the points where the sides of the teeth come into contact.

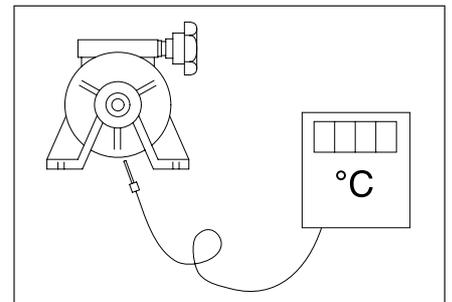


### 6.2 CLEANING

Clean the variator casing on a regular basis to assure good heat exchange with the outside.

### 6.3 MEASURING THE OPERATING TEMPERATURE

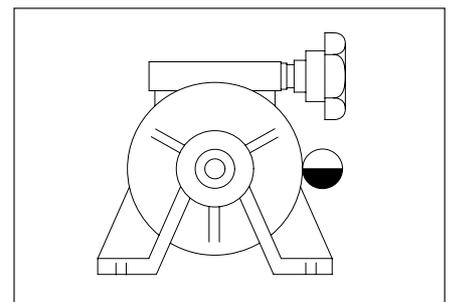
Wherever possible, suitable instruments should be used to measure the external temperature of the variator housing. As, under regular operating conditions the temperature inside the variator increases 50 °C compared to the outside temperature, the housing normally becomes too hot to touch. It is therefore wrong to assume that the variator is too hot just because it cannot be touched. In fact, it cannot be touched as soon as the temperature goes above 50 °C. It is important to check that once the variator has reached the normal speed the operating temperature remains more or less constant under the same work conditions. This indicates that the variator is running in a trouble-free manner.



### 6.4 CHECKING THE LUBRICANT LEVEL

Regularly check that the oil level is correct when the variator has stopped and cooled down sufficiently. To do this, use the sight-glass provided. This should be kept clean and be see-through at all times (see par 6.7). When looking through the sight-glass, if it seems as though there are deposits in the oil, make sure that no foreign bodies such as dust, sand or water have got inside the variator housing. If the oil level has fallen below the minimum level, top up immediately. If the variator is run without enough lubricant, it may be seriously and often irreparably damaged.

Efficiency of the heat exchange process is notably affected if the oil inside the variator is too low. As heat dissipation and the cooling capacity are considerably reduced, the inside operating temperature increases above all at the points where the sides of the teeth come into contact.



## 6.5 REPLACING THE SEALS

The efficiency and service life of the ring seals largely depends on the operating temperature in the contact zone, any chemical reactions which may occur between the rubber compound and the lubricant and, finally, its wear condition.

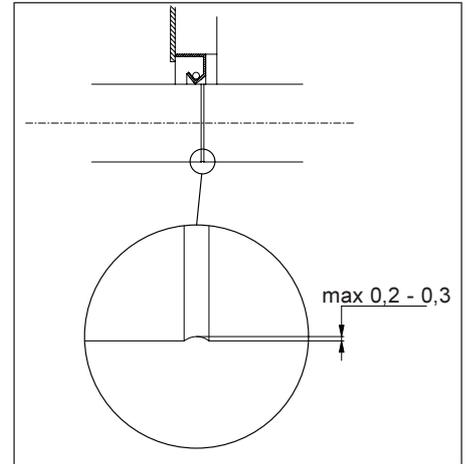
The ring seals need to be replaced when:

- the seal is no longer efficient and, as a result, oil is leaking out;
- the entire machine or system is overhauled.

Whenever a seal is no longer efficient, it must be replaced immediately to avoid any further leakage and prevent any other parts from being damaged.

When installing the new ring seal, follow the instructions below:

- take great care when handling the seal and make sure it is in good condition (do not leave it in stock for too long as this could cause premature wear especially if it is stored in a damp environment);
- always check that the seat where the seal is to be fitted is perfect i.e. without scoring, marks, nicks, dents or surface defects of any kind;
- make sure the lip of the new seal is not fitted at exactly the same point as the previous one;
- if the area where the ring seal comes into contact with the shaft has worn down by more than 0.2-0.3 mm, do not, under any circumstances, install a new seal but contact our local service centre where the staff will see whether the shaft can still be used and identify the cause of the damage;
- install the ring seal perpendicularly to the shaft, with the lip absolutely free and not curled under or pinched;
- install the ring seal so that the lip faces the oil that must be kept in or the side from where the pressure is exerted;
- for ring seals without a dust-tight lip, coat the outside of the lip with grease;
- for ring seals provided with a dust-tight lip, fill the gap between the seal lip and the dust-tight lip with grease;
- lubricate the seal seat on the shaft;
- do not use sealants because, if they get on the seal lip or shaft surface they can cause rapid wear;
- when installing the seal, press down as near as possible to the outside edge;
- do not block the ring seal axially or apply too much load;
- always use suitable tools to avoid damaging the seal lip with threads, grooves, sharp edges or keyways;
- always cover the seal lip and the seat on the shaft when repainting the variator.



All the precautions mentioned above need to be taken in order to prevent the ring seal from becoming dry especially when the shaft first starts to rotate. If the seal becomes dry, the temperatures in the area where it comes into contact with the shaft become too high immediately damaging the seal material and causing the lip to harden, crack and discolour.

## 6.6 LUBRICATION

The MK mechanical **variators** are supplied with lubricant type shell **ATF DEXRON III**.

Before starting up the unit, check that the oil is at the halfway level with the variator stopped. Top up if this is not the case. The oil should be changed after a running in period of 300 hours of operation and thereafter every 3000 hours. Use the sight-glass provided to check the oil level regularly.

The mechanical variators, type .../1 and .../2 are a combination of variators and **gearbox**; the variators is always lubricated with DONAX TA, the gearbox is lubricated with a synthetic oil type **ISO VG 320**. Depending on the size, some gearboxes are supplied with lubricant, some other are supplied without lubricant, but equipped with the due plugs. The filling of oil of these gearboxes is at the customer care; in particular, the customer shall pour in the quantity of oil indicated for the related mounting position (see paragraph "Lubricant quantity").

Once the lubricant has been added, make sure the filler, drain and level plugs are in the correct location for the pre-determined mounting position.

The following table shows the sizes that require lubricant in the combined **gearbox**.

Size	Variator	Gearbox
MK 2	Supplied with oil	X
MK 5	Supplied with oil	
MK 10	Supplied with oil	
MK 20	Supplied with oil	
MK 30	Supplied with oil	
MK 50	Supplied with oil	
MK 100	Supplied with oil	
MK 2/1	Supplied with oil	
MK 5/1	Supplied with oil	Supplied with oil
MK 10/1	Supplied with oil	Supplied with oil
MK 20/1	Supplied with oil	Supplied without oil

Size	Variator	Gearbox
MK 30/1	Supplied with oil	Supplied without oil
MK 50/1	Supplied with oil	Supplied without oil
MK 100/1	Supplied with oil	Supplied without oil
MK 2/2	Supplied with oil	Supplied with oil
MK 5/2	Supplied with oil	Supplied with oil
MK 10/2	Supplied with oil	Supplied with oil
MK 20/2	Supplied with oil	Supplied without oil
MK 30/2	Supplied with oil	Supplied without oil
MK 50/2	Supplied with oil	Supplied without oil
MK 100/2	Supplied with oil	Supplied without oil

### A Gearboxes supplied with oil

Lubricating the gearboxes with synthetic oil ensures top performance, unlimited service life and minimum maintenance is required. In this case the only maintenance procedure to be performed is cleaning the outside of the gearbox housing with gentle solvents so as not to ruin the paintwork.

#### a) Running in the gearboxes

The running in time is about 300 hours. During this period we recommend gradually increasing the power up to a limit of 50-70% of the maximum power output (during the first hours of operation). At this stage the gearbox may reach higher temperatures than normal. The oil does not need to be changed after the running in period unless any dirt or particles of abrasive material are found which could affect the gearbox operations.

### B Gearboxes supplied without oil

The gearboxes supplied by our company without oil are the ones intended for heavy-duty use. In this case, the maintenance procedures to be performed are as follows:

#### a) Running in the gearboxes

The running in time is about 300-400 hours. During this period we recommend gradually increasing the power output up to a limit of 50-70% of the maximum power output (during the first hours of operation). At this stage the gearboxes may reach higher temperatures than normal. It is advisable to change the oil after the running in period.

#### b) Changing the oil

##### Warning!

 **Before changing the oil, make sure the gearbox has come to a full stop and wait until the oil has cooled down to a temperature at which the operator does not risk getting burnt.**

- Take off the plug.
- Drain the oil from the gearbox. Remember that oil greatly pollutes the environment.
- Use a container to collect the oil. Do not dispose of the oil in the environment.
- Add oil and put the plug back on.



##### Note

**Dispose of the oil in compliance with current environmental protection laws and standards.**



## LUBRICANT CHARTS

### Variator lubrication

Make	Type of oil
* SHELL	DONAX TX
AGIP	A.T.F. DEXRON
BP	BP AUTRAN DX
CHEVRON	AUTOMATIC TRANSMISSION FLUID (DEXRON)
ESSO	AUTOMATIC TRANSMISSION FLUIDS (DEXRON)
FINA	A.T.F. DEXRON
IP	IP DEXRON FLUID
MOBIL	A.T.F. 220
SHELL	DONAX TA

\* When this product is used, the oil does not need to be changed.

### Gearbox lubrication

Make	Type of oil
IP	TELIUM OIL VSF 320
SHELL	TIVELA OIL SC 320
KLÜBER	SYNTHESO D 320 EP
FINA	GIRAN S 320

AMBIENT TEMPERATURE - 30°C ÷ + 50 °C  
 OPERATING TEMPERATURE - 40°C ÷ + 130 °C

### Lubricant quantity (litres)

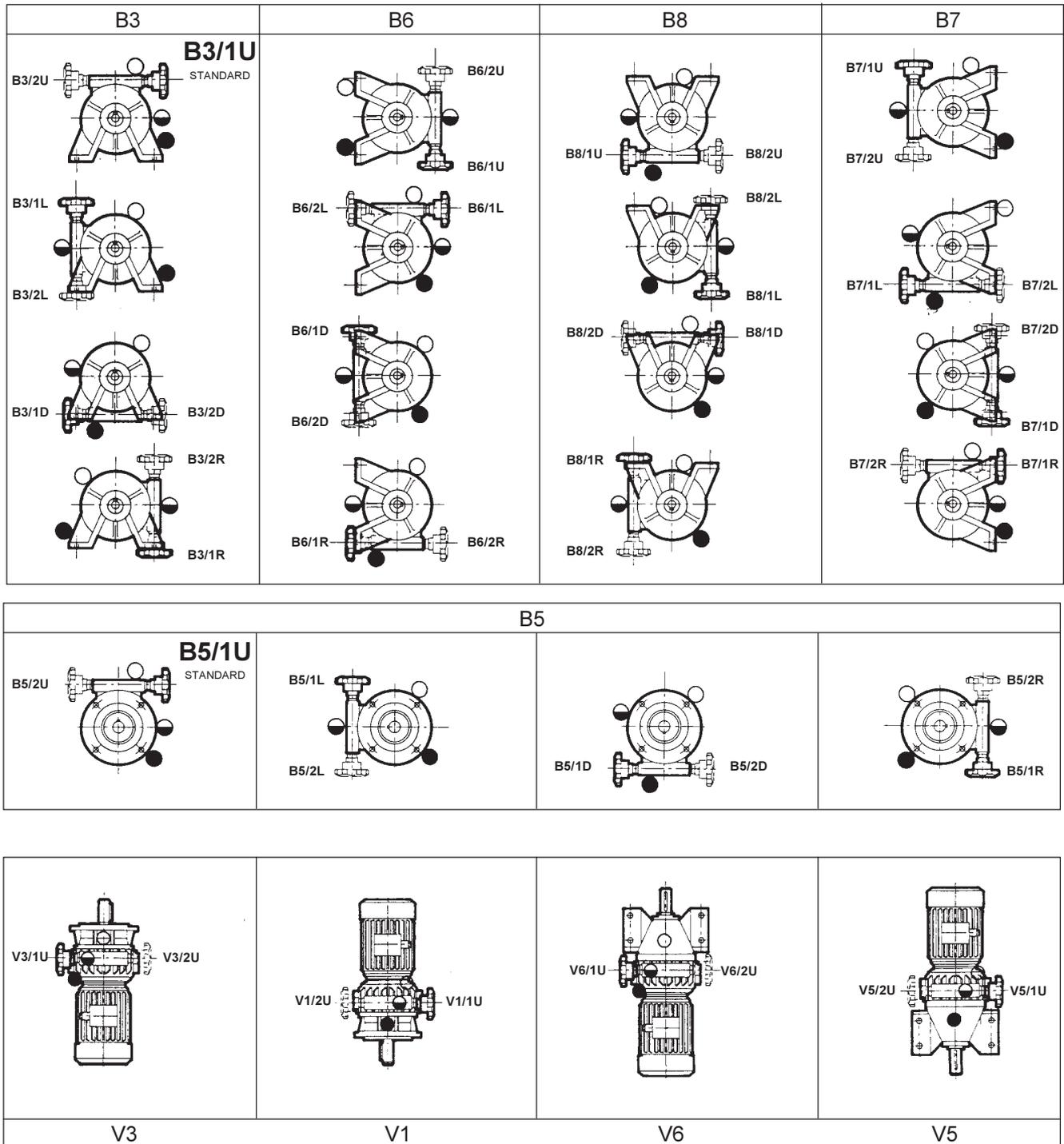
VARIATOR			
MK	B3-B5-B6-B8	V1-V5	V3-V6
2	0.120	0.260	0.130
2/1	0.120	0.260	0.130
2/2	0.120	0.260	0.130
5	0.150	0.750	0.200
5/1	0.150	0.300	0.200
5/2	0.150	0.300	0.200
10	0.420	1.700	0.450
10/1	0.350	0.700	0.450
10/2	0.350	0.700	0.450
20	0.800	2.600	-
20/1	0.800	1.200	0.950
20/2	0.700	1.200	0.950
30 - 50	1.100	5.500	-
30/1 - 50/1	1.000	2.200	2.100
30/2 - 50/2	1.000	2.200	-
100	2.700	9.000	-
100/1	2.000	4.000	4.000
100/2	2.000	4.000	4.000

GEARBOX		
B3		
0.08	MC 105/1	Lifetime oil lubricated
0.20	MC 105/2	
0.12	MC 115/1	Lifetime oil lubricated
0.40	MC 115/2	
0.18	MC 135/1	Lifetime oil lubricated
0.75	MC 135/2	
1.700	MC 170/1	Without oil
3.000	MC 170/2	
2.800	MC 210/1	Without oil
5.200	MC 210/2	
3.300	MC 260/1	Without oil
6.500	MC 260/2	

### Warning!

It is essential to check the exact amount of lubricant required for the specific mounting position as this could vary according to the operating position. Once the lubricant has been added, make sure the filler, drain and level plugs are in the correct location for the pre-determined mounting position.

## 6.7 MOUNTING POSITIONS



○ Fill-in plug

◐ Oil level plug

● Breath plug

## 6.8 TIGHTENING TORQUE CHART

For variators, gearboxes and accessories

Screw threading Class 8.8	Cast and steel twisting moment (Nm)	Aluminium twisting moment (Nm)
<b>M 4</b>	2,9	2,3
<b>M 5</b>	6	4,8
<b>M 6</b>	10	8
<b>M 8</b>	25	20
<b>M 10</b>	49	39
<b>M 12</b>	86	69
<b>M 14</b>	135	108
<b>M 16</b>	210	168
<b>M 18</b>	290	232
<b>M 20</b>	410	328

## 6.9 TROUBLESHOOTING GUIDE

This chart contains malfunctions that may arise during operation. They are listed according to the individual functions of the variator. The trouble, causes and part that may have caused the fault are indicated in the chart.

PROBLEM	POSSIBLE CAUSES	REMEDY
The motor does not start	<ul style="list-style-type: none"> <li>a) The motor's electrical wiring is faulty</li> <li>b) The motor is faulty</li> <li>c) Wrong size motor</li> </ul>	<ul style="list-style-type: none"> <li>a) Check the connections</li> <li>b) Replace the motor</li> <li>c) Replace the motor</li> </ul>
The motor and variator reach temperatures which are too high	<ul style="list-style-type: none"> <li>a) Mechanical overload</li> <li>b) Wrong size geared motor assembly</li> </ul>	<ul style="list-style-type: none"> <li>a) Check the mechanical parts driven by the geared motor assembly</li> <li>b) Replace the geared motor assembly</li> </ul>
The current absorbed and/or the temperature of the motor are too high	<ul style="list-style-type: none"> <li>a) Motor faulty</li> <li>b) Wrong size motor</li> </ul>	<ul style="list-style-type: none"> <li>a) Replace the motor</li> <li>b) Replace the motor</li> </ul>
The variator reaches a temperature which is too high	<ul style="list-style-type: none"> <li>a) Variator faulty</li> <li>b) Wrong size variator</li> <li>c) Wrong mounting position</li> <li>d) Not enough lubricant</li> </ul>	<ul style="list-style-type: none"> <li>a) Repair or replace the variator</li> <li>b) Replace the variator</li> <li>c) Check that the variator supplied is that ordered</li> <li>d) Add lubricant until the level indicated is reached</li> </ul>
Oil leaks from the shafts	<ul style="list-style-type: none"> <li>a) Ring seals worn down or defective</li> <li>b) Seal seat on the shaft worn</li> </ul>	<ul style="list-style-type: none"> <li>a) Replace the ring seals</li> <li>b) Replace the ring seals and install them in a very slightly different position or replace the shafts</li> </ul>
Oil leaks from the seals	<ul style="list-style-type: none"> <li>a) Flanges not tightened properly</li> <li>b) Seals defective</li> </ul>	<ul style="list-style-type: none"> <li>a) Tighten the flanges</li> <li>b) Replace the seals and check that the surfaces are properly machined</li> </ul>
The variator is making a banging noise.	<ul style="list-style-type: none"> <li>a) Gear teeth defective (applicable only to ../1, ../2 and MKD)</li> </ul>	<ul style="list-style-type: none"> <li>a) Contact our customer service department</li> </ul>
The variator is whistling.	<ul style="list-style-type: none"> <li>a) Not enough lubricant</li> <li>b) Gears defective or worn down (applicable only to ../1, ../2 and MKD)</li> <li>c) Bearings defective or not installed properly</li> </ul>	<ul style="list-style-type: none"> <li>a) Add lubricant until the level indicated is reached</li> <li>b) Contact our customer service department</li> <li>c) Contact our customer service department</li> </ul>

## 7 REPLACEMENT PARTS

If used properly and the scheduled maintenance is regularly performed as specified in this manual the variators are designed and engineered not to require spare parts due to faults or break downs.

If some parts need to be replaced, use only original spare parts. The parts are to be removed and re-installed only by specially-trained authorized personnel.

**Along with voiding the warranty, use of non-original spare parts may also affect proper operation of the variator.**



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MOTORIDUTTORI  
VARIATORI CONTINUI  
MOTORI ELETTRICI C.A./C.C.  
GIUNTI ELASTICI

GEARBOXES  
GEARED MOTORS  
SPEED VARIATORS  
A.C./D.C. ELECTRIC MOTORS  
FLEXIBLE COUPLINGS



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