



**INSTRUCTION MANUAL  
ACTUATOR CLASSE I  
KOZLODUY  
TYPE MA, MB**

**B BERNARD**

<b>L. BERNARD</b>	<b>INSTRUCTION MANUAL</b>	<u>Number</u> : NR 1121	Page : 2/22
		<u>Revision</u> : C	
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<b>PRODUCT DESCRIPTION</b>			

## **GENERAL DESCRIPTION**

### **CLASS I ACTUATOR DESIGN**

The answer to intensive and fast electric modulation demand is the L. BERNARD Class I actuators. A complete actuator program ranging from direct quarter turn to linear actuators as well as rotary systems with operating levers : a unique Class I program.

Powerful brushless DC motor with low inertia associated to a high mechanical efficiency is proof that guarantees a product particularly adapted to modulating requirements in all fields of industry with difficult environments.

L. BERNARD gear trains are constructed of heat-treated steel and special bronze wheel for durability and long life. Fast rotating shafts are all with ball bearings. The planetary gear reduction has the advantage of greatly reducing motor speed and at the same time obtaining a very high mechanical efficiency. The secondary reduction wheel and worm which follows consequently has a low input speed requiring only a small reduction and therefore obtaining also a high mechanical efficiency. However, if the main actuator reduction were obtained by means of a wheel worm, a large reduction on this type of gearing would produce a poor mechanical efficiency.

Because of its high mechanical efficiency, the planetary gears system allows the use of a compact motor with a very low inertia rate, where as a far more powerful and heavier motor would be needed for a system with low mechanical efficiency.

The first distinctive sign of a modulating actuator is therefore a highly compact motor. In fact, a compact motor has a low inertia rate and as all motorized unit, inertia comes from the motor rotor, the more compact the motor, the more precise and accurate the regulation will be.

As an actuator with a too high inertia rate would be unable to reach the position required quickly, a phenomenon known as "hunting" caused by the motor inertia will happen.

It is also necessary that the actuator has a minimum of backlash between the motor output-shaft and the position sensor. The connection is mechanically direct between the motor and the output shaft without the need for dog-clutching, clutch engaging, hammer blows, causing backlash in the gearing and connections in the regulation.

the second essential characteristic is the use of a modulating motor with a tendency to frequent changes in direction and which can bear high start-up rates. The motor, proposed for this type of actuator, is a brushless DC motor.

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## **BRUSHLESS DC MOTOR**

For a short time response, the actuator needs a motor with low inertia, a high starting torque and speed control. The brushless DC motor is the best choice to move the Class I actuators. The motor samarium cobalt magnets produce a high magnetic field to assure high starting torque and high efficiency. The special DC motor design without brushes is a reliable system requiring no maintenance.

The motor digital sensor gives the angular rotor position and also a speed feedback signal.

Through PRECIGAM power electronic, rotation, speed and torque are controlled. In spite of important torque variations during the stroke of the valve, this control guarantees the modulation precision.

## **POSITION FEEDBACK SIGNAL**

For a high precision positioning, a contactless sensor is fitted to the output shaft without play. The technology is a LVDT (Linear Variable Differential Transformer) with a local signal treatment on electronic board.

- Precision :  $\pm 0.25\%$
- Output signal : 4-20mA
- Voltage supply: 24V DC

## **PRODUCT SPECIFICATION**

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## Actuator

Ambient temperature :	-10°C to +60°C
Enclosure :	IP67
Voltage supply :	DC 500V
Type of cooling :	Surface cooling
Insulation class :	F
Duty :	100%
Motor protection :	Built-in thermal protection embedded in winding connected to terminal. When motor becomes too hot the contact is interrupted.
Travel limit switches :	2 contacts SPDT type for control circuit 2 contacts SPDT for signaling rating (gold contact) 24VDC 5mA
Torque limit switches :	2 contacts SPDT type for control circuit

### Mechanical dial position indicator:

Position transmitter :	LVDT Linearity $\pm 0.25\%$
Electronic board LVDTAM :	MCHP module Output signal 4 to 20 mA Supply voltage 24V DC

### Particular specifications :

Actuator type :	MB+VE100
Modulating :	Class I
Stroke :	Maxi 100 mm
Momentary thrust :	Maxi 2600 daN maxi
Permanent thrust :	Maxi 1082 daN
Actuator speed :	Maxi 43 rpm
Operating time :	15 secs.
Motor Nominal power :	0.3Kw
Voltage :	500V
Speed :	3000 rpm
I nominal :	0.6 Amp.
I starting :	3.2 Amp.
Moment of inertia:	$5,5 \times 10^{-4}$ Kg.m <sup>2</sup>

## PRODUCT SPECIFICATION

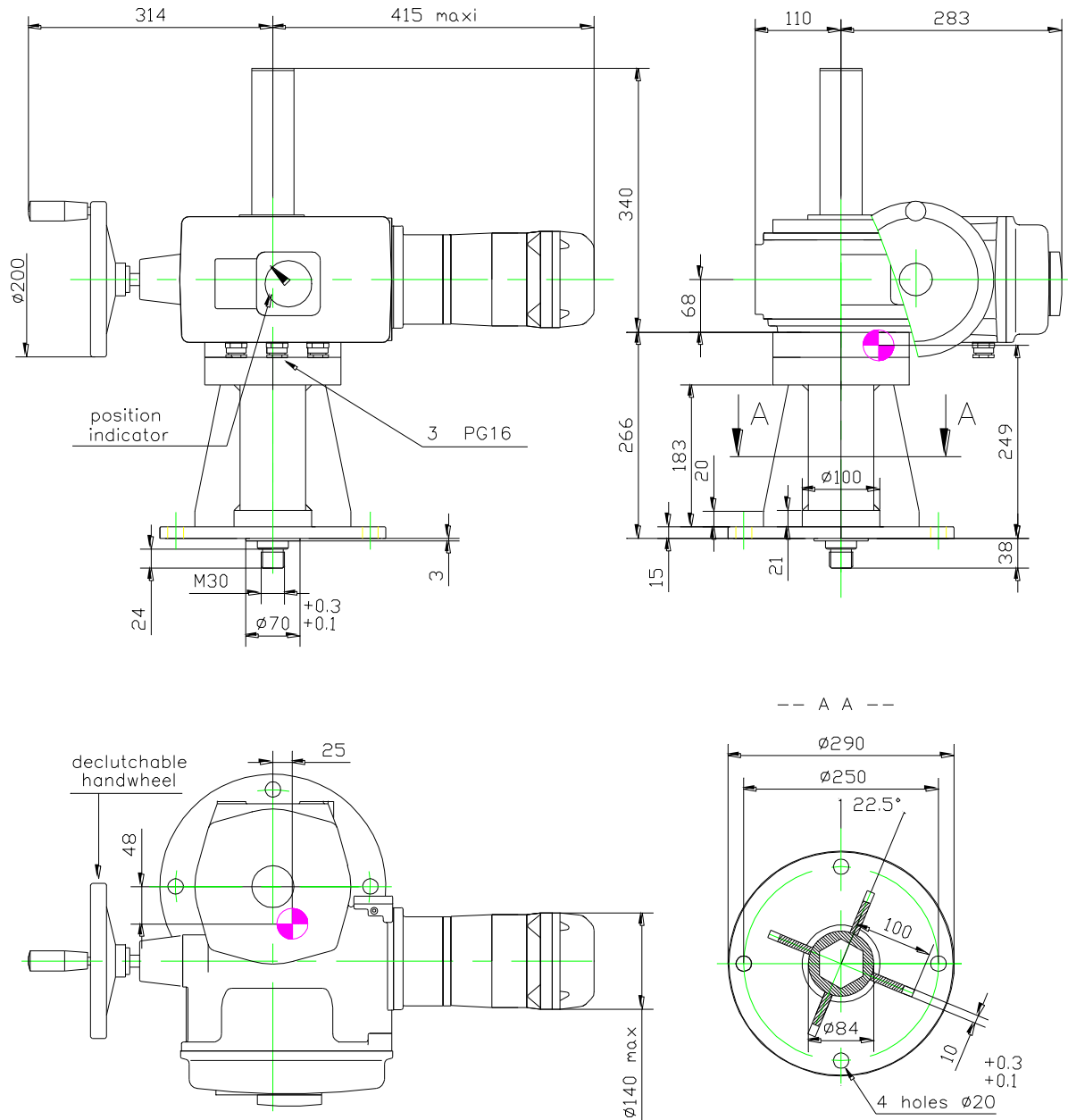
Positioner PRECIGAM

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<b>PRODUCT DESCRIPTION</b>			

- Cabinet
  - metallic box
  - Dimensions : 300 x 400 x 200 mm
  - Front door with key
  - Cable entries: 2 Pg16 for actuator  
3 Pg16 for user
  
- Ambient temperature : -10°C to + 60°C
- Enclosure : IP55
- Voltage supply : 3 phase, 380V, 50Hz ( $\pm 10\%$ )
  
- Input signal : 4 - 20 mA (270 $\Omega$ )
- Output signal : 4 - 20 mA (load 300  $\Omega$  maxi) :  
*This signal is not electrically isolated from the input signal.*
  
- Remote impulsional command
- Precision of positioning :  $\pm 0.5\%$
- Alarm relay  
*This relay is normally activated and released in case of :*
  - Motor thermal overload
  - Torque switch tripped either way
  - Fault electronic card voltage supply
  
- Electronic chassis
  - Aluminum housing with mother board and 4 slots.
  - The 4 electronic boards are :*
    - Positioner board GAMX
    - Control board CONT1
    - Control board CONT2
    - Power board with heatsink P400
  
- Technology :
  - Logic : CMOS
  - Power: MOSFET transistor

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## OUTLINE DIMENSION DRAWINGS



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<b>INSTALLATION</b>			

## STORAGE

The actuators should be stored under shelter in a clean, dry place and protected from constant changes in temperature.

Avoid placing the actuators directly on the floor. For the actuators equipped with heat resistance, it is recommended that you connect and give supply to it especially if the place of storage is humid (standard voltage 230 volts, unless otherwise specified).

Check that temporary sealing plugs of the cable entries are well in place. In case of humidity, use metal plugs.

Make sure that the covers and the boxes are well closed to ensure weatherproof sealing.

### ***Control after storage***

#### 1. Storage not exceeding one year :

- Maintain a visual check of electric equipment.
- Operate manually the microswitches, buttons, selectors, etc. to insure the correct mechanical function.
- Operate apparatus manually.
- Verify the correct grease consistency.
- Follow instructions included in the commissioning instruction here given.

#### 2. Storage exceeding one year :

- Long time stocking change grease consistency. The grease thin thickness on stem dries up. Remove all the old grease of the actuator mechanical parts and replace with new grease.
- Maintain a visual check of electric equipment.
- Operate manually the microswitches, buttons, selectors, etc. to ensure the correct mechanical function.
- Follow instructions included in the commissioning instruction here given.



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## UNPACKING

L Bernard actuators are packed in standardized cardboard. Actuators mounted on valves are strapped to a skid and crated. After unpacking, the wooden platform may be used to transport the actuator to the installation site.

## HANDLING

Do not attach to the actuator ropes or hooks to lift valve by hoist. Handling a heavy valve through the actuator may damage coupling between valve and actuator.

## INSTALLATION - MECHANICAL

The MB actuator with linear system should be installed vertically. Be sure it is firmly bolted to the valve.

**Caution: For installation, actuator and valve should not be uncoupled otherwise a new adjustment is necessary.**

## INSTALLATION - ELECTRICAL

Verify cable maximum length between actuator and positioner PRECIGAM is less than 50m. Verify cable diameter is in concordance with cable gland. Check wiring very carefully between actuator terminals and positioner terminals before connecting power.

**Caution: Always close covers and positioner door immediately after installation or service to prevent moisture or other foreign matter from entering the actuator or electronic positioner box.**

Refer to the wiring diagram furnished with positioner for proper AC power and signal connections. It is advisable to provide normal short circuit protection on the AC power line. For safety and electrical noise protection the actuator and the positioner box should be grounded. Control cable between actuator and positioner box should be a screened cable. Connect the screen to terminal 95 (only positioner side) and isolated from ground. Do the same with input signal cable.

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	<b><i>INSTALLATION</i></b>		

## **START-UP INSTRUCTIONS**

After the actuator and positioner are mounted and their wiring connections are made, it is ready to be tested for proper operation.

**Note: Actuator mounted on the valve is ready for installation. No electrical adjustments are required before placing them in operation.**

Turn on the power supply. Operate the actuator with the manual control knob inside the positioner box PRECIGAM and with the switch on manual position. Run the actuator through its full stroke, both directions. Observe that the actuator travels through its desired stroke. If satisfactory, set the switch on AUTO position.

**Note: If there is no input signal the actuator stay in its last position**

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<b>MAINTENANCE</b>			

## DESCRIPTION

Actuator is designed for modulating duty. Housing includes a brushless dc motor, a planetary gear and a worm and wheel. Rotating shaft drives a nut / power screw system for a linear movement. Equipment includes a travel limit switch and a torque limit switch for each direction of rotation. To control feedback position a sensor LVDT contactless and linear measures directly valve stem movement through the output shaft of actuator. This sensor is located upper part of actuator in line with valve stem. A separate box includes electronic positioner PRECIGAM. Input signal for remote control is 4 to 20 mA. Impulsional command, open, close is also possible after selecting this mode remotely. When opening positioner box a local auto/man switch allows driving the actuator for test with a manual control knob.

## COMMISSIONING INSTRUCTIONS

### ***1 notes concerning the electrical connection***

Positioner PRECIGAM is located in a separate box. This positioner has to be wired to actuator with 2 cables: one for power and one for control. Control cable has to be separated from power cable and to be of shielded type. Electrical screen has to be isolated from earth and connected only on positioner box on terminal 95 (0v electric). Also control cable coming from control room has to be shielded type. To avoid interference a distance of minimum 10 cm will be maintained between other cables. Electrical screen has to be isolated from earth and connected only on positioner box on terminal 71 (0v electric).

### ***2 direction of rotation***

After assembly of actuator and valve achieve wiring between actuator and positioner box, check this wiring. Push and turn handwheel until actuator is in intermediate position. Open terminal box of actuator (close to cable gland) and also positioner box. Check remote impulsional command is not active (no link on 19-34, 35 and 36). Put the switch auto/man of card GAMX on manual: « MAN ». Supply positioner with power (see electrical wiring). Direction of rotation verification: GREEN LED on, open the valve or RED LED on, close the valve. In any other case, disconnect immediately power supply and check that the wiring between actuator and positioner is correct. Then with the incorporated manual control knob of GAMX card check that positioner works correctly. An ORANGE LED is on when the torque limit switch is tripped. This protection is effective even in the case of a wrong direction of rotation of the motor.

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### **3 setting of dead band**

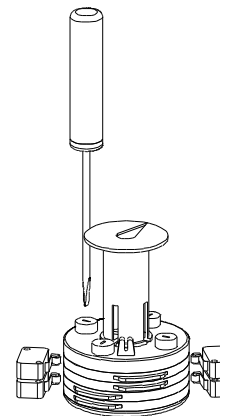
This setting is already done in our works. If it is necessary to adjust this dead band use a little screwdriver to operate, on GAMX card, potentiometer « dead band ». (Dead band will decrease when potentiometer is turned CCW). If setting is too narrow, actuator is hunting. Note: If dead band is excessively narrow, actuator may operate in one direction only.

### **4 Setting of travel limit switching with cam bloc system**

Ends of travel settings are done in actuator. The cam block is equipped with 4 cams different colors. White and black cams for end of travel limits. Use manual control knob on GAMX card to operate the actuator in a closed or open direction. Put the actuator in open position. Using a screw driver rotate the cam to the position in which it can trip the limit switch.

Then put the actuator in close position. Using a screw driver rotate the cam to the position in which it can trip the limit switch.

Open and close the valve again to check at 0% position actuator stops just before valve seat and RED and ORANGE LED are off.



#### To stop when valves are closed by torque limiter

If the valve must to be closed on torque limit switch, cam will not trip the switch in close direction before valve tight. Adjust the cam beyond the stop position.

Auxiliaries travel limit switches are adjusted with gray and beige cams. Rotate the cam to trip the switch just before actuator stops.

### **5 setting of 0 %**

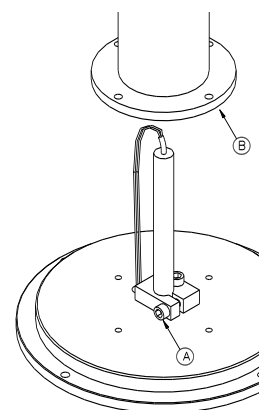
Turn manual control knob clockwise until mechanical stop is reached (0% position). Actuator starts in a closed direction and stops before reaching the closed position. Remove sensor cover item B (4 screws). Loosen the fixing screw item A of sensor LVDT and carefully slide LVDT inside to move actuator just before touching valve seat. RED AND ORANGE LED are off. Tighten the fixing screw item A.

#### Special case:

Actuator starts in closed direction and doesn't stop before reaching closed position. In this case, loosen fixing screw item A and carefully slide LVDT outside until RED LED is off.

Tighten the fixing screw item A.

Open and close the valve again to check at 0% position actuator stops just before valve seat and RED and ORANGE LED are off.



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To adjust 0% when valves are closed by torque limiter

Turn manual control knob clockwise until mechanical stop is reached (0% position). Actuator starts in a closed direction and stops before reaching the closed position. Remove sensor cover item B (4 screws). Loosen the fixing screw item A of sensor LVDT and carefully slide LVDT inside to move actuator **until touching valve seat and stop on torque limiter**. RED LED IS OFF AND ORANGE LED IS **ON**. Tighten the fixing screw item A. Check again to be sure to stop on valve seat by torque limiter.

Special case:

Actuator starts in closed direction and doesn't stop before reaching closed position. In this case, loosen fixing screw item A and slide LVDT a little bit outside. With manual control knob move the actuator in open direction and close again (until knob mechanical stop is reached: 0% position).

Actuator must stop before reaching the closed position then apply the above method.

**6 setting of 100%**

Span of positioner is done in our works and is in accordance with valve stroke. Therefore no adjustment is necessary.

## ADDITIONAL TECHNICAL INFORMATIONS

### 1 0% setting with a voltmeter

0% setting can be done with more precision by using a DC voltmeter. Connect voltmeter between terminals 95 and 17 (terminals of positioner box).

Turn control knob to 0%, actuator will run to closed position. Loosen fixing screw item A of sensor LVDT and carefully slide LVDT to area where the voltage reads 1 volt on the voltmeter. Actuator must stop just before valve seat and ORANGE LED off. Set LVDT at point just when voltage starts increasing. Tighten the fixing screw item A.

#### To adjust 0% when valves are closed by torque limiter

Turn control knob to 0%, actuator will run to closed position. Loosen fixing screw item A of sensor LVDT and carefully slide LVDT inside to move actuator **until touching valve seat and stop on torque limiter**. The voltage reads a little bit more than 1 volt on the voltmeter. Actuator must stop on valve seat and ORANGE LED ON. Tighten the fixing screw item A. Check again to be sure to stop on valve seat by torque limiter.

### 2 how to use the output signal of the positioner

Connect a millimeter on terminals 72+ and 73-. No supply voltage is required from outside. Important note: This signal is not electrically isolated from the input signal.

### 3 Fail safe position

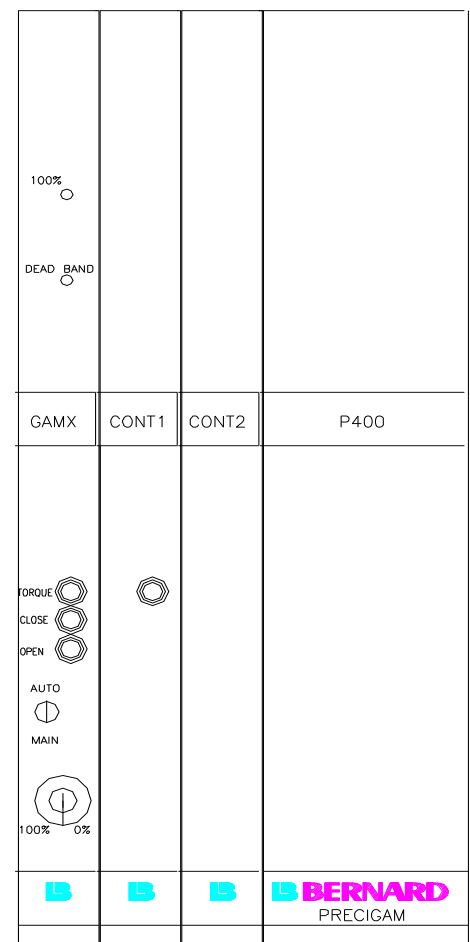
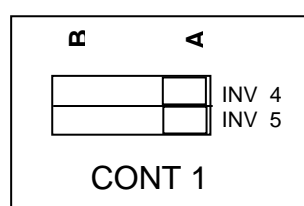
Fail-safe position if input signal is out of range.

Fail safe position is configured in close position.

To configure the fail safe position, switch off the current, remove the board CONT1 and configure the switches INV4 and INV5

3 choices :

Switches on board CONT1	INV 4	INV 5
actuator stays in position	A	A
actuator closes	A	B
actuator opens	B	A



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## **ACTUATOR**

A minimum of inspection is sufficient during normal life of actuator. A visual inspection is in order to verify that the connection with positioner PRECIGAM is intact and because of possible vibration that all terminal screws are tightened.

### ***Lubrication***

Periodic lubrication is not required on L.BERNARD actuator. Only in most severe applications, and during major shut downs, the linear system nut and screw can be inspected to determine the need to relubricate this gear.

### ***Linear system inspection***

**Caution: This operation needs to remove position sensor and to uncouple stem valve.**

To inspect the gears, remove sensor cover on the top of the actuator, remove the plate supporting the sensor body. Take care during this operation not to damage the core sensor that still remains on actuator. Unscrew the core sensor from power screw. Remove upper flange of linear system (4 screws). Nut and power screw become visible. If grease is black and loaded with bronze powder it should be necessary to replace it. This requires complete disassembly of the nut and screw. Clean all parts thoroughly, removing all old lubrication. All damaged or worn parts should be replaced.

Recoat the nut, screw, and hexagonal part with grease of Emperor Laminex EP1 or equivalent. Laminex EP1 is a grease with lithium, extreme pressure properties and grade NLGI 1 (EP1). Working temperature range -25°C to + 130°C. Quantity: about 250g.

Reassemble the linear system. Screw the sensor core on power screw and secure with medium tape lock. Replace the sensor body. Now see commissioning instructions to adjust sensor 0% position.

### ***Repair and replacement***

The following sections describe the procedures to follow to remove and replace various components of L.BERNARD actuator. Refer on drawings for location of components.

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### *Gaskets*

During routine service, inspect the covers, motor and control box and change gaskets for wear or damage. In order to protect internal components worn or damaged gaskets and O-rings should be replaced. Remove all of the old gasket material from the body housing and cover before fitting a new gasket.

### *Mechanical component, bearings or seals of main housing*

Field replacement of these components is not recommended.

### **Motor**

Field- repair of the motor is not recommended. Disassembly of the motor will result in loss of precise position between cam and rotor.

To remove the motor, first disconnect the motor wires in the terminal compartment of the actuator (9 wires). Remove the 4 mounting screws and motor. Don't remove intermediate module between motor and main housing. Carefully remove the motor with its wires.

To install the motor, insert the 9 wires through the sleeve in the wire hole and inside the terminal compartment. Carefully engage motor shaft with its key and drive wire to be sure not to damage them. Reconnect the motor wires.

### **Sensor board LVDTAM**

Field- repair of the electronic board is not recommended.

To remove LVDTAM disconnect power voltage. Record the wire colors on the terminal block of LVDTAM then disconnect the wires. Loosen and remove the 4 screws that hold the board. Install the new LVDTAM and fix it with 4 screws. Reconnect wires to the terminal board.

On actuator terminal board remove the link 41-28 in order to lock the motor. Restore power voltage. Connect a meter DC current on LVDTAM board terminals 5 and 6. Open manually the valve until voltage value is 0 volt (50% position). Then connect the meter on actuator terminals 80-82 and adjust offset potentiometer P2 exactly to 3 volts (corresponding to 12 mA). Fully open the valve (travel limit switch position) and adjust gain potentiometer P1 exactly to 5 volts (corresponding to 20 mA) .

Replace the link 41-28 and check closed position. In case of deviation adjust the sensor (see commissioning instructions).



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## POSITIONER PRECIGAM

Positioner PRECIGAM doesn't require special maintenance. Verify connection is intact and terminals for tightness. This section describes the procedures to follow for replacement of electronic boards. Note that electronic boards are not field-repairable.

To remove an electronic board, first disconnect power supply.

**Caution: Electronic board should not be removed under voltage.**

Remove up and down screws and carefully slide the board out of the positioner block. To install a new board, carefully slide it into guide slots and fix it with screws. Take care not to interchange 2 boards of different tag. Reconnect electric power.

### Fuses protection

Fuses located on P400 electronic board

Power fuse: FUS1 - 6.3 x 32mm - Fast fuse - 4A / 400v-500v.

Control circuit fuse: FUS2 - 5 x 20mm - Fast fuse 500mA.

Fuse located on power supply AL 24 for feedback sensor:

FUS - 5 x 20mm - TempORIZED 100mA

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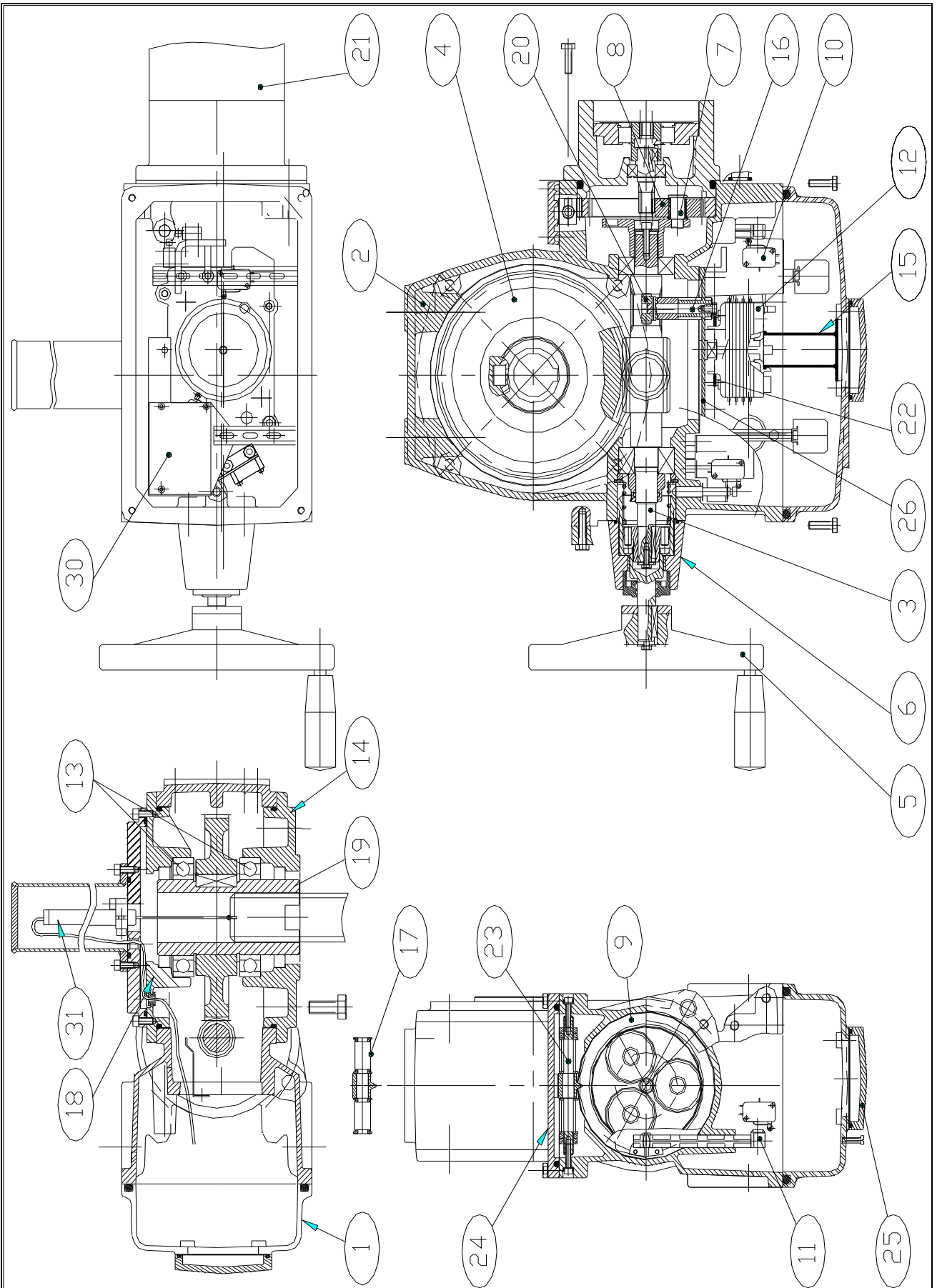
**Type MB - MB1**  
ACTUATOR 6 SERVOMOTEUR  
Drawing/plan n°X1743-01

<b>SPARE PARTS LIST - LISTE DE PIECES DE RECHANGE</b>			TYPE 1
ITEM	PART NAME	DESIGNATION	CODE
1	COVER	COUVERCLE	
2	HOUSING	CARTER	
18	UPPER FLANGE	JOUE SUPERIEUR	
14	FIXING FLANGE	BRIDE DE SORTIE	
5	HANDWHEEL	VOLANT DE CDE MAN.	
6	DECLUTCHING DEVICE	DÉBRAYAGE DE CDE MAN.	
15	POINTER DISK	INDICATEUR DE POSITION	
25	INDICATOR WINDOW	FENETRE D'INDICATEUR	
12	CAMBLOCK	BLOC A CAMES	
9	CROWN	COURONNE	
7 + 8	PLANETARY GEAR+3 SATELLITES	PORTE SATELLITES - 3	
3	WORM ( worm-wheel / according type )	VIS SANS FIN ( vsf/roue )	
4	WHEEL ( according type )	ROUE	
20	WHEEL TLS-1	ROUE FIN DE COURSE	
16	PINION TLS	FIN DE COURSE	
22	WHEEL TLS-2	ROUE FIN DE COURSE	
26	SWITCH PLATE	PLATEAU DE FIN DE COURSE	
17	SPRING ( torque device )	RESSORT DE LIMITEUR	
23	BOLT	TIGE	
11	PLASTIC SHAFT	TIGE PLASTIQUE	
24	TORQUE COVER	COUVERCLE LIMITEUR	
13	BALL BEARING SET	POCHETTE DE ROULEMENTS	
Set / jeu	GASKETS & O-RINGS SET	POCHETTE DE JOINTS	
19	MAIN DRIVE SHAFT	ARBRE DE SORTIE	
21	MOTOR	MOTEUR	
10	MICROSWITCH	MICRORUPTEUR	
30	SENSOR BOARD LVDTAM	CARTE CAPTEUR LVDTAM	
31	POSITION SENSOR LVDT	CAPTEUR DE POSITION LVDT	
			REF-LIST SP-MB-B1 TT01

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**ELECTRIQUES/ELECTRONIQUES  
POSITIONER PRECIGAM  
COMPONENTS/COMPOSANTS**

<b>SPARE PARTS LIST - LISTE DE PIECES DE RECHANGE</b>			TYPE 1	
ITEM	PART NAME	DESIGNATION	CODE	
GAM-X	ELECTRONIC BOARD	CARTE ÉLECTRONIQUE		
CONT.1	ELECTRONIC BOARD	CARTE ÉLECTRONIQUE		
CONT.2	ELECTRONIC BOARD	CARTE ÉLECTRONIQUE		
P400	ELECTRONIC BOARD	CARTE ÉLECTRONIQUE		
				REF-LIST SP00PREC I TT01



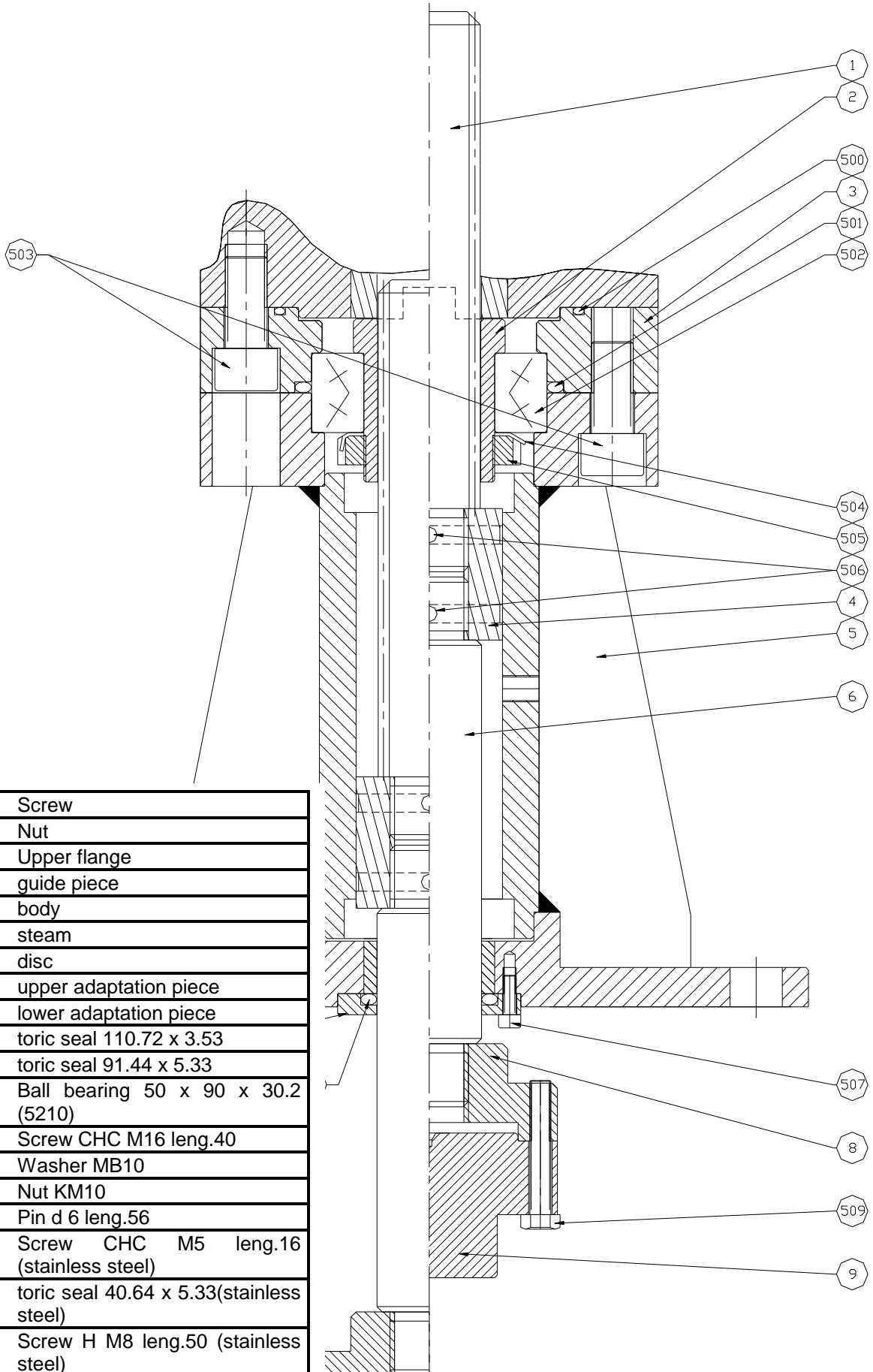
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IND.	DATE	AUTEUR	VERIF.	APPROUV.	MODIF.
		60 av. du President WILSON 93211 LA PLAINE ST DENIS FRANCE		TEL. (1) 48.09.29.12 FAX. (1) 48.09.25.29	

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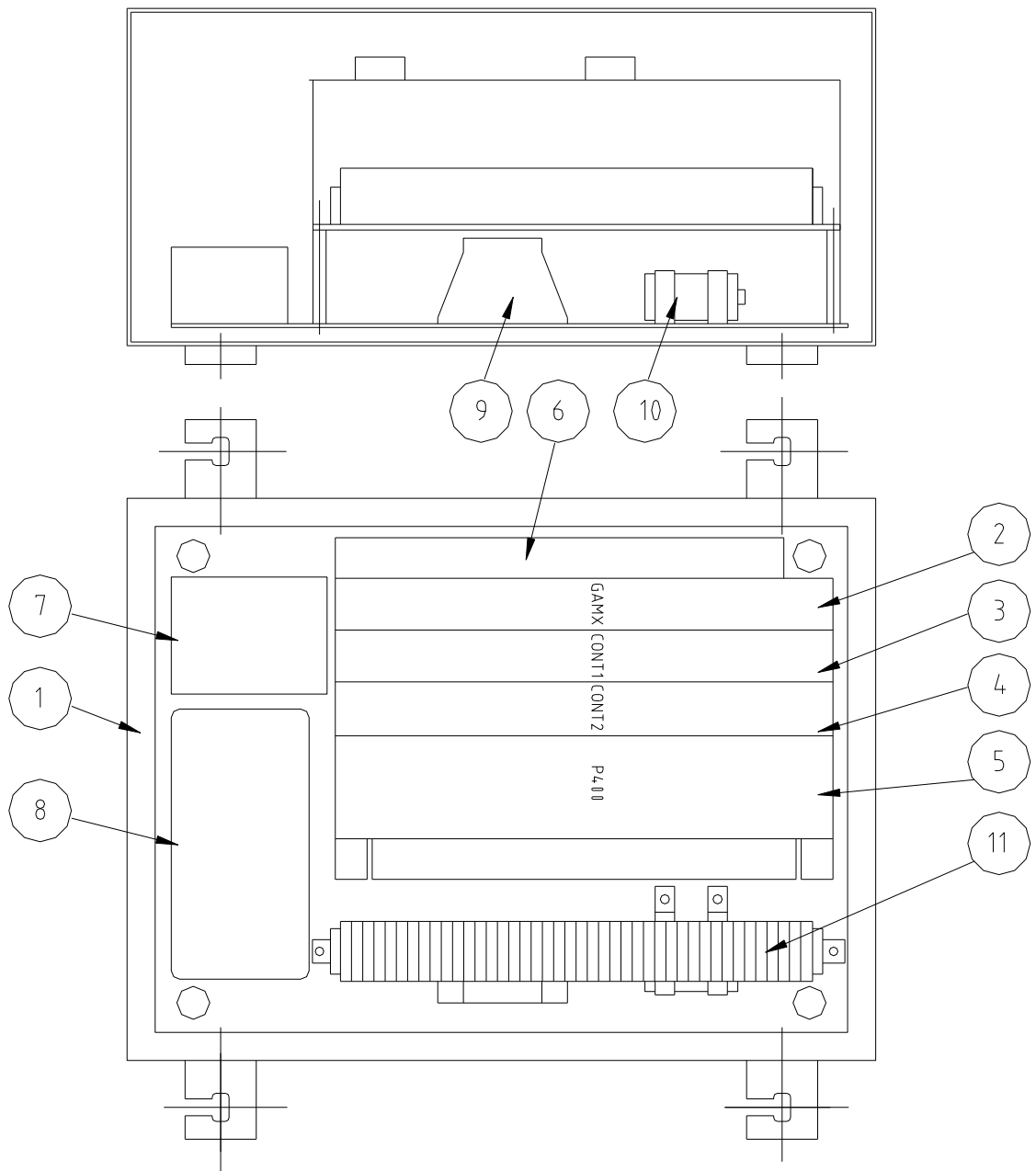
PIECES DE RECHANGE / SPARE PARTS

MB

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1	Screw
2	Nut
3	Upper flange
4	guide piece
5	body
6	steam
7	disc
8	upper adaptation piece
9	lower adaptation piece
500	toric seal 110.72 x 3.53
501	toric seal 91.44 x 5.33
502	Ball bearing 50 x 90 x 30.2 (5210)
503	Screw CHC M16 leng.40
504	Washer MB10
505	Nut KM10
506	Pin d 6 leng.56
507	Screw CHC M5 leng.16 (stainless steel)
508	toric seal 40.64 x 5.33(stainless steel)
509	Screw H M8 leng.50 (stainless steel)



- 1 metallic box SAREL 300x400x200mm
- 2 GAMX board
- 3 CONT1 board
- 4 CONT2 board
- 5 P400 board
- 6 carrier module 4 slots. PRECIGAM
- 7 power supply AL24
- 8 power line filter SCHAFFNER FN251-4-07
- 9 transformer 400/24V, 10VA
- 10 capacitor 10 $\mu$ F/400V
- 11 terminals

A	27/02/01	SALVUCCI			
IND.	DATE	AUTEUR	VERIF.	APPROUV.	MODIF.
<b>B</b>		4 rue d' Arsonval BP 91 TEL. 01.34.07.71.00			
		95505 GONESSE CEDEX - FRANCE FAX. 01.34.07.71.01			
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CONTROL BOX PRECIGAM