

ATH 400M / ATH 1000M

MAGLEV HYBRID TURBOMOLECULAR PUMP



TECHNICAL REFERENCE MANUAL

High Vacuum Technology



France

Alcatel CIT - High Vacuum Technology
98, avenue de Brogny - BP 2069
74009 ANNECY Cedex
Tel : (33) 4 50 65 77 77
Fax : (33) 4 50 65 77 89

Germany

Alcatel HOCHVAKUUMTECHNIK GmbH
Am Kreuzeck 10
D - 97877 WERTHEIM
Tel : (49) 9342 9610-0
Fax : (49) 9342 9610-30

Italy

Alcatel Vacuum Systems S.p.A
Via Trento, 30
20059 VIMERCATE (MI)
Tel : (39) 39 686 3855
Fax : (39) 39 667 125

Japan

Alcatel ITS JAPAN
High Vacuum Technology Division
Ebisu MT Building 5th Floor, 15-7, Higashi
3-Chome, Shibuya-ku, TOKYO 150-0011
Tel : (81) 3 5468 1621
Fax : (81) 3 5468 1603

Korea

Alcatel Vacuum Technology Korea
5th Floor, Sunghyun B/D
10-5, Karak-Dong, Songpa-ku
Seoul, SOUTH KOREA
Tel : (82) 2 409 6277
Fax : (82) 2 409 6279

United Kingdom

Alcatel Vacuum Technology (U.K.) Ltd.
10 Lancaster Court - Coronation Road
HIGH-WYCOMBE, HP 12 3TD
Tel : (44) 1 494 448 444
Fax : (44) 1 494 448 222

USA

Alcatel Vacuum Products
67 Sharp Street
HINGHAM, MA. 02043
Tel : (1) 781 331 - 4200
Fax : (1) 781 331 - 4230

High Vacuum Technology



ATH 400M / ATH 1000M

Maglev hybrid turbomolecular pump

Welcome

Dear Customer,

You have just purchased an Alcatel maglev hybrid turbo pump.

We would like to thank you and are proud to count you as one of our customers.

This product has benefited from Alcatel's many years of experience in the field of turbomolecular pump design.



In order to ensure the best possible performance of the equipment and your complete satisfaction in using it, we advise you to read this manual carefully before any intervention on your pump and to pay particular attention to the equipment installation and start-up section.

MANUAL REFERENCE : **105 923**
EDITION : **06 - SEPTEMBER 1997**

APPLICATIONS:

SEMICONDUCTOR APPLICATIONS
Plasma etching, Ion implantation, Sputtering,
Plasma deposition.

OTHERS APPLICATIONS

Electron microscopes, Surface analysis,
Research and development, High energy physics,
Space simulation, Accelerators.

ADVANTAGES:

High throughput - Quiet and clean vacuum - Corrosion proof - High MTBF - Minimum size, volume and weight - Smart and compact electronic controller - Reliability - Maintenance free - Battery free - Easy integration.

List of chapters for the document ED06

The document edition 06 includes the following chapters:

■ Welcome	Ed 06	■ Chap.C contents .	Ed 06	■ D 170.	Ed 06
		■ C 10.	Ed 06	■ D 180.	Ed 06
■ Contents.	Ed 06	■ C 20.	Ed 06	■ D 190.	Ed 06
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■ B 120.	Ed 06	■ D 160.	Ed 06	■ E 90.	Ed 06

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| ■ <i>E 100</i> | <i>Ed 06</i> | ■ <i>G10</i> | <i>Ed 05</i> |
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Introduction to the ATH 400M/ATH 1000M and their associated ACT controllers

2 magnetically levitated hybrid turbo pumps



ATH 400M and ATH 1000M

Five active axes

ACTIDYNE® Maglev bearings type (S2M Patent)
Rotor position control in 5 directions.

Exclusive protection.

Inert gas purge

Eliminate corrosion of the motor and magnetic bearing coils.

Automatic balancing system

Lowest possible levels of noise and vibration.
Compensation for any imbalance of the rotor.

Maintenance free

Battery free

In case of a power failure, the pump motor acts like a generator to transform the rotor energy into electrical power to supply the controller.

Inverted dynamic seal

High compression ratio.

ATH 400MT ATH 1000MT

Integral heater band

Maintaining the pumps internal surface up to 75°C to prevent the condensation effect.
Temperature regulated by the ACT controllers.

Introduction to the ATH 400M/ATH 1000M and their associated ACT controllers

ACT 600M and ACT 1000M controllers



The new generation of ACT controller family

Especially designed for maglev turbopumps

Light and small controllers.
Battery free.

Convenient interface

Handy keyboard;
Alphanumeric display.

Modern pump monitoring

Monitoring of testing and troubleshooting parameters;
RS 232/485 serial links;
Automatic power supply detection from 85 to 265 V,
48/63 Hz single phase.

Large range of interface

Dry contacts interface for status signals and optocoupled
control inputs;
Selectable Analog 0-10 V output.

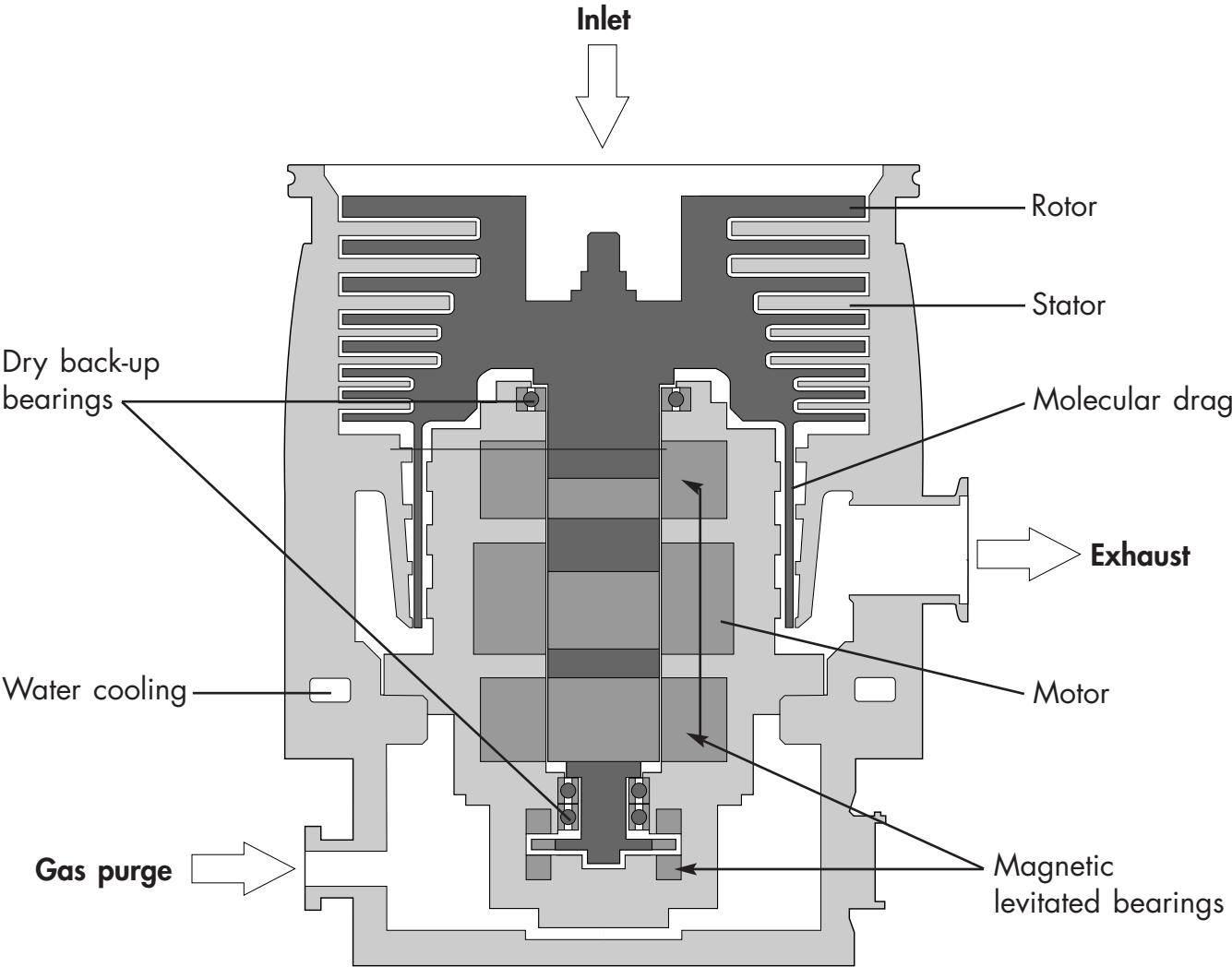
The pump operating principle

A hybrid technology

The ATH 400M and ATH 1000M integrate the advantages of a multi-staged turbomolecular pump with a spiral helix molecular drag section to enhance ultra high-vacuum (UHV) and ultra clean technology (UCT).

The turbomolecular section provides high pumping speeds and UHV ultimate vacuum.

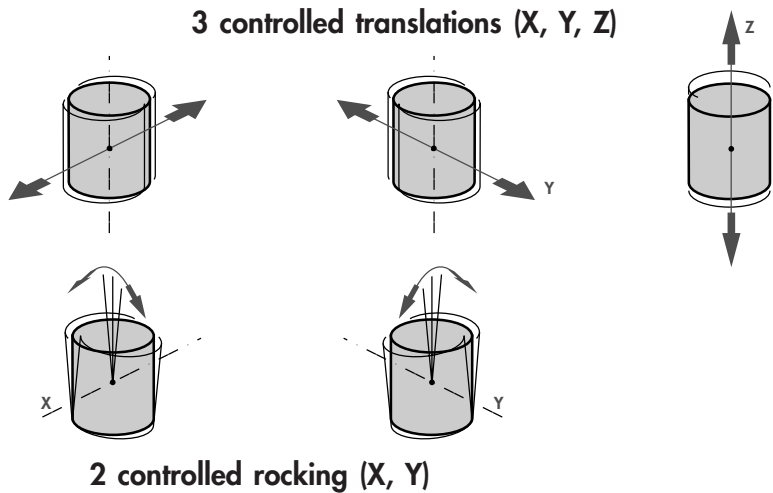
The molecular drag section provides a high compression ratio and extends forevacuum tolerance up to 5 mbar.



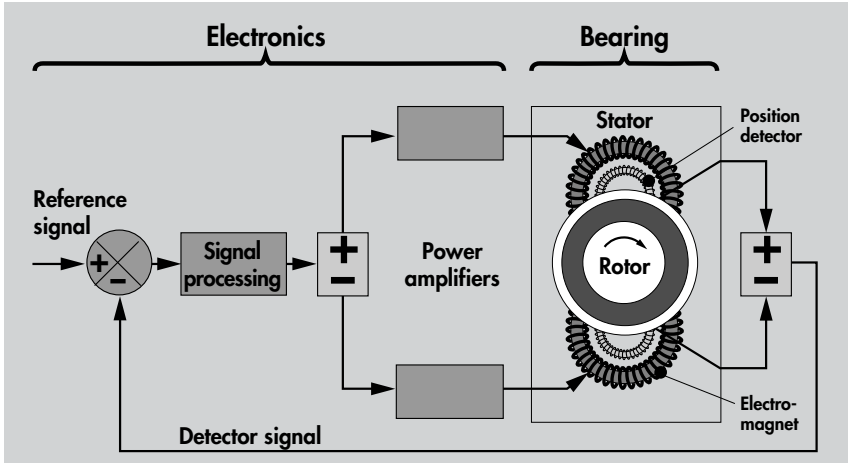
Edition 05 - October 96

The pump operating principle

5 axes The mobile assembly formed by the turbo rotor and the shaft is known as the rotor. This rotor is driven by the motor and held in suspension by magnetic fields generated by electromagnets housed in active bearing, type ACTIDYNE® maglev bearing (S2M Patent). The mobile rotor has five axes of freedom monitored by 5 active bearings.



Movements in relation to these axes are monitored by position sensors. According to the position data recorded, the ACT controller corrects differences to bring the rotor back to its optimum position, by varying the current in electro-magnets.



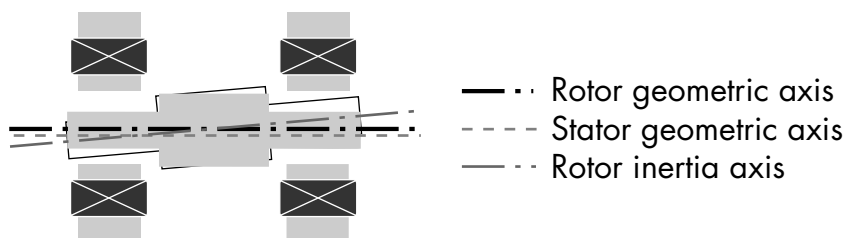
Edition 05 - October 96

The pump operating principle

Automatic Balancing System

The **Automatic Balancing System** is an electronic device. That monitors the rotor position, allowing it to rotate on its own axis of inertia.

Changes in the rotor balance, due to deposit built-up during the life time of the pump, are automatically compensated by the **Automatic Balancing System**. Therefore, there is a total absence of vibration.



The back-up bearings

They are dry-lubricated ceramic ball bearings.

They are never used in normal operation, since the rotor is not in contact with the bearings.

The back-up bearings are only used to protect the pump in accidental air in-rushes, accidental shocks or power failure.

No maintenance

By design, the pump doesn't include parts liable to wear and doesn't need preventive maintenance. However, the back-up bearings used in case of accidental shut-downs have to be changed when the controller indicates it: the percentage of landing time to be deducted depends on its frequency of use (**see D 10**).

Battery free

In case of a power failure, the motor acts like a generator, supplying enough power for the magnetic bearings. When the rotation speed is lower than the minimum setpoint, the pump lands and shuts down on the back-up bearings: the emergency breaking valve opens.

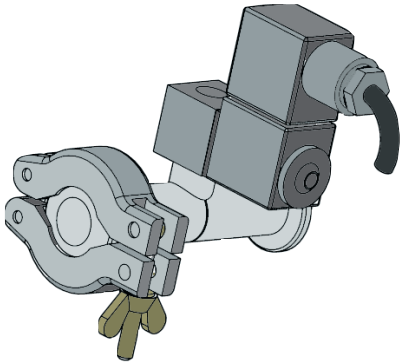
The pump operating principle

Emergency braking valve

The valve is fitted in parallel with purge port and opens in case of events such as:

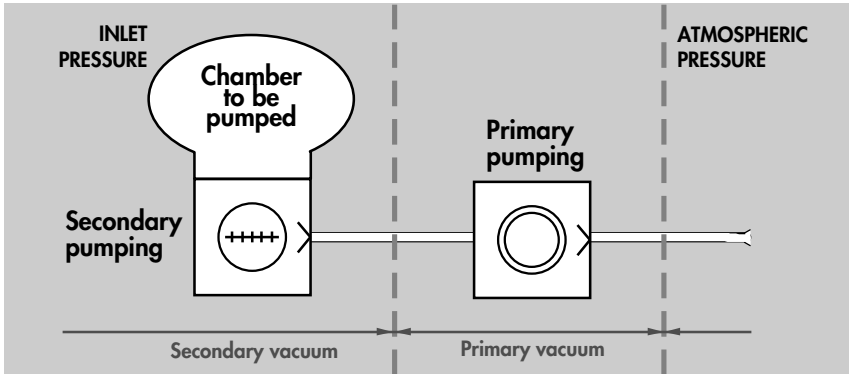
- uncontrolled violent shocks applied to the pump;
- large accidental air in-rushes.

It will also put the pump to atmospheric pressure when the controller is stopped. This valve will slow down the pump in complete safety.



The hybrid-turbo pump in an installation

At the pump exhaust, the gases are evacuated to atmosphere by a primary pump. Since the ATHM compression ratio is set by the design, the ATHM limit the pressure is given by that of the primary pump used.



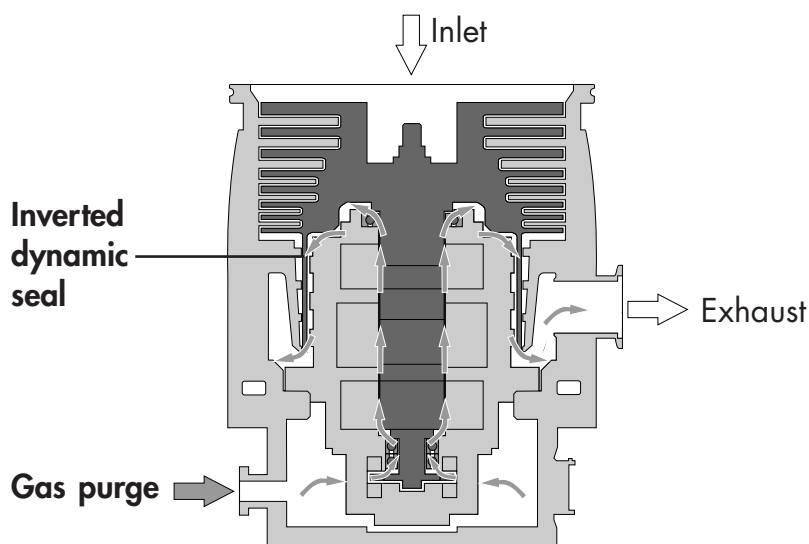
The different versions

Standard version ATH 400M - ATH 1000M

An inverted dynamic seal

It creates a high compression ratio between the bearings and the pump exhaust and thus minimizes the quantity of corrosive gases in contact with the bearings.

When used with **a gas purge** for high flow rate applications, the dynamic seal can, on its own, provide excellent protection for corrosive applications.



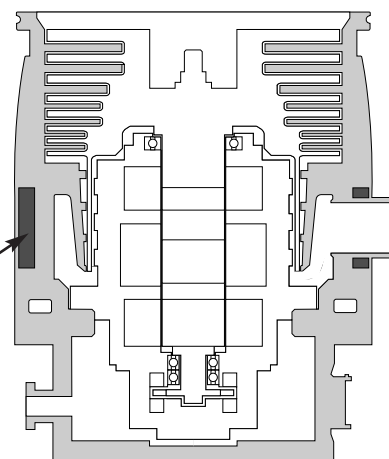
ATH 400MT ATH 1000MT

The built-in heater band

In high pressure and high throughput processes such as metal etch, deposit can build up in the lower compression stages of the rotor, leading the pump to early failure.

The built-in heater band allows pump heating up to 75°C, which is sufficient to prevent the condensation effect.

This device is thermally controlled by the ACT controllers.



The different versions

Variation of the pump rotational speed

The ATHM pump rotation speed can be selected and set between a standby speed and the maximum speed. This makes it possible to optimize pumping characteristics according to each customer application (for example, high pressure pumping).

A distinction is made between the following speeds:

- **reduced speed (STANDBY speed)** which can be set between the low speed value and the maximum speed.
- **maximum speed** preselected at factory which corresponds to the pump model.

depending on operating conditions:	Pump model	Min. speed	Max. speed
Inlet pressure $\geq 10^{-2}$ mbar or Housing temperature $\geq 50^{\circ}\text{C}$	ATH 1000MT (with temperature control)	15000 rpm	30000 rpm
Inlet pressure $\leq 10^{-2}$ mbar or Housing temperature $< 50^{\circ}\text{C}$	ATH 1000M	15000 rpm	33000 rpm
Inlet pressure $\leq 10^{-1}$ mbar	ATH 400M ATH 400MT	18000 rpm	39000 rpm

ACT 600M and ACT 1000M controllers

The ACT 600M and the ACT 1000M controllers belong to the new generation of ACT controller family.

Compact and functional

Dimension: **1/2 Rack**.
 Weight: **8.5 kg** (18 lb).

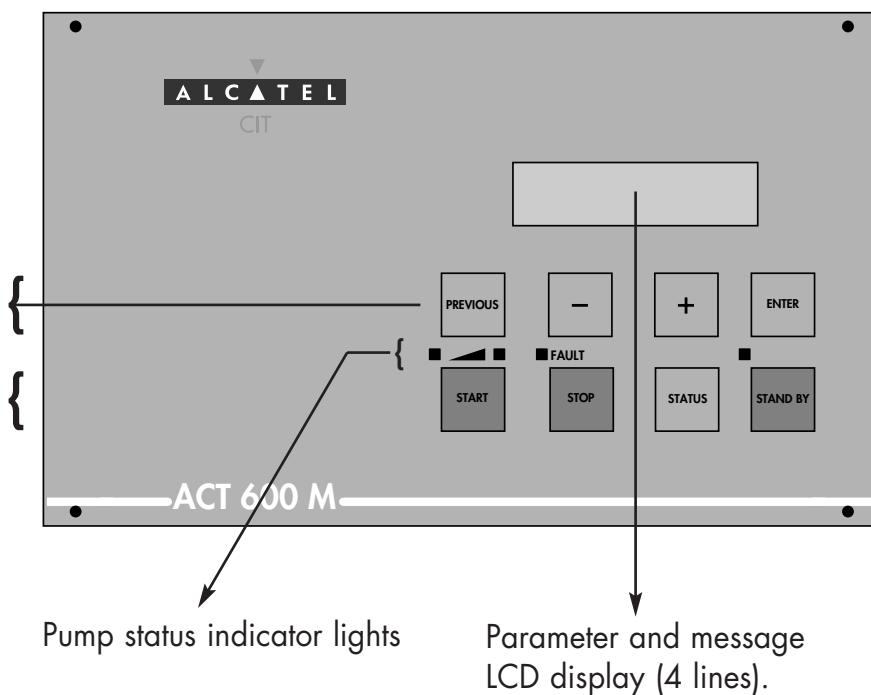
All functions to monitor the ATHM are integrated into the controller.

Convenient interface

The front panel of the unit consists of:

Parameter selection and configuration keys

Manual control keys



ACT 600M and ACT 1000M controllers

The rear panel of the unit consists of:

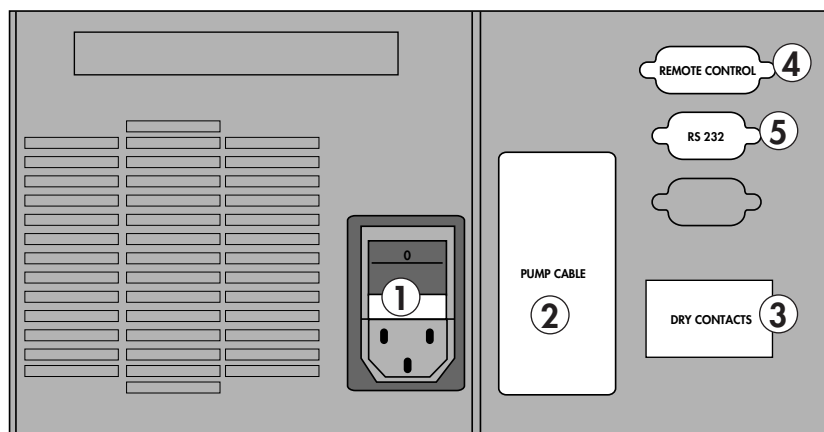
① Power supply connector

② Pump connector

③ Relay terminal strip
(Wiring characteristics on B 80.)

④ Remote control connector/RS 485
(Wiring characteristics on B 90.)

⑤ RS 232 connector
(Wiring characteristics on B 100.)



- to replicate the monitoring parameters available in the form of dry contacts.

- for the remote control of the START, STOP, STANDBY functions;
 - selectable 0 - 10 Volts output for speed, pump current or temperature;
 - heater band control temperature;
 - external safety taken in account.
 RS485 serial link allowing many pump installations in a network.

The RS 232 serial link is used to control and monitor the pump **using a computer**.

The accessories

Pump accessories

Screen filter



This filter protects the pump against solid particles. Mesh size 2.5 mm.

Inlet flange P.N.

100 ISO-KF (FPM)*	056844
100 ISO-KF (NBR)*	103070
100 CF-F	056845
160 ISO-KF	056942
160 ISO-KF (NBR)*	103071
160 CF-F	056928
200 ISO-KF (FPM)*	063158
200 ISO-KF (NBR)*	103072
200 CF-F	063159
ASA 6"	102933

Compact filter



This filter stops particles ≥ 20 microns and is used in the event of high densities of dust or risks of implosion when pumping tubes or lamps.

Inlet flange P.N.

100 ISO-KF	063215
160 ISO-KF	063216
200 ISO-KF	063911

Purge reduction device

This device is used to reduce the purge gas flow rate to 25 SCCM in some processes.

Flow rate P.N.

25 SCCM	066950
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Isolation valve at inlet pump

The secondary isolation valve is used to maintain the vacuum in the chamber while the pump is reset to atmospheric pressure.

See the Alcatel catalog.

An entire range of connection accessories are available in the Alcatel catalog (clamping ring, centering ring, etc.).

The accessories

Controller accessories

Connection cable	Interconnecting cable between pump and controller.	Length	P.N.
		1 m	104624
		3.5 m	103719
		5 m	103720
		10 m	103721
		15 m	104587

Thermo. cable	Interconnecting cable between heater band and controller.	Length	P.N.
		1.0 m 115 V	104627
		1.0 m 230 V	105206
		3.5 m 115 V	103728
		3.5 m 230 V	103729
		5.0 m 115 V	103730
		5.0 m 230 V	103731
		10 m 115 V	103732
		10 m 230 V	103733
		15 m 115 V	105202
		15 m 230 V	105204

The technical characteristics

The performances of the pumps

Model characteristics		ATH 400M ATH 400MT		ATH 1000M		ATH 1000MT	
Inlet flange	DN	100 ISO-K	160 ISO-K	160 ISO-K	200 ISO-K	160 ISO-K	200 ISO-K
Rotation speed	rpm	39000		33000		30000	
Pumping speed*	N ₂ l/s	320	410	710	850	610	800
	He l/s	290	360	650	750	600	650
	H ₂ l/s	180	230	430	450	330	350
Compression rate*	N ₂	1×10 ⁺⁸		2×10 ⁺⁸			
	He	2×10 ⁺³		1×10 ⁺⁴			
	H ₂	1×10 ⁺²		4×10 ⁺²			
Ultimate pressure without purge, meas. according to Pneurop standard	mbar	8×10 ⁻⁹		8×10 ⁻⁹			
Maximum pressure at inlet in continuous operation**	mbar	1		1×10 ⁻¹			
Maximum permissible pressure at exhaust**	mbar	5		5			
Noise level	dBA	≤ 39		≤ 39			
Start-up time	min	< 3		< 5			
Maximum start-up power	W	650		650			
Maximum operating power	W	300		300			
N ₂ purge flow rate	SCCM	50		50			
Cooling water flow rate	l/h	< 60		< 60			
Water temperature	°C	15 < T < 25°C		15 < T < 25°C			
Maximum ambient temperature	°C	40		40			
Weight	kg	19		28			
Recommended forepump		ADP 31		ADP 81			

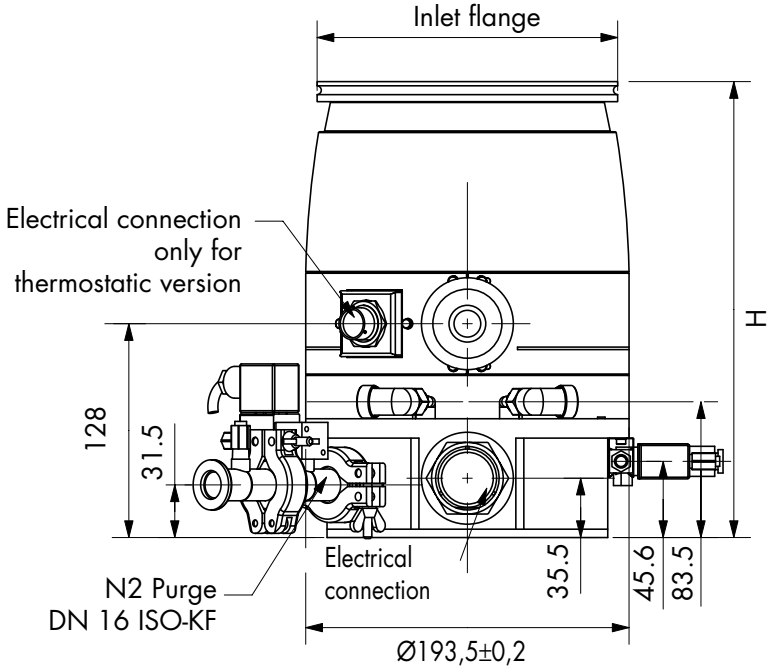
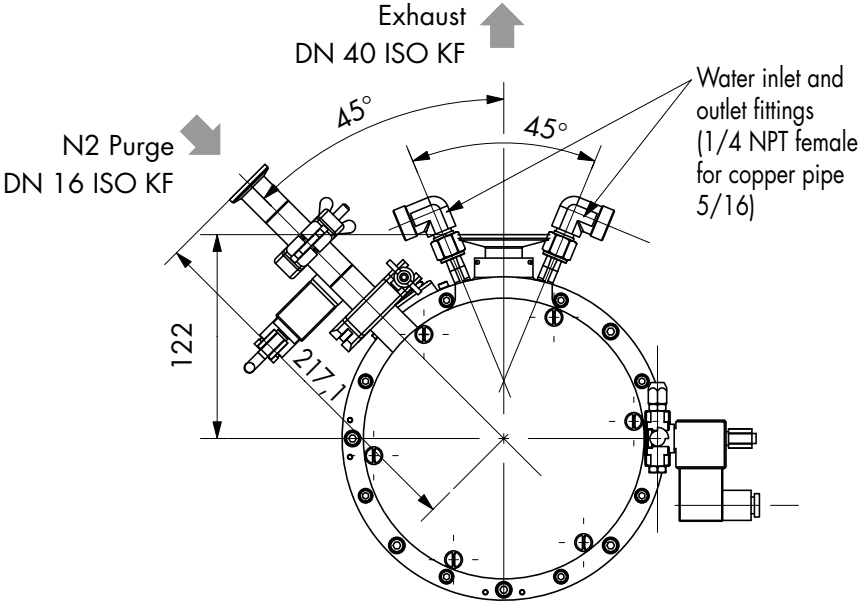
* See curves in G 10 and G 20.

** The two maximum pressure cannot occur at the same time.

The technical characteristics

Dimensions

ATH 400M
or ATH 400MT

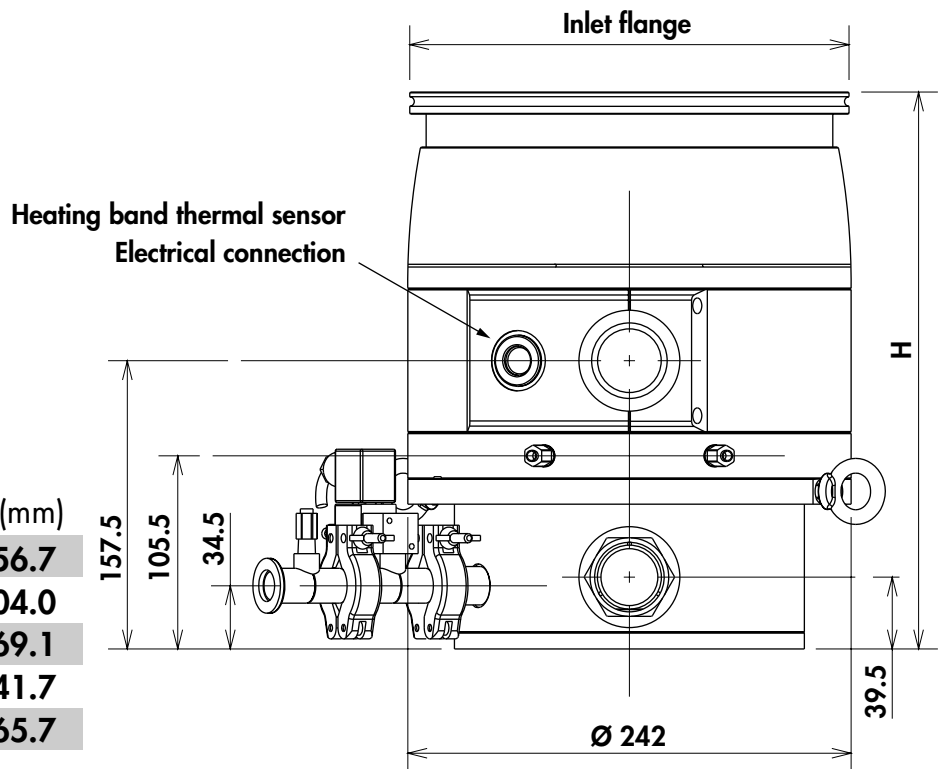
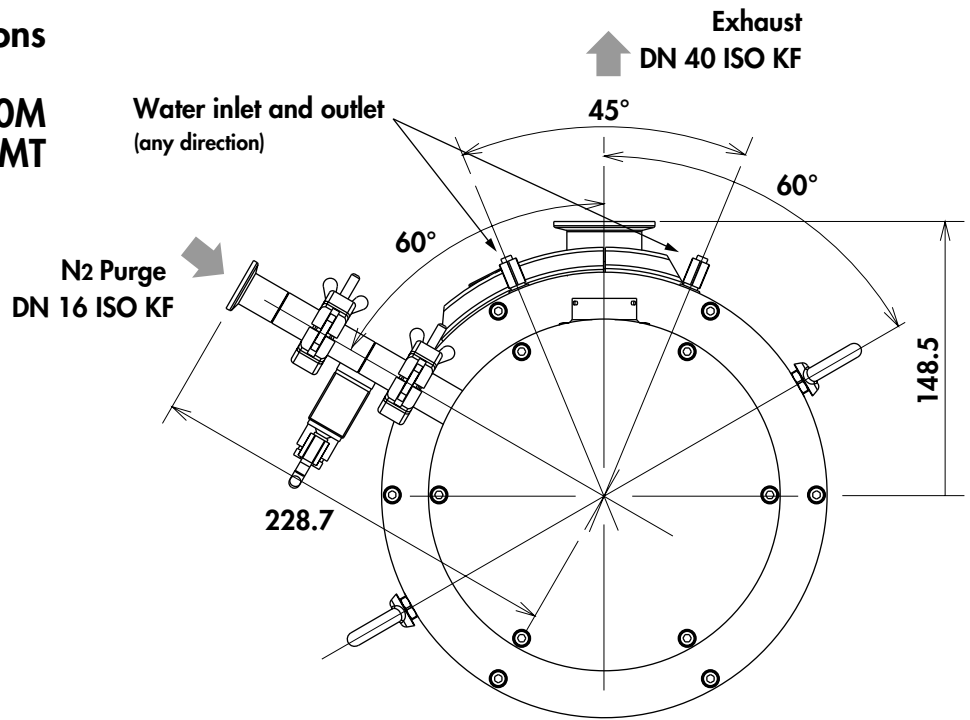


Inlet flange	H (mm)
DN 100 ISO-K	292.5
DN 160 ISO-K	272.8
DN 100 CF-F	298.9
DN 160 CF-F	294.5
ASA 6"	279.8

The technical characteristics

Dimensions

**ATH 1000M
or ATH 1000MT**



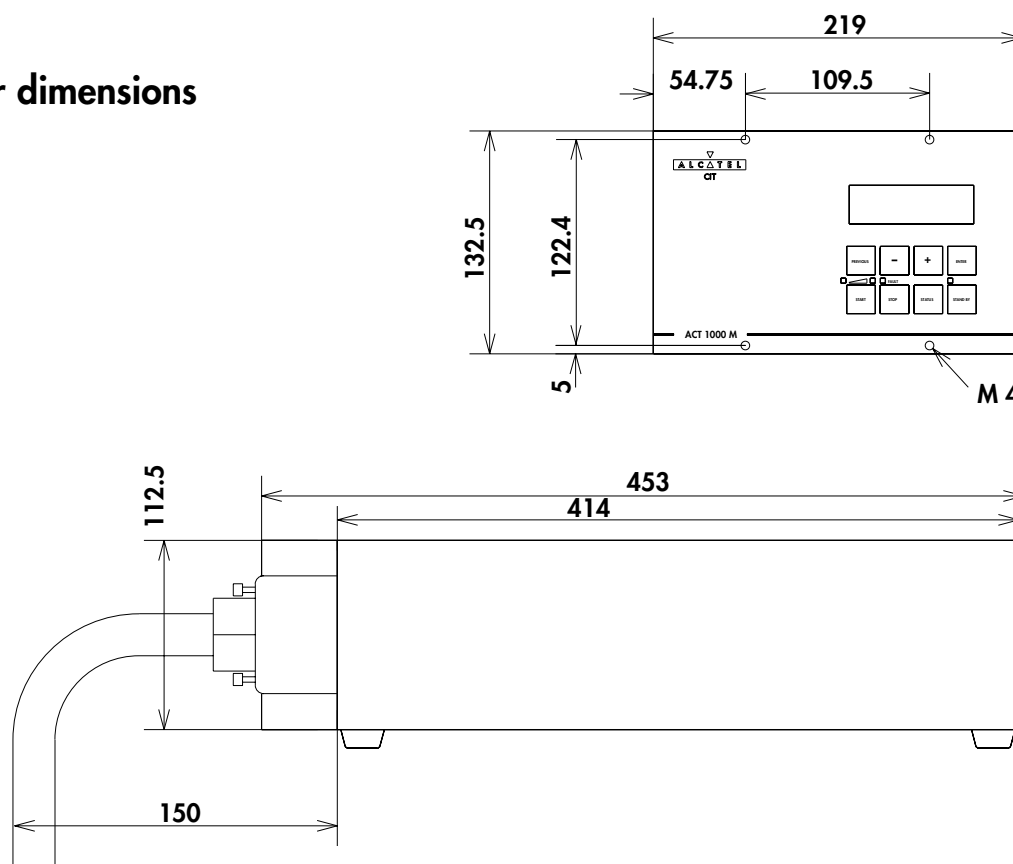
Inlet flange	H (mm)
DN 160 ISO-K	356.7
DN 200 ISO-K	304.0
DN 160 CF-F	369.1
DN 200 CF-F	341.7
ASA 6"	365.7

The technical characteristics

Controller characteristics

Model characteristics		ACT 600M	ACT 1000M
Weight	kg	8.5	
Dimensions HxWxD	mm	132.5 x 219 x 453 1/2 Rack 19"	
Power supply			
Nominal voltage	V	85 to 132 - 170 to 264	
Frequency	Hz	48/63	
Maximum power consumption	VA	750	
Customer main circuit breaker rating		10 A	
Ambient operating temperature °C		T ≤ 50	

Controller dimensions



Technical Reference Manual ATH 400M / ATH 1000M

Start-up

■ Safety instructions related to installation	■ B 10
■ Unpacking and storage	■ B 20
■ Pump connections to an installation	■ B 30
■ Emergency braking valve connection	■ B 40
■ Nitrogen purge device connection	■ B 50
■ Water cooling connection	■ B 60
■ Heating band connection	■ B 70
■ Electrical connections	■ B 80
■ «Dry contacts» relay wiring	■ B 90
■ «Remote Control» connector wiring	■ B 100
■ RS 232 or RS 485 serial link wiring	■ B 110
■ Detailed description of RS commands	■ B 120

Safety instructions related to installation



Before switching on the pump, the user should study the manual and follow the safety instructions listed in the compliance certificate booklet supplied with the pump.

Installation Start-up

- The controllers must be connected to an electrical installation including an ground connection in compliance with decree 88.1056 of 14th November 1988.
- Our products are designed to comply with current EEC regulations. **Any modification of the product made by the user** is liable to lead to non-compliance with the regulations, or even to put into doubt the EMC (electromagnetic compatibility) performance and the safety of the product. ALCATEL declines any responsibility for such operations.
- Before any maintenance operations on a product performed by a maintenance technician who has not received safety training (EMC, electrical safety, chemical pollution, etc.), isolate the product from the various energy sources (electricity, compressed air, etc.).
- The EMC performance of the product is obtained on the condition that the installation complies with EMC rules. In particular, in disturbed environments, **it is essential** to:
 - use shielded cables and connections for interfaces,
 - stabilize the power supply line with shielding from the power supply source to a distance of 3 m from the product inlet.
- The units containing control circuits are designed to guarantee normal safety conditions taking their normal operating environment into account (use in rack). In specific cases of use on tables, make sure that no objects enter the ventilation openings or block the openings when handling the units.

Safety instructions related to installation

Installation Start-up (continued)

- When switching off an item of equipment containing loaded capacitors at over 60 VDC or 25 VAC, take precautions concerning the access to the connector pins (single-phase motors, equipment with line filter, frequency converter, monitoring unit, etc.).
- When handling the equipment, use the devices provided for this purpose (hoisting rings, handle, etc.).
- Risk of toppling over: although compliance with EEC safety regulations is guaranteed (normal range $\pm 10^\circ$), it is recommended to take precautions against the risk of toppling over during handling, installation and operation.
- The performance and the operational safety of this product are guaranteed provided that it is used in normal operating conditions.
- The vacuum pump is also a compressor: incorrect use may be dangerous.

Study the user manual before starting up the pump.

- The access to the rotor of a turbomolecular pump with an unconnected intake is dangerous. Similarly, if the pump is not switched on, it may be driven by another pump in operation (risk of injury).
- Make sure that the parts or chambers connected to the intake of our pumps withstand a negative pressure of 1 bar in relation to the atmospheric pressure.
- The leaktightness of the products is guaranteed when they leave the factory for normal operating conditions. It is the user's responsibility to maintain the level of leaktightness particularly when pumping dangerous gases.

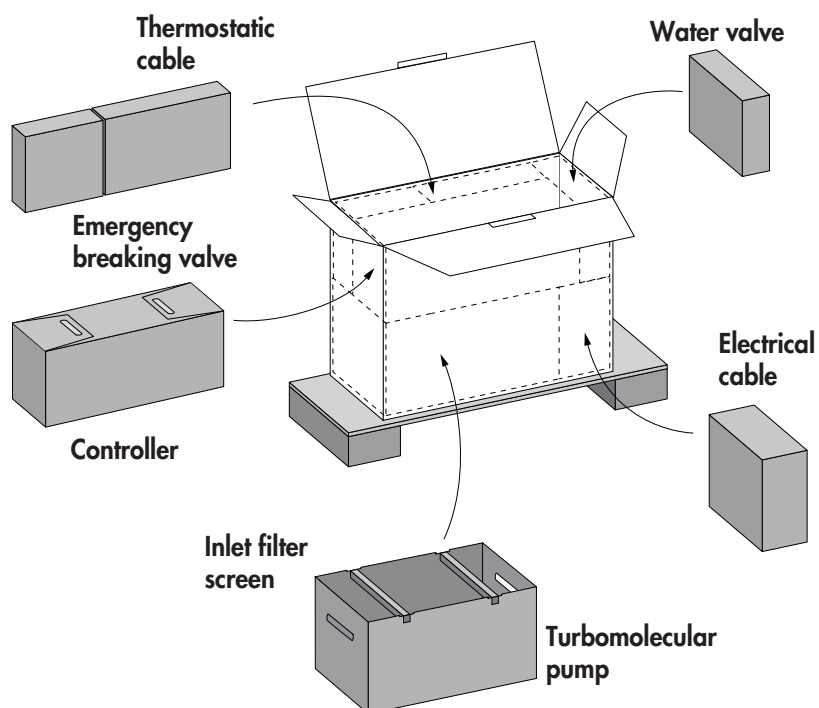
Unpacking and storage

Unpacking Unpack the equipment carefully and keep the packaging. Make sure that the equipment has not been damaged during the transport. If it has been damaged, take the necessary steps with the carrier and inform Alcatel if necessary.

In all cases, **we recommend that you keep the packaging (reprocessing material)** to transport the equipment if necessary or for prolonged storage.

To keep your product in the clean condition in which it left our factory, we recommend to unpack the pump only on its assembly site.

Weight of the complete shipping crate : 50 kg maxi.



Unpacking and storage

The accessories This packaging also contains other cardboard boxes, for the accessories (screen filter, emergency braking valve, water valve and purge device) and for the electric cable.

The controller It is packaged in a separated cardboard box.
Lift the device out of its packaging (weight 8.5 kg) by hand.

The pump It is packaged in a separated cardboard box.



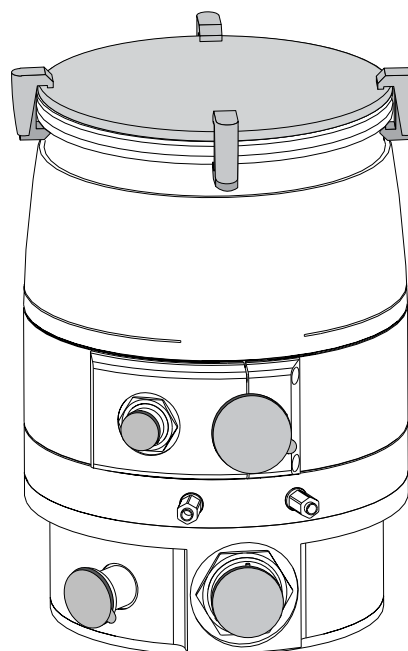
Lift the ATH 1000M out of its packaging by using the hoisting rings (weight 28 kg).

Pump storage Our equipment can be stored without special precautions (ambient temperature between 5 and 40°C) .

Inlet ASA 6", ISO or CF-F flange blanking and rotor holding system.

Exhaust Blanked with a DN 40 ISO-KF protector.

Connection for emergency braking valve and nitrogen device Blanked with a DN 16 ISO-KF protector.



Unpacking and storage

Controller storage The controller can be stored in its cardboard box at storage temperature between - 20°C and + 70°C.

Storage mode The controller is set in STORAGE mode at factory, to protect internal RAM memory during transport and storage.

When the controller is powered, the storage mode disappears automatically.

Set the storage mode for prolonged storage when the pump is stopped.

Pump connections to an installation

Maglev pump connection instructions Why securing MAGLEVpump installation ?

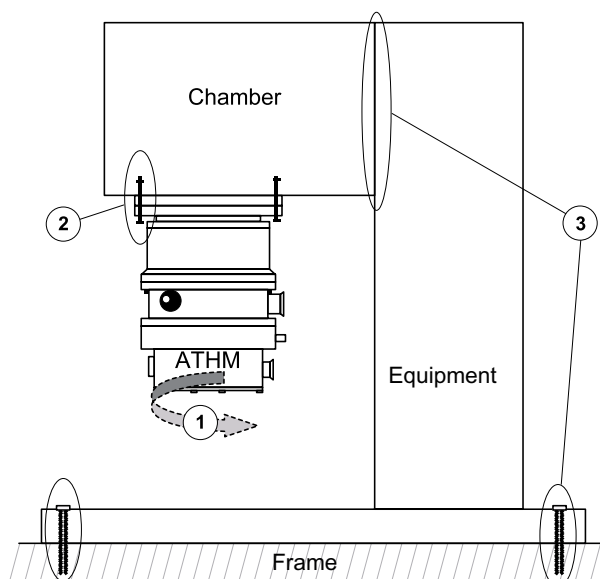
Maglev hybrid Turbopumps are designed so as to prevent any safety hazard to the user in standard operating conditions.

However, some operating conditions may generate hazards for the user and the environment: **the kinetic energy stored in a maglev turbopump is very important. In case of a mechanical failure an improperly installed pump could be ejected from the equipment if the kinetic energy was transferred to the pump body.**

It is absolutely necessary to install the pump according to the following installation specifications to secure the user and the equipment.

Alcatel declines any responsibility if the pump installation is not design in accordance with these installation specifications.

Installation spécifications



Pump connections to an installation

Installation with bolted flange

The kinetic energy of the rotor has to be absorbed by the installation **if the pump seizes suddenly.**

The resulting maximum deceleration torque is based on the assumption, that the rotor stops in half a turn and that the whole energy has to be taken by the pump assembling bolts.

Design and secure the pump frame so that it can withstand the maximum deceleration torque.

Maximum deceleration torque to stop the rotor in half a turn (item 1)

- 9159 Nm for ATH 400 M at nominal speed 39000 rpm
- 20000 Nm for ATH 1000 M at nominal speed 33000 rpm

Inlet flange installation conditions (item 2)

According to the housing type:

Mounting holes at inlet flanges				
Inlet flange	DN - ISO-F	160	200	250
Type of bolts dictated		M 10	M 10	M 10
Number of bolts dictated		8	12	12
Bolt metric grade		12 ⁻⁹	12 ⁻⁹	12 ⁻⁹
Installation torque per bolt	N.m	35 ⁺⁵	35 ⁺⁵	35 ⁺⁵



For safety reasons, it is important to tighten the bolts with a torque wrench according to the specified values :

- lower torque: risk of loosened bolts
- higher torque: risk of damaging the bolts.

Pump connections to an installation

Inlet flange installation conditions (item 2)) (Continued)



We strongly recommend the use of ISO-F or CF-F flanges.

ISO-K type flanges are not recommended to fasten turbomolecular pumps with inlet flange equal or larger than DN 200 because:

- there is no visual reminder (like threaded holes on ISO-F) to signal how many clamps are needed to secure the pump,
- it is not as easy to fasten claw clamps on ISO-K flanges as to secure bolts on ISO-F flanges,
- the ISO-K flanges do not prevent accidental rotation of the pump on the equipment flange in case of pump rotor crash. This rotation could damage the foreline and the purge gas line which would generate hazards for the user.

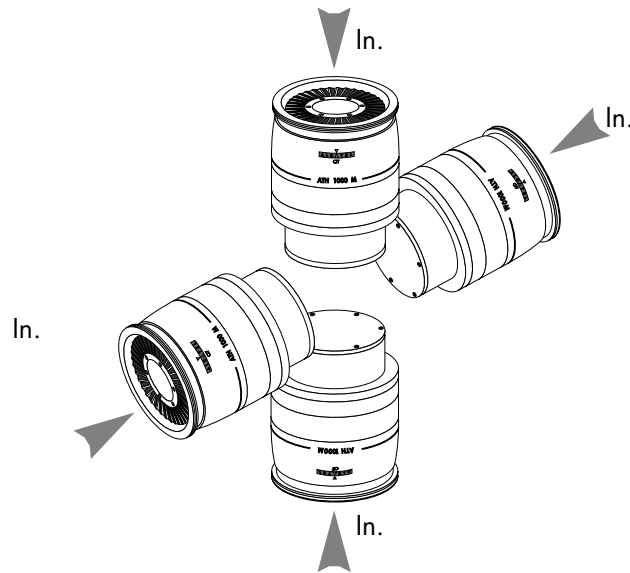
Equipment installation conditions (item 3)

The equipment frame on which the pump is installed must be sufficiently rigid to absorb the kinetic energy of the rotor in case of pump rotor crash. For this, take into account:

- the maximum deceleration torque to calculate the equipment attachment devices,
 - the flange dimensions,
 - the quality and the number of screws,
- no reducing adapter or bellows should be installed between pump inlet flange and the chamber.

Pump connections to an installation

The pump can operate in any position



Rotor flanging device disassembly

Welcome

To prevent the pump maglev bearings from being damaged due to shocks during transport, **the rotor is flanged to the pump housing.**



The pump must never be switched in this condition. This flanging must only be removed when the pump is to be installed.

We recommend that you keep the flanging to transport the equipment.

Pump connections to an installation

Vacuum connections



Remove the protective parts blocking the inlet, exhaust and purge openings: these components prevent foreign bodies from entering the pump during transport and storage. It is dangerous to leave them on a pump in operation.

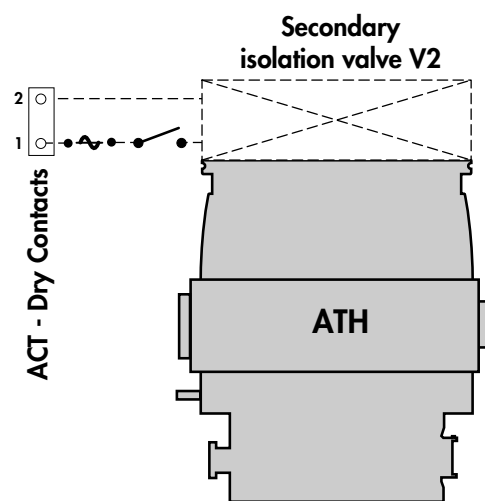
At inlet:

Screen filter

Install the screen filter or compact filter accessory on the pump; connect the pump to the installation or connect a secondary isolation valve.

Secondary isolation valve

It is recommended to install an isolation valve between the chamber to be pumped and the pump inlet to maintain the pressure in the chamber while the pump is reset to atmospheric pressure. This valve can be driven by the controller («ISOL.VALVE» contact see B 90).



If the controller stops the pump by opening the emergency braking valve, the contact opens and closes the secondary isolation valve.

Pump connections to an installation

At exhaust:

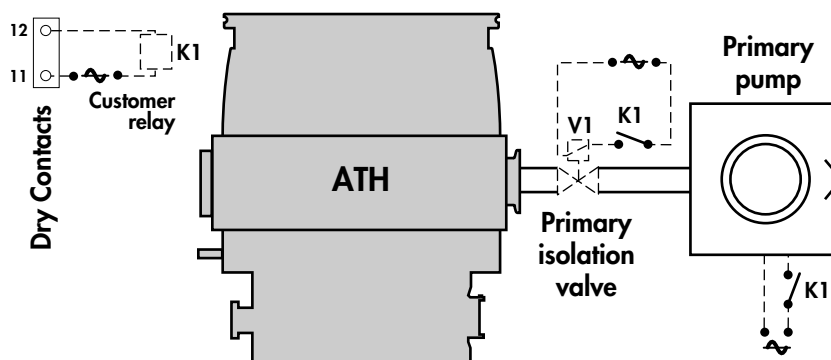
Primary isolation valve

It is highly recommended to install an isolation valve, (closed with power off) between the ATH pump and the roughing circuit.

The valve is closed using the « START » contact on the controller. If the valve is missing, the time taken to slow down in the event of an accident is increased, thereby reducing the service life of the back-up bearings.

Connect this valve such as an Alcatel bracket valve **as near the pump exhaust as possible** depending on the space available and the accessories installed.

Connect the valve to the primary pumping circuit*.

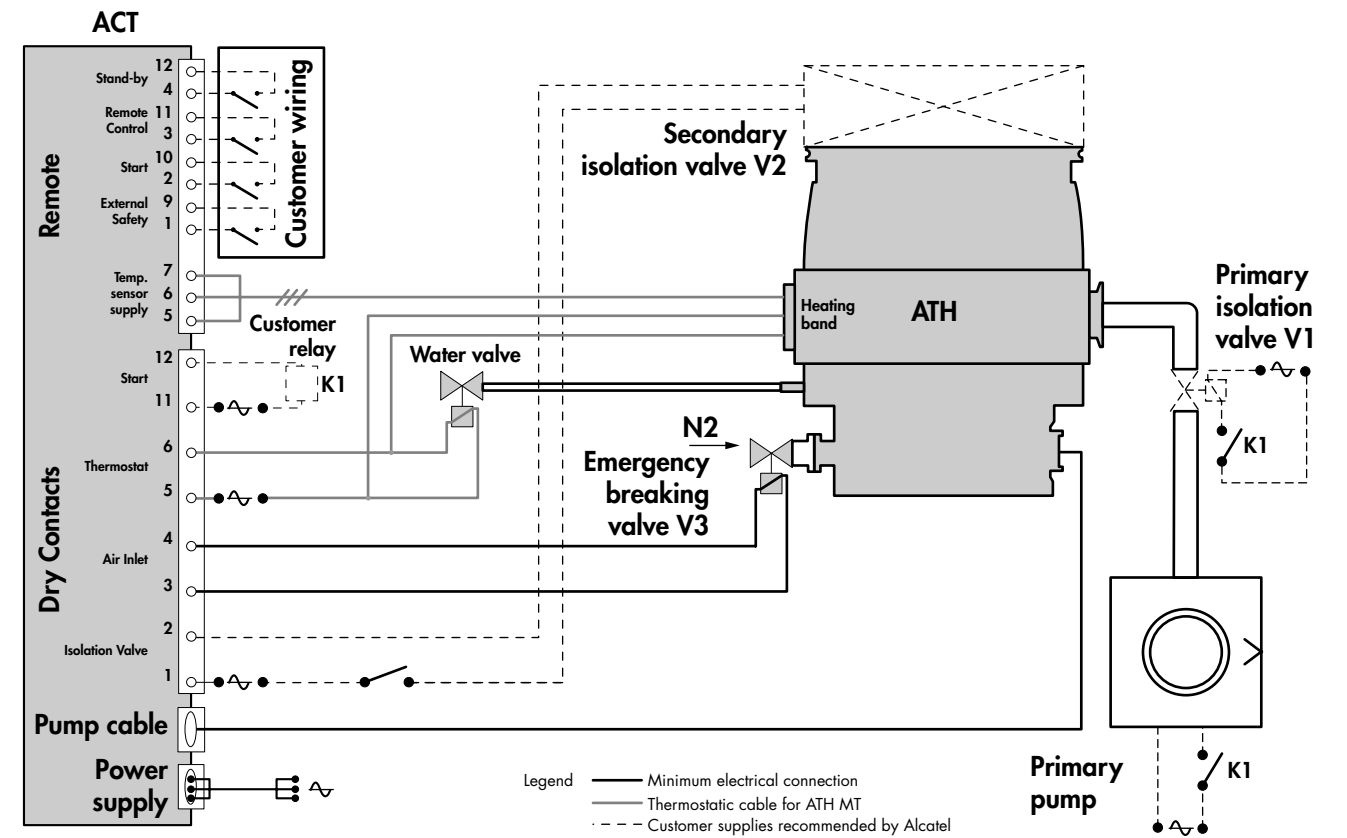


* Different connection accessories can be found in the Alcatel Catalog.

Pump connections to an installation

Typical connection

- In this installation, we use:**
- A primary isolation valve **V1** between the ATH and the roughing pump;
 - a secondary isolation valve **V2** between the ATH and the chamber to be pumped;
 - a relay **K1**, their contacts drive the valve **V1** and the primary pump power supply;
 - the thermostatic option.



Emergency braking valve connection



The braking valve must be connected to ensure the pump's safety and durability.

Function

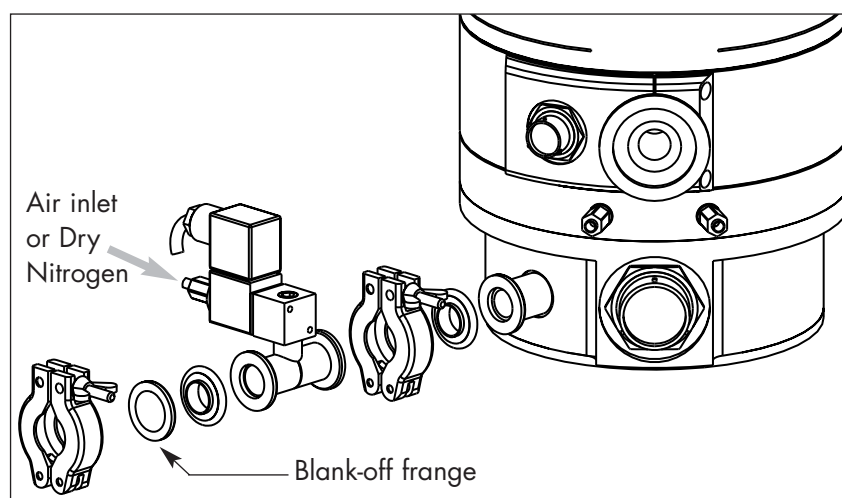
In the event of a major problem (magnetic bearings fail, external shock...), the pump must be stopped as soon as possible to prevent damage to the back-up bearings.

The emergency braking valve is calibrated to reset the volume of the pump to atmospheric pressure.

When the pump is isolated (at inlet and exhaust) the rotor slow down efficiency is increased.

The reset to atmospheric pressure takes place when faults are registered on the controller which stops the pump and controls the air inlet (*see D 20*).

Vacuum connection



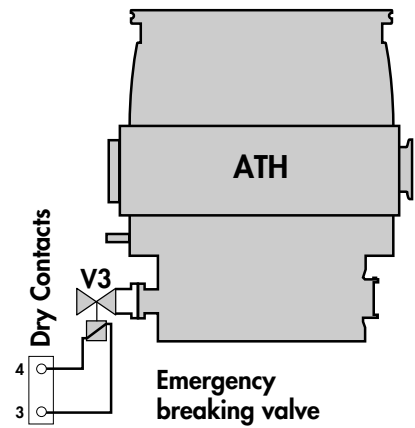
Install the calibrated emergency braking valve on the DN 16 fitting of the pump.

The valve must be connected to an air inlet line which can be for example dry nitrogen (Pressure between 1 and 1.5 bars absolute) (*see B 50 for nitrogen characteristics*).

Emergency braking valve connection

Electrical connection

Connect the valve powered and driven by the controller via the «AIR INLET» contact on the Dry Contacts connector (see B 90).



Nitrogen purge device connection

Characteristics of of filtered dry nitrogen supply

A filtered dry nitrogen supply with the following characteristics is required:

- Dew point < 22°C
- Dust < 1 µm
- Oil < 0.1 ppm
- Absolute pressure of 1 to 1.5 bar.

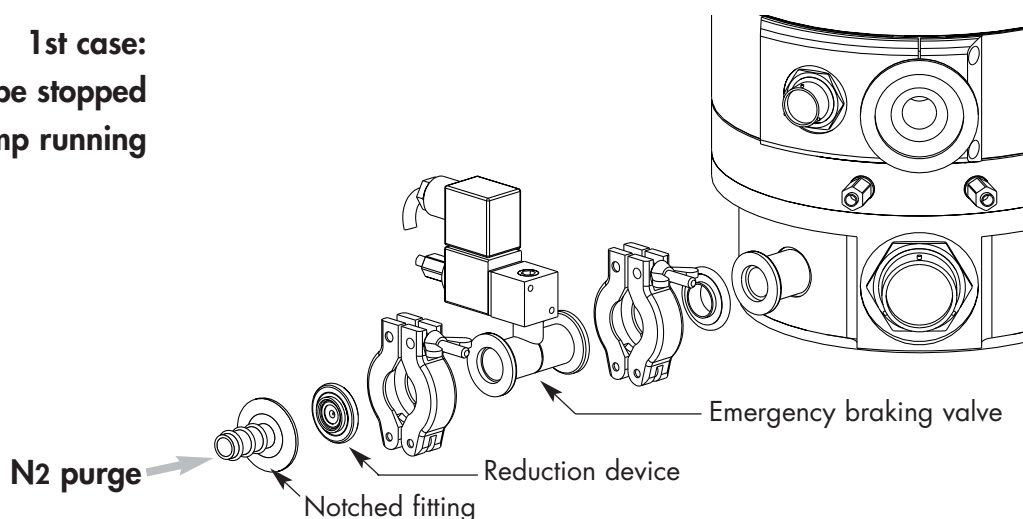
Purge connection



The nitrogen purge must be connected to the braking valve so as not to disturb its operation and not between the valve and the pump.

Connect the nitrogen supply to the DN 16 purge fitting*. The nitrogen flow reduction device controls the pressure and guarantees a flow rate of 50 SCCM at pressure 1.1 bars.

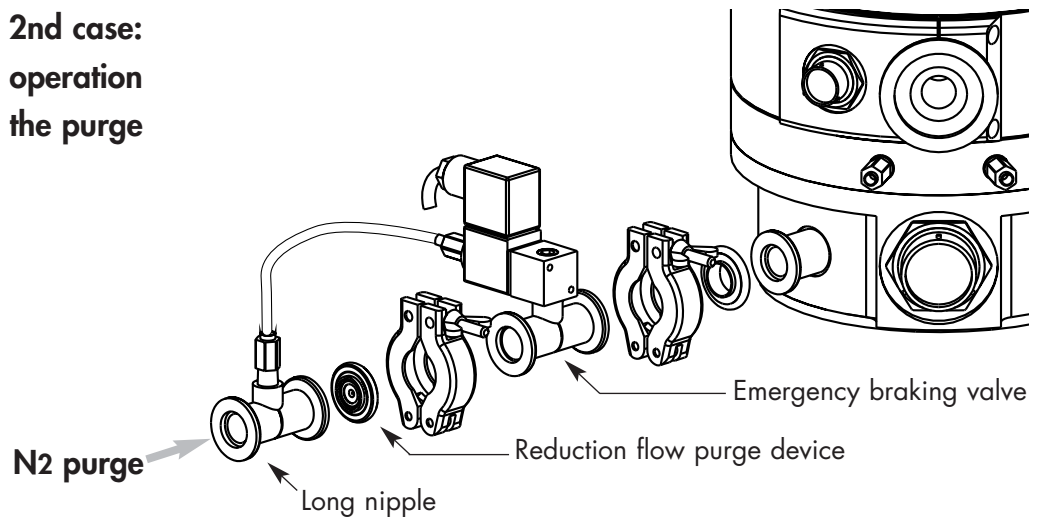
1st case: Purge can be stopped during pump running



* Différent connection accessories can be found in the ALCATEL catalog.

Nitrogen purge device connection

2nd case:
Continuous operation
of the purge

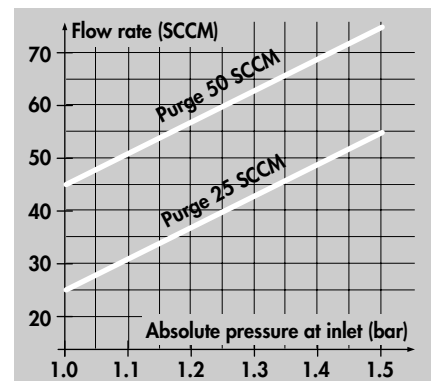


Connect the little flexible pipe between the long nipple and the valve.

Adjust the flow rate

Feed the nitrogen purge throughout pumping according to the flow rate and pressure values in the scale given.

For limited the flow rate at 25 SCCM, connect the nitrogen flow reduction device accessory (see A 50).



Water cooling connection

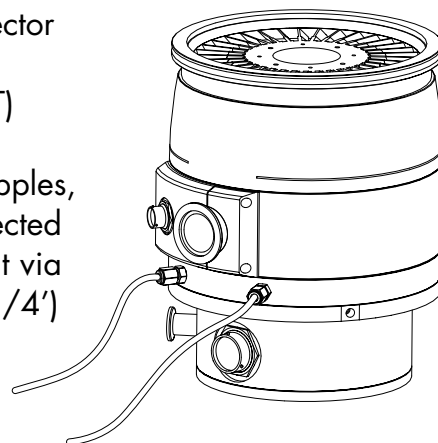
Characteristics of water cooling

In order to limit the corrosion and clogging of the cooling pipes, it is recommended to use cooling water with the following characteristics:

- treated soft water or non-corrosive industrial water
- pH between 7.5 and 11
- hardness < 7 milli-equivalent/dm³
- Resistivity > 1500 Ω.cm
- Solid pollution < 100 mg/dm³
- Max. pressure: 7 bars
- Temperature: 15 < T < 25°C
- Flow rate: 60 l/h

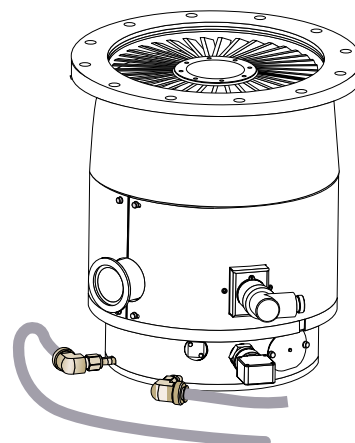
For ATH 1000M models

- Provide a water inlet pipe and a tap to adjust the flow rate.
- Install the two male connector delivered on the cooling device (connector 1/8 NPT)
- Connect the water inlet line to one of the cooler nipples, with the other nipple connected to the water draining circuit via a flexible tube (ext. diam 1/4") (supplied by customer).



For ATH 400M models

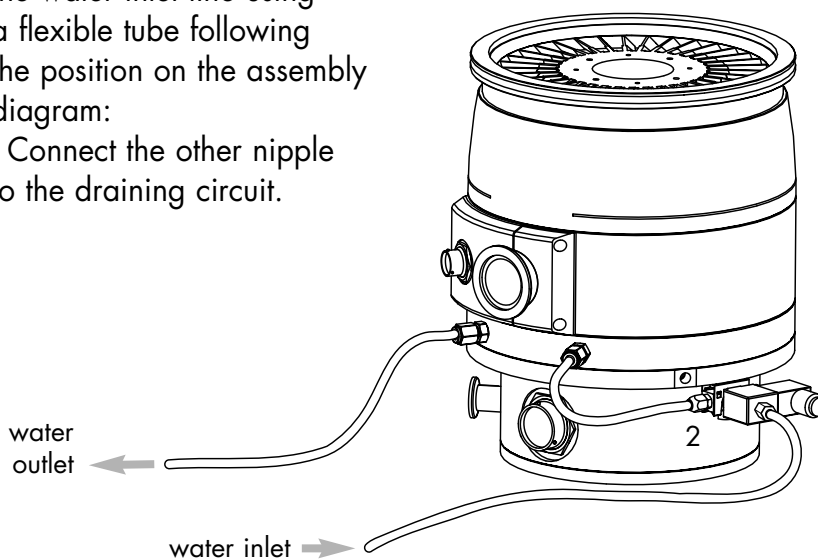
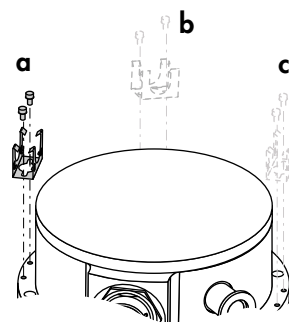
- Connect the water inlet line to one of the cooler water fittings 1/4 NPT female on the pump, with the other fitting connected to the water draining circuit via a tube (supplied by customer).



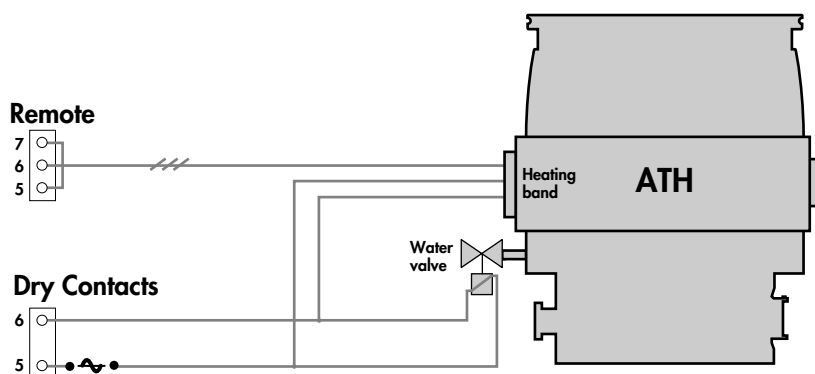
Water cooling connection

**For ATH 400MT
or ATH 1000MT models**

- Provide a water inlet pipe and a tap to adjust the flow rate.
- Assemble the valve holding stirrup on the pump frame (3 positions **a,b,c**).
- Install the water electrovalve on its holding.
- Install the water valve to the water inlet line using a flexible tube following the position on the assembly diagram:
- Connect the other nipple to the draining circuit.



Electrical connection



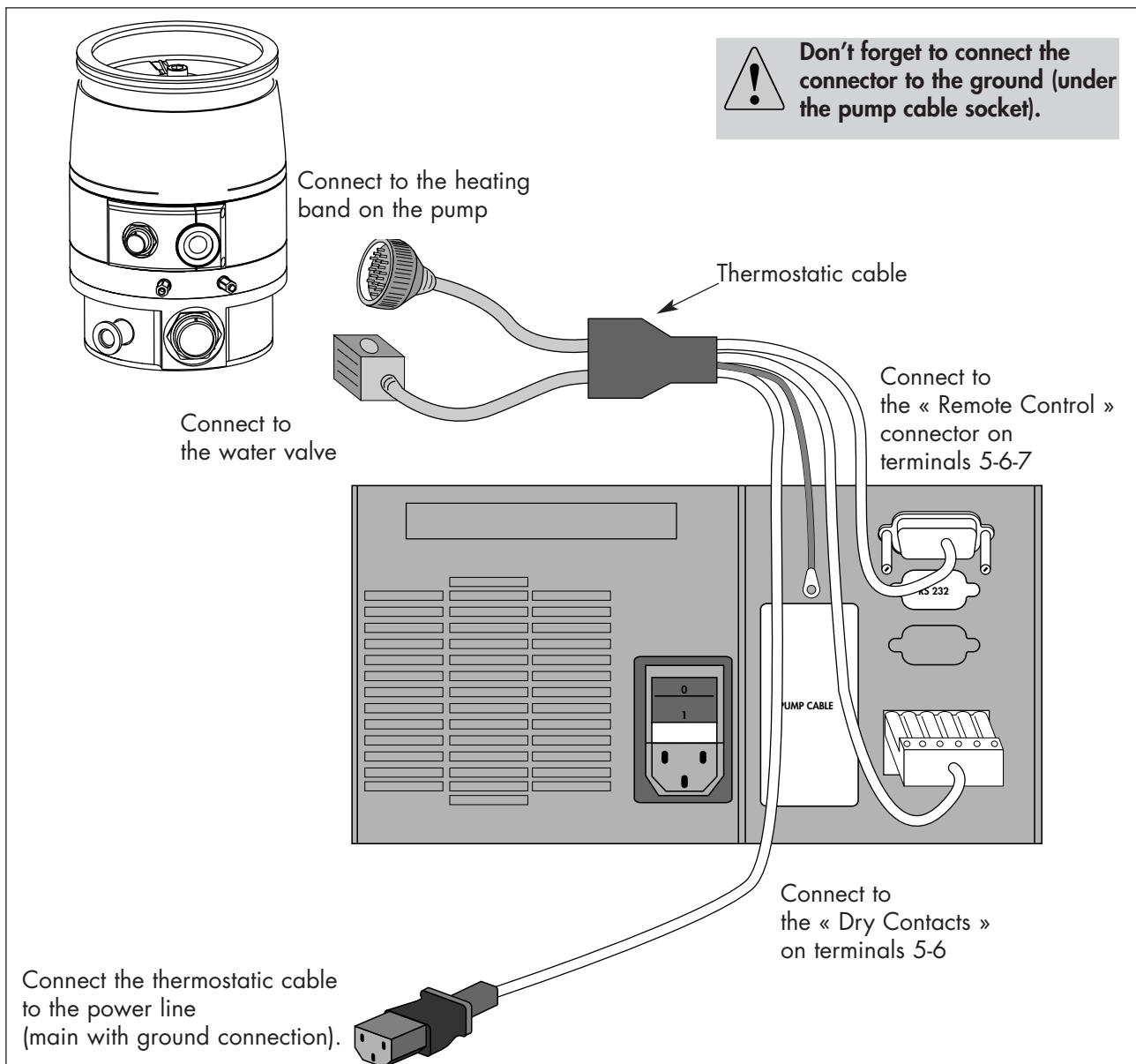
Connect the water valve via the «THERMOSTAT» contact on the DRY CONTACTS connector and supply it via the thermostatic cable.

Heating band connection

For ATH 400MT and ATH 1000MT

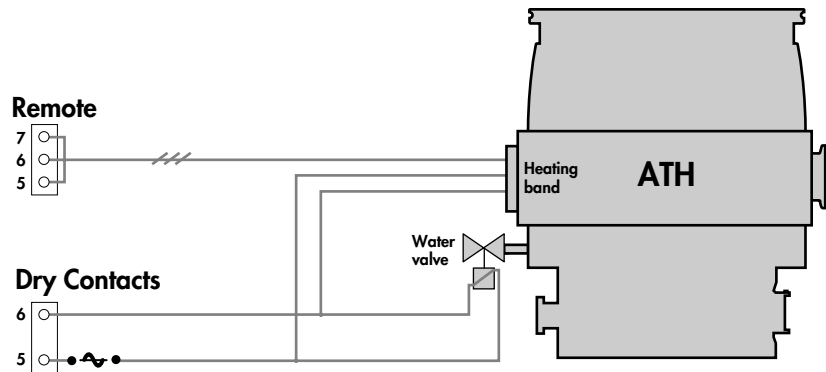
These pumps are equipped with an heating band, a thermal sensor and a valve to regulate the water flowrate. The body of the pump can be heated to 75°C to avoid gas condensation in the pump on the semiconductor processes.

Connection Connect the thermostatic cable as follows:



Heating band connection

Heating band temperature





The temperature can be chosen on the controller (between 31 and 75°C or NO°C).
By choosing «NO°C» temperature, the heating band is switched off and the pump is cooled permanently.

If there is a failure on the temperature sensor on the heating band, the controller display indicates:

PUMP-TEMP2	00 °C
DEF 38	TEMP.SENSOR 2

The heating band is switched off and the pump is cooled permanently.
The temperature of the heating band can be read on the display of the controller (*see C 30*).

Hot surfaces are signalled by  symbol.
 The pump housing temperature can reach 75°C.

Electrical connection

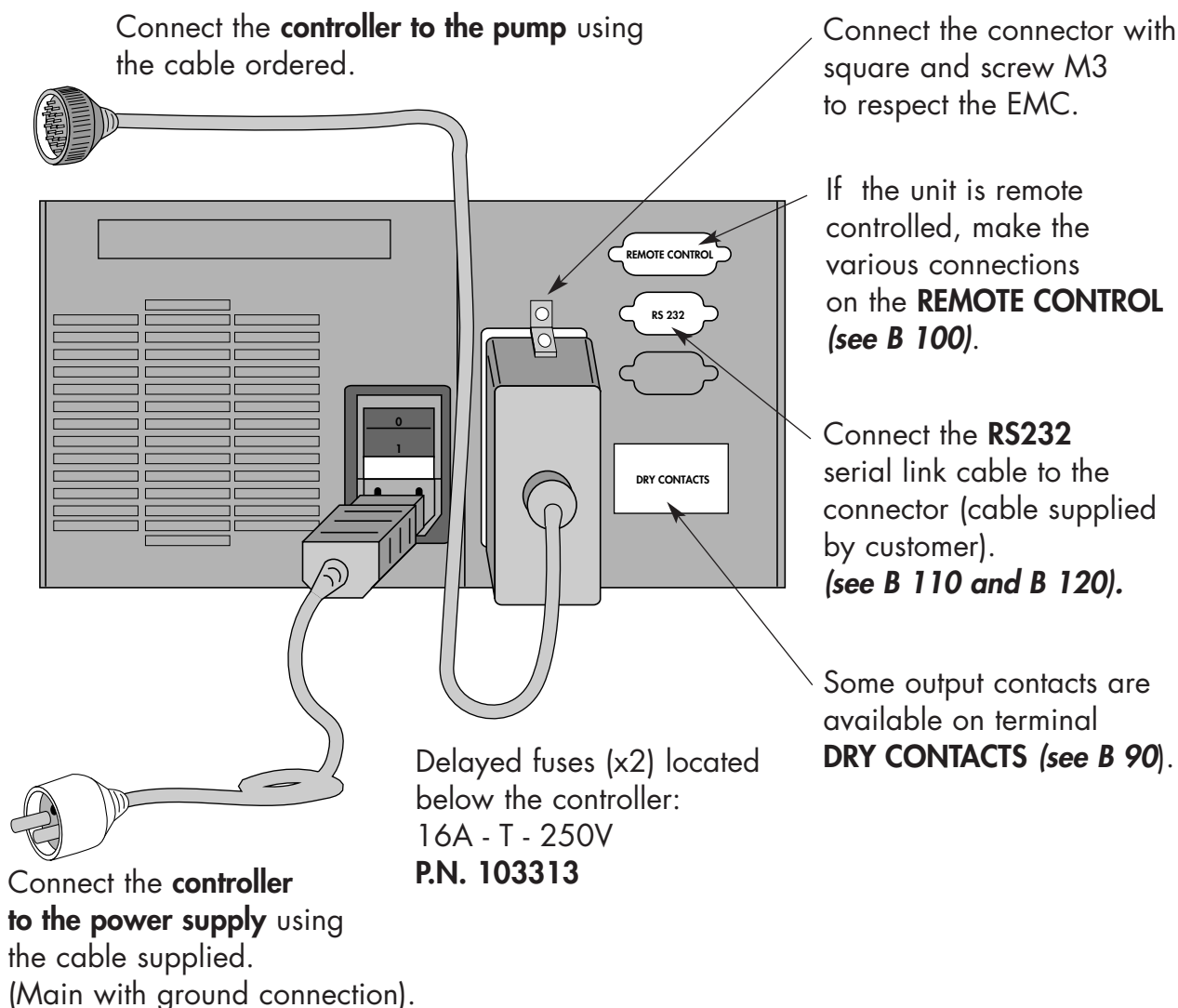
Controller installation

The unit must be installed in an environment ventilated either by natural convection or by the movement of forced air. Cooling is normally performed by an internal fan which ventilates air from the inside to the outside of the unit.

Make sure that:

- the openings on the bottom, top and rear of the unit are not blocked;
- the ambient temperature does not exceed 50°C;
- a free space of at least 15 mm is left behind and below the unit.

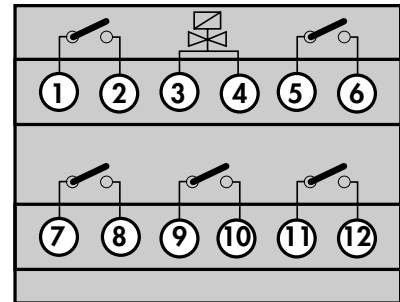
Connections



«Dry contacts» relay wiring

Signaling using output contacts:

These are dry contacts (220VAC - 3A): their functions are to copy the data concerning the pump operating status.



Isol. valve 1 - 2

When the controller detects a bearing operating fault or after a stop, it opens the contact. **This contact must be used to control a secondary isolation valve** which is used to maintain the pressure in the chamber while the pump is reset to atmospheric pressure.

Air inlet 3 - 4

When the controller detects a bearing operating fault, it stops the power supply to the emergency braking valve (12V-5W): the valve opens and air enters.

Speed 7 - 8

The contacts is closed when the pump reaches the selected speed.

Fault 9 - 10

The contact is opened if a faults appears.

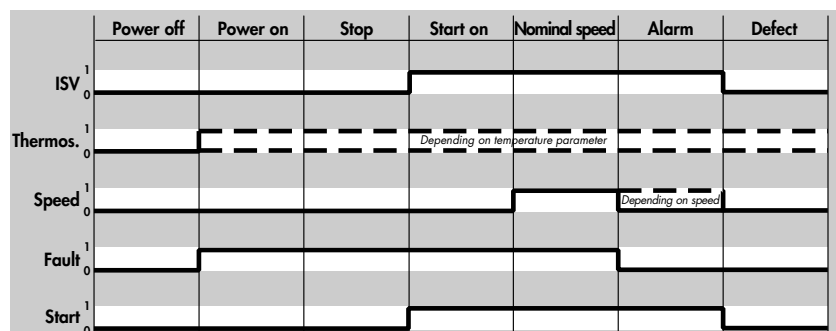
Thermostat 5 - 6

The contact is opened or closed, depending on the pump temperature and the selected temperature.

Start 11 - 12

The contact is closed when the «START» control is activated on the controller. The contact can be used to control a primary isolation valve, and via a power relaying device, to control a primary pump.

Contact fonctionnal status

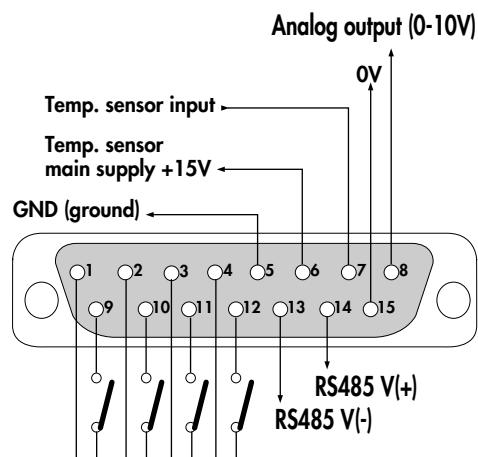


"Remote Control" connector wiring



When the units containing the control circuits are equipped with dry contact outputs, it is the customer's responsibility to use the outputs in compliance with safety regulations.

The control contact



Ext. safety 1 - 9

When the contact is closed, an external safety device is signalled: the motor is stopped and the controller generates a fault. This contact must be opened for the pump to operate. The emergency valve is opened.

Start/Stop (in remote mode) 2 - 10

When the contact is closed, the pump is started up and accelerates to reach its nominal speed or reduced speed (depending on parameter settings). If the contact is open, the pump is no longer powered.

REMOTE Mode 3 - 11

When the contact is closed, the remote control mode is selected. The actions on the keyboard are without effect. If the contact is open, the local mode is selected (control using the front panel keypad).

STANDBY Mode 4 - 12

When the contact is closed, the reduced speed rotation mode is selected.

Temp. Sensor 5 - 6 - 7

These contacts allows to read the heating band temperature.

Analog. Output 8 - 15

Used to monitor the selected parameter (see ANALOG OUT menus C 30).

"Remote Control" connector wiring

Analog output signal

The signal is transmitted between terminal 8 and 15 of the remote connector.

Five values can be used to plot curves:

θ1 Pump temperature: 0°C (OV) to 100°C (10V)
(θ1 PUMP)

θ2 Pump temperature: 0°C (OV) to 100°C (10V)
(θ2 PUMP)

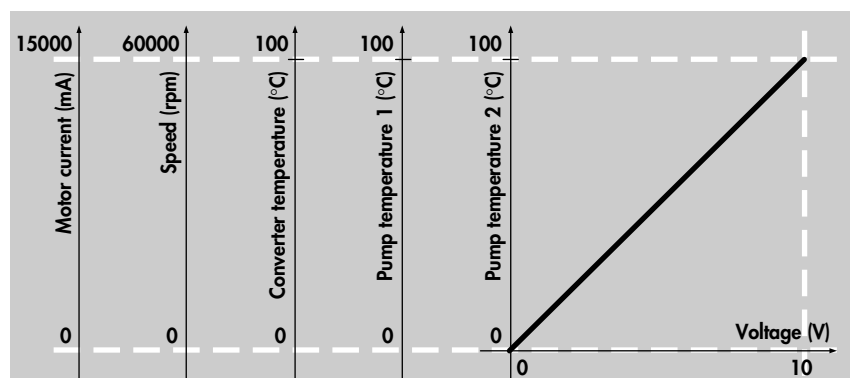
Pump rotation speed: 360 rpm (OV) to 30000 rpm (5V)
(SPEED)

360 rpm (OV) to 33000 rpm (5.5V)

360 rpm (OV) to 39000 rpm (6.5V)

Controller temperature: 0°C (OV) to 100°C (10V)
(θ CONV)

Motor current: 0 mA (OV) to 8700 mA (5.8V)
(I MOTOR)



Factory configuration is setted on **(SPEED)**.

RS 232 or RS 485 serial link wiring

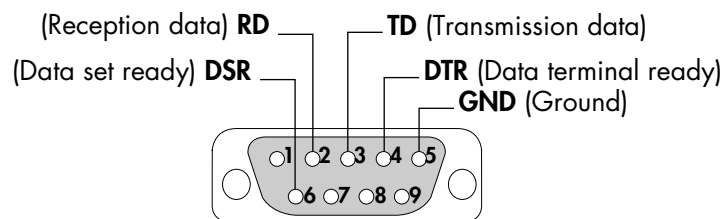
At the first power-up, the user finds the default configuration. The serial link parameters can be modified by accessing the corresponding unit menu (see C 30).

The default configuration of the serial link is as follows:

- Type: **RS 232**
- Transmission speed: **9600 bauds**
- Data length: **8 bits**
- Parity: **NONE**
- Stop bit: **1**

Refer to C 30 to customize the parameters.

RS232 connector wiring:



DB 9 contacts, male connector.

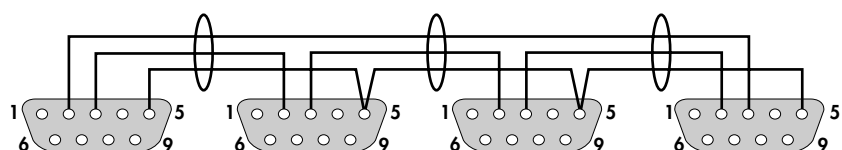
Connection examples:

RS232 type serial link with a single controller



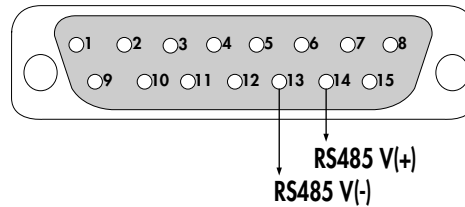
The multiple link is obtained by creating a loop:

Multiple RS232 serial link:
 several units (up to 999) can be controlled on a single link.



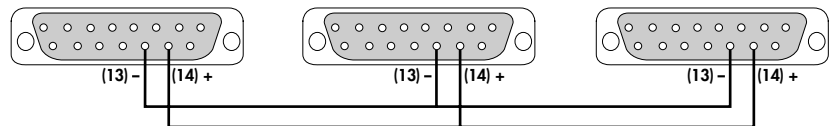
RS 232 or RS 485 serial link wiring

RS485 connector wiring:



«Remote Control» connector 13 and 14 pins
DB 15 contacts, male connector.

Multiple RS485 serial link:
several units (up to 999) can
be controlled on a single link.



Detailed description of RS232 and RS485 commands

(valid from V.2.03 version controller)

Conventions applicable to the syntax of all commands:

adr = address, from 000 to 255
<CR> Carriage Return (ascii 13)
<LF> Line Feed (ascii 10); between square brackets:
 this character is not compulsory.

Status values **OK** : command executed correctly

Error messages **Err0** : adjustment error (out of bounds)
Err1 : command error (syntax)
Err2 : parameter error (e.g. non-hexadecimal character)
Err3 : context error
Err4 : checksum error

ADR Specifies the address of the device for networking.

Syntax #adr**ADR**,aaa<CR>[<LF>]
 adr = address of the device before the command
 aaa = new address of the device
 condition : $000 \leq aaa \leq 255$

Result #aaa,OK or Err2

This command is used to allocate a specific number to each of the products making up a network (loop for RS 232 or parallel for RS 485).

Note : it is important to note down the number allocated to each device.

DEF List the faults

Syntax #adr**DEF**<CR>
 List the faults separated by the separator character.

Result #adr,OK if there is no fault

Detailed description of RS232 and RS485 commands

DLI Defines the DataLogger transmission interval

Syntax #adr**DLI**,xxx<CR>[<LF>]
 xxx: DataLogger send interval in seconds
 condition: $001 \leq xxx \leq 255$

Result #adr,OK or Err2

See also: **DLR** Note: if OK, the interval sent is stored in user memory.

DLR Enables DataLogger operation (only with RS232)

Syntax #adr**DLR**<CR>[<LF>]

Result #adr,OK

The main characteristics of the pump and its controller are sent over the RS link, at the rate defined by the **DLI** command.

Note: any new characters arriving on the serial port (RS 232) will cancel the automatic DataLogger transmission.

GET List the data (data only)

Syntax #adr**GETAI**<CR>[<LF>] : List analog inputs
 #adr**GETLI**<CR>[<LF>] : List logical inputs
 #adr**GETLO**<CR>[<LF>] : List logical outputs

Detailed description of RS232 and RS485 commands

IDN Identifies the device which is communicating, and its software version

Syntax #adr**IDN**<CR>[<LF>]

Result #adr, ACT1000M Vx.zz

Returns the type of Variable drive Supervisor, the software version (x), the software edition (zz).

LEV10 Returns the state of the parameters defined by SET

Syntax #adr**LEV10**<CR>[<LF>]

Result #adr,nnnnn,sssss,00000,0,cccc,eeee,dddd,pppp,qqqq, jj,kk,000,mmm

Returns current values:

nnnnn : nominal speed set point (in rpm)
sssss : stand-by speed set point (in rpm)
00000 : not used
0 : not used
cccc : pump working time (in hours)
eeee : electronic working time (in hours)
dddd : start delay (max 14459 s,
that is 240 mn 59 s)
pppp : time to venting (max 3599 s,
that is 59 mn 59 s)
qqqq : venting time (max 3599 s,
that is 59 mn 59 s)
jj : speed threshold for relay (3 to 50 %)
kk : control temperature (30 to 75°C)
00 : not used
mmm : bearing current value (0 to 100 %)

Detailed description of RS232 and RS485 commands

NOW Display date and time

Syntax #adr**NOW**<CR>[<LF>]

Result MM/DD/YY HH:MM:SS

NSP Switches the speed set point to the nominal speed value

Syntax #adr**NSP**<CR>[<LF>]

Result #adr,OK

The speed set point for the pump is set to its nominal value.

OPT Used to select possible user choices

Syntax #adr**OPT**01,n<CR>[<LF>]

choice of parameters on the analog output:

n = 0 : real pump speed

n = 1 : pump current

n = 2 : temperature of pump body

n = 3 : temperature of internal electronics

Result #adr,OK

Comment: The choice of the temperature unit affects the results of the DLR and STA strings and the display (if cabinet fitted).

Detailed description of RS232 and RS485 commands

RPM Defines the speed set point in stand-by mode

Syntax #adr**RPM**,nnnnn<CR>[<LF>]

Result #adr,OK or #adr,ErrX
1, out of range; 2, parameters ; 3, context
(not in Stand-by mode)

Comment: if OK, the new speed is automatically stored in user memory.

SBY Switches the speed set point to the stand-by value

Syntax #adr**SBY**<CR>[<LF>]

Result #adr,OK

Resets the stand-by speed to its last stand-by stored value, and allows it to be modified if an «RPM» command is sent. This configuration is automatically stored in user memory.

SEL10 Returns the state of the parameters defined by OPT

Syntax #adr**SEL10**<CR>[<LF>]

Result #adr,a,0,0,0
a : Returns choice of parameters on the analog output:
a = 0 : real pump speed
a = 1 : pump current
a = 2 : temperature of pump body
a = 3 : temperature of internal electronics
0,0,0 : not used

Detailed description of RS232 and RS485 commands

SCR List all the data (titles and data)

Syntax #adr**SCR**<CR>[<LF>] : List all the data
 #adr**SCRAI**<CR>[<LF>] : List all the analog inputs
 #adr**SCRAO**<CR>[<LF>] : List all the analog outputs
 #adr**SCRLI**<CR>[<LF>] : List all the logical inputs
 #adr**SCRLO**<CR>[<LF>] : List all the logical outputs

SET Defines the internal operating parameters

Syntax #adr**SET10**,cccc<CR>[<LF>] : pumping working time
 (in hours)
 #adr**SET11**,eeee<CR>[<LF>] : electronic working time
 (in hours)
 #adr**SET13**,dddd<CR>[<LF>] : start delay (max 14459s,
 that is 240mn 59s)
 #adr**SET14**,pppp<CR>[<LF>] : time to venting (max 3599s,
 that is 59mn 59s)
 #adr**SET15**,qqqq<CR>[<LF>] : venting time (max 3599s,
 that is 59mn 59s)
 #adr**SET30**,jj<CR>[<LF>] : speed threshold for relay
 (3 to 50 %)
 #adr**SET31**,kk<CR>[<LF>] : control temperature
 (30 to 75°C)
 #adr**SET33**,mmm<CR>[<LF>] : bearing current value
 (0 to 100 %)

Result #adr,OK or ErrX

Detailed description of RS232 and RS485 commands

SEP Defines the character which separates the parameters in a reply

Syntax #adr**SEP**,nnn<CR>[<LF>]
nnn: 3-digit decimal value of the ascii code of the desired character (with leading zeros).
condition : $000 \leq nnn \leq 255$

Result #adr,OK or #adr,ErrX if error

Allows the user to select the character which separates the parameters returned by the **DLR**, **STA** and **LEV** commands.

Default value: comma «,» ascii code = 044

If ok, the selected value is automatically stored in user memory.

SPD Returns the current speed

Syntax #adr**SPD**<CR>[<LF>]

Result #adr,nnnnn

Detailed description of RS232 and RS485 commands

STA Returns the status of the internal dynamic parameters

Syntax #adr**STA**<CR> or **STA**<CR>

Result #adr,s,rrrrr,vvv,www,xxx,yyy,zzz,aaa,bbbb,cccc,ddd,eee,fff,gggggggggggggggggggggggg<CR>

adr: address

s: order status

Bit	7	6	5	4	3	2	1	0
			LOCAL	STOP	RS	REM	STDBY	START
0	-	OFF	OFF	OK	OFF	OFF	OFF	OFF
1	1	-	ON	fault	ON	ON	ON	ON

rrrrr: speed in rpm

vvv: Radial v13

www: Radial w13

xxx: Radial v24

yyy: Radial w24

zzz: Axial z12

aaa: Motor voltage V

bbbb: Motor current mA

ccc: Motor load W

ddd: Pump temp 1 (°C)

eee: Pump temp 2 (°C)

fff: Controller temp (°C)

g	0 = OK	1 = ALERT	2 = FAULT
0	0=OK	D02: motor overheat	
1	0=OK	D03: converter overheat	
2	0=OK		D04: hall sensor
3	0=OK		D05: permanent fault sensor
4	0=OK		D06: external safety
5	0=OK		D31: jump DT0/DT1/DT2
6	0=not used		
7	0=not used		
8	0=not used		
9	0=OK		D14: v13
10	0=OK		D15: w13
11	0=OK		D16: v24
12	0=OK		D17: w24
13	0=OK		D18: z12
14	0=OK	D23: hot pump	D21: overheat-1
15	0=OK	D22: controller temp.	
16	0=OK		D26: wires disconnected
17	0=OK	D27: converter memory	
18	0=OK	D28: pump memory fault	
19	0=OK		D29: input power failure
20	0=not used		

Detailed description of RS232 and RS485 commands

TIT List the data titles

Syntax #adrTITAl<CR>[<LF>] : List analog inputs
#adrTITLI<CR>[<LF>] : List logical inputs
#adrTITLO<CR>[<LF>] : List logical outputs

TMP Defines the operating state of the turbomolecular pump

Syntax #adrTMPON<CR>[<LF>] start pump rotation
#adrTMPOFF<CR>[<LF>] stop pump

Result #adr,OK or #adr,Err3 if the pump is already in the state requested (context error)

Technical Reference Manual ATH 400M / ATH 1000M

Operation

■ Safety instructions related to operation	■ C 10
■ Controller start-up	■ C 20
■ Configuring the controller for the application	■ C 30
■ Controlling the pump using the controller front panel	■ C 40
■ Pump operation in a pumping application	■ C 50
■ «Ext. safety» contact operation	■ C 60

Safety instructions related to operation



Before using the controller, make sure that the mechanical and electrical connections have been made (*see chapter B*).
If an error message is displayed during operation, *see D 20*.

The machines are designed so as not to present a thermal risk for the user's safety. However, specific operating conditions can generate temperatures which require particular care to be taken by the user (external surfaces > 70°C).

Avoid moving or causing a shock on a pump in operation.
There is a risk of seizing if the pump rotates in an axis perpendicular to its axis of rotation.

The emergency braking valve must be connected (*see B 40*) to ensure the pump's safety and durability.
As long as the pump is running, the emergency braking valve has to be supplied with neutral gas.



The controller should never be switched off as long as the rotor is moving.

It is highly recommended to install:

- a screen filter at the pump inlet;
- an isolation valve between the chamber to be pumped and the ATH pump;
- an isolation valve between the ATH pump and the backing pump.

Controller start-up

Once the various electrical connections have been made, set the main switch on the rear panel to "I".

The controller performs a self-test and identifies the pumps to which it is connected.

The initialization time is approximately 4 seconds.

Display initialization:



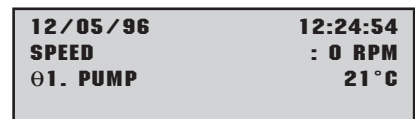
The equipment is identified, the program version is displayed.



Indicator light test: they are lit in succession.



The working screen is displayed.



The parameter setting keys

Parameter setting access



- used to access the parameter setting mode.
- used to exit the various menus without validating the functions.

Selection



- used to move in the menus, or from one parameter to another.
- used to select or adjust the value of the selected parameter.

Validation



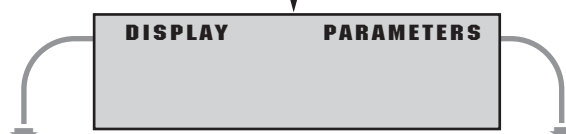
- used to validate the selection of a menu, parameter or value.



- used to exit the menus and return to the pump parameter display.

Configure the parameters for the application using the various menus.

Enter the sub-menus by pressing

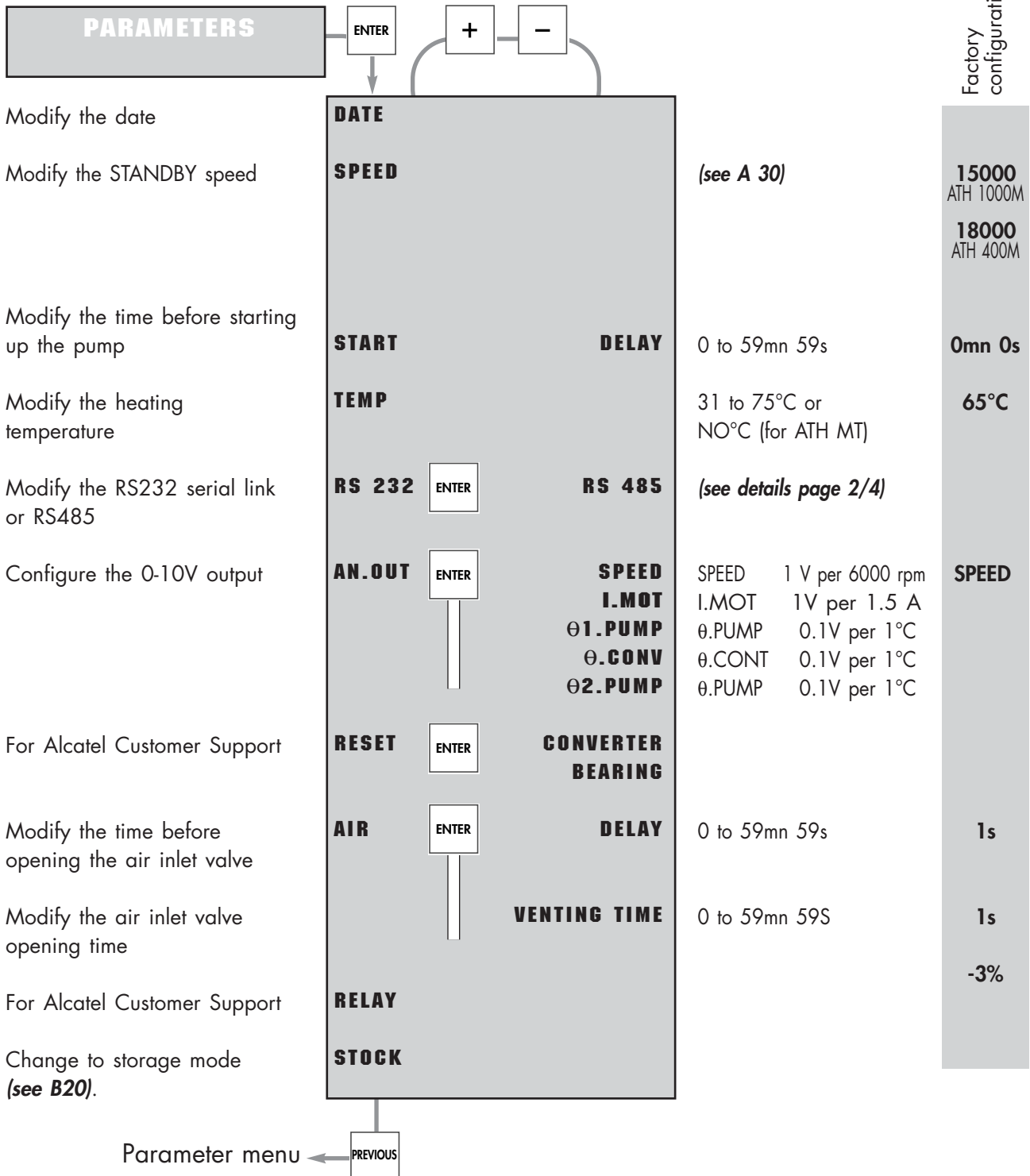


Display and/or select the parameters to be monitored (see C 30).

Access the parameter programming (see C 30).

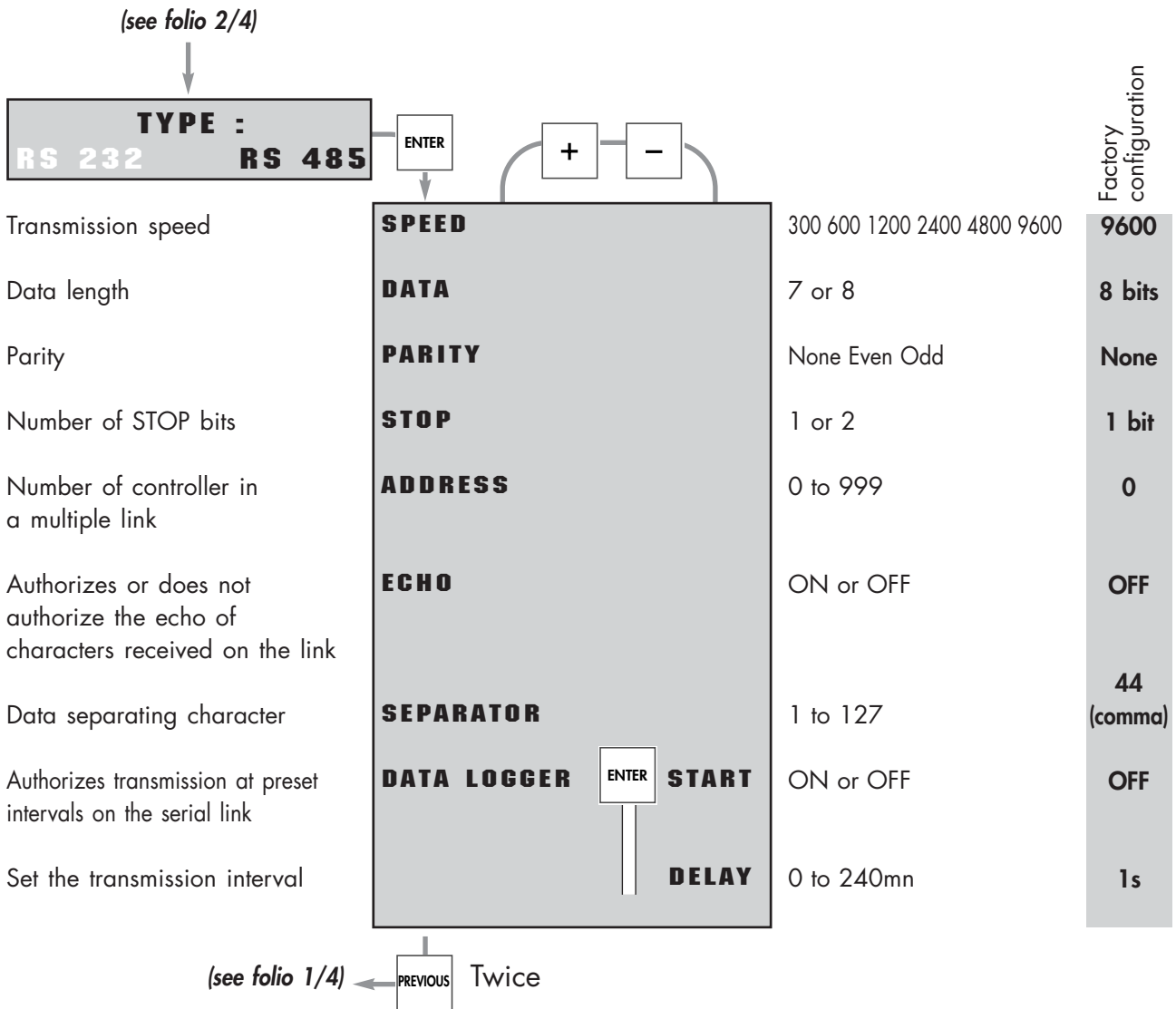
Configuring the controller for the application

Programming the parameters

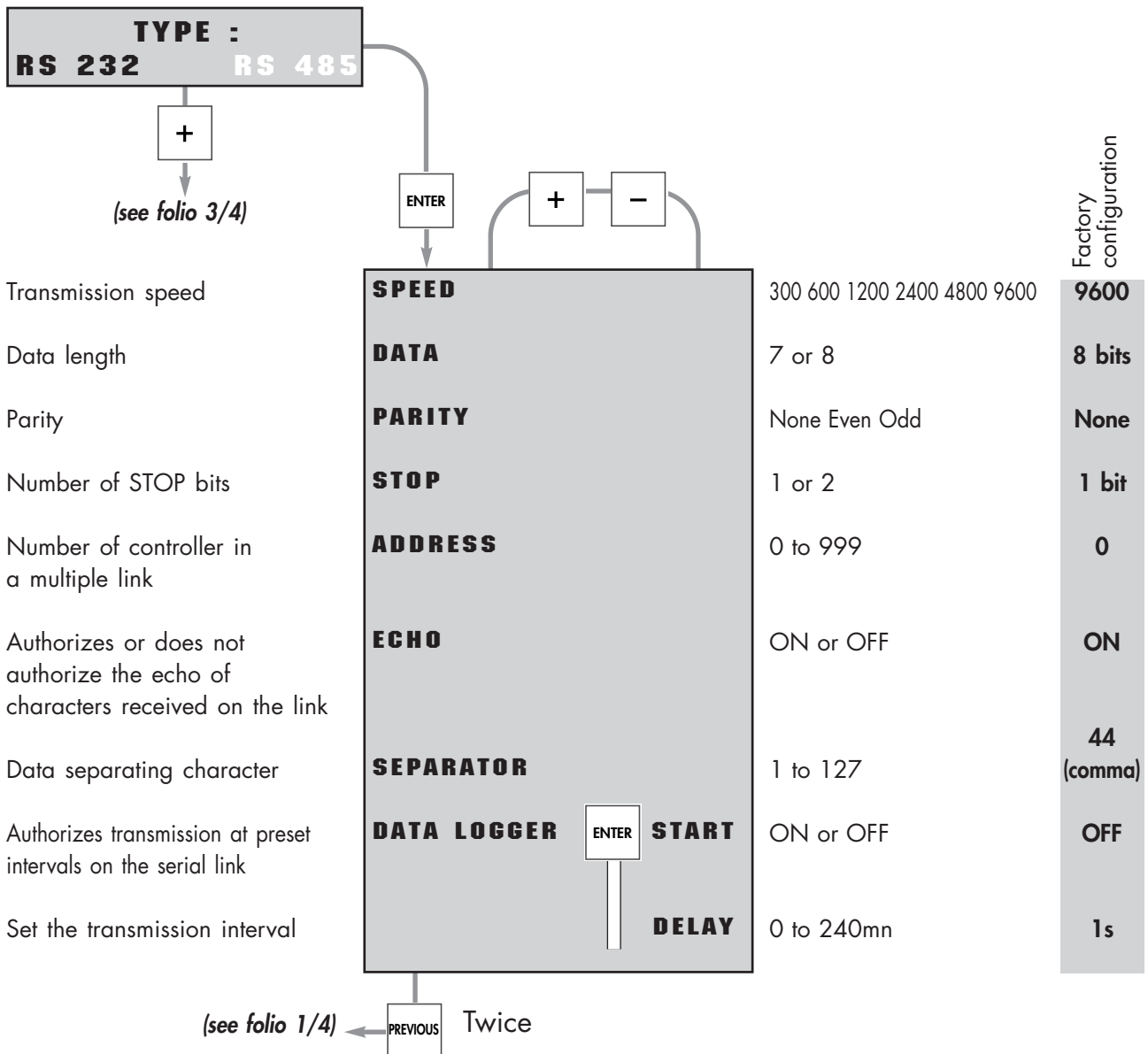


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Configuring the controller for the application

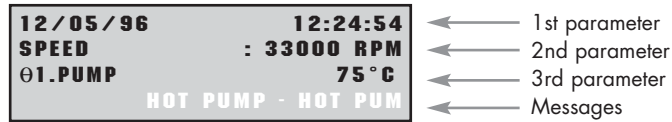


Configuring the controller for the application



Configuring the controller for the application

The various indicators on the display:

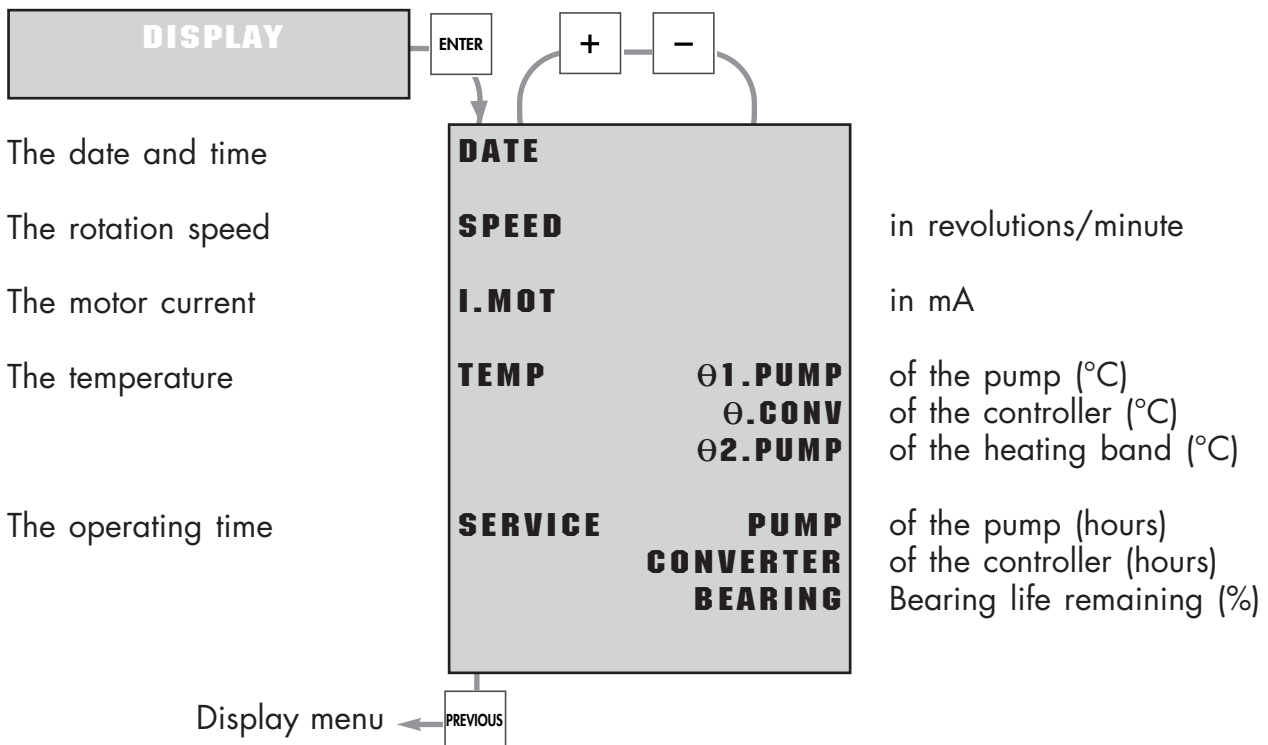


3 parameters can be selected in the pull-down menu from the list below:

- the current date and time;
- the rotation speed of the pump in «rpm»;
- the current pump motor (mA);
- the pump internal temperature and the housing temperature of the pump (°C);
- the temperature of the controller (°C);
- the number of hours that the pump is in operation (h);
- the number of hours that the controller is in operation (h);
- the % life remaining on the back-up bearings (%) before changing the bearings.

When switched on, the controller displays: the date and time, the rotation speed and the pump temperature.

Configuring the display screen



Controlling the pump using the controller front panel

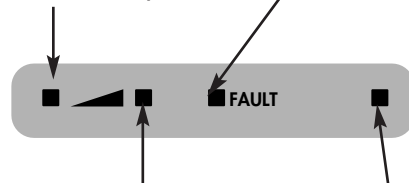
Rotation indicator lights:

Yellow lit

The pump rotation speed is **lower** than the selected speed.

Red lit

The pump is faulty. This fault is accompanied by an audible signal.



Green flashing

The pump rotation speed is **higher** than the selected speed (decrease of the selected speed during operation).

Yellow lit

Standby mode selected.

Green lit

The pump has reached the selected speed.

Start up the pump by pressing



The pump is started up to reach the selected speed.



The yellow rising speed indicator light comes on. When the pump reaches its selected speed, the yellow indicator light goes off and the green indicator light comes on.

Select the reduced speed rotation mode by

pressing



The speed selection indicator light comes on. The pump



regulates its speed to reach the value of the programmed reduced rotation speed (*see C 30*).

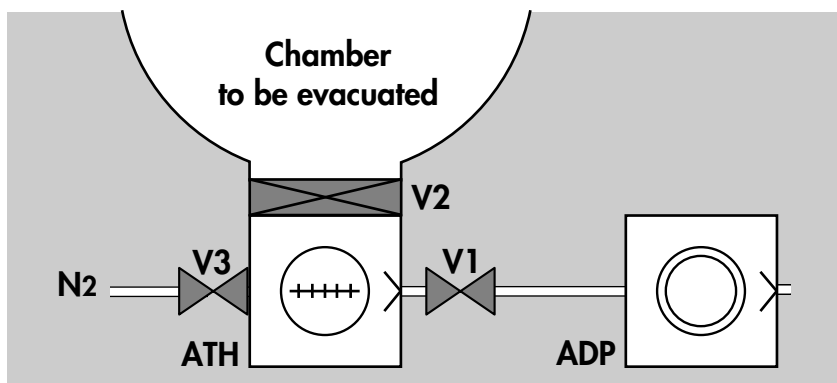
Stop the pump by pressing



The rotation speed monitoring indicator light goes off. The pump motor is no longer powered, the pump decelerates.

Pump operation in a pumping application

Pumping cycle
from chamber
at atmospheric pressure



Local mode operation

Pumping start

Switch on the controller

The valve **V3** closes and the «FAULT» contact closes.
The rotor is levitated.
The heating band is powered (for ATH MT).

Start the pumping by

The primary pumps starts and valve **V1** opens (if the primary pumping is controlled by the controller).
If the pump start-up time has been programmed (*see C 20*), the countdown of the time before the pump begins rotating is displayed on the screen.
If the pump start-up time has not been programmed, the primary pumping system and ATH start up at the same time.

Open the valve **V2**

Take care to wire the customer relay in series with «ISOL. VALVE» contact.
The chamber continues to be pumped until the customer operating pressure is reached.

Select the stand-by mode

The pump reaches the standby speed programmed (*see C 30*).
The standby mode can be selected when pump is stopped or in rotation.

Pump operation in a pumping application

Pumping stop

Stop the pumping by 

This closes the primary isolation valve **V1** and the primary pump stops. If the ISV contact is connected, **V2** closes.

Close the valve **V2**

The level of vacuum in the chamber is maintaining.

Allow the purge to flow through after pumping has stopped in order to eliminate the dead volume in the pump with neutral gas.

Eventually, make an air inlet on the pump to brake its rotation.

Without air inlet, the duration of the rotor slow-down until its complete stop could be more than 30 minutes.

Remote control mode operation

Remote control mode
selection

Close the contact «REMOTE» on the Remote Control connector (*see B 90*).

The keyboard control keys on the front panel (Start, Stop, Standby) are deactivated.

In this mode, the functions are the same to the local mode.

Pump operation in a pumping application

Immediate restarts If the pump has been stopped by an air inlet, we advise to limit to 2 the number of immediate restarts.
If the pump has been stopped without air inlet, immediate restarts are not limited.

Event of a power cut **If a power cut occurs, the rotor remains suspended by the energy emitted by the motor's counter-electromotive force, until the rotor rotation speed is low enough** (around 9000 rpm) so that it can rest on the back-up bearings without being damaged.

Short power cuts The controller display indicates temporarily:

D 29 : INPUT POWER

If the power is restored before this minimum speed (9000 rpm) is reached, the pump resumes its initial speed without any disturbance. The landing's time counter doesn't decrease.

Long power cuts Otherwise, the minimum speed is reached before the power is restored:

- «ISOL.VALVE» contact is open (V2 closes);
- «START» contact is open (V1 closes);
- the emergency braking valve is open by power failure;
- the pump lands on its back-up bearings;
- the controller is stopped;
- the landing's time counter decreases (*see D 10*).

The normal start-up procedure is to be resumed after power has been restored (*see page 1*).

If the pump is remote controlled, open the START contact and close it again.

«External safety» contact operation

If the «EXT. SAFETY» contact on the Remote Control connector (*see B 90*) is closed:

- the controller display indicates: **D 06 : EXT.SAFETY**
- the pump is stopped and the emergency braking valve opens.

To restart the pump, open the «EXT. SAFETY» contact and start the pump:

- in local mode: push the START key;
- in remote control mode: open «START/STOP» contact then, close it (*see B 100*).

Technical Reference Manual ATH 400M / ATH 1000M

Maintenance

■ Safety instructions related to maintenance	■ D 10
■ Diagnosis and troubleshooting	■ D 20
■ Screen blocked on a display	■ D 30
■ D01 : POWER OVERHEAT	■ D 40
■ D02 : MOTOR CONTROL OVERHEAT	■ D 50
■ D03 : MOTOR CONTROL OVERHEAT	■ D 60
■ D04 : HALL SENSOR	■ D 70
■ D05 : OVERCURRENT OR SENSOR	■ D 80
■ D06 : EXTERNAL SAFETY	■ D 90
■ D11 : MAG SUSPENSION	■ D 100
■ D12 : POWER	■ D 110
■ D13 : POWER OVERCURRENT	■ D 120
■ D14 - D15 - D16 - D17 - D18	■ D 130
■ D21 : PUMP OVERHEAT-1	■ D 140
■ D21 : PUMP OVERHEAT-2	■ D 150

Note: In the present chapter, the letter **■ M ■** indicates that the following item is not covered in the User's Manual.

Technical Reference Manual ATH 400M / ATH 1000M

Maintenance

■ D22 : CONTROLLER OVERHEAT	■ D 160
■ D23 : HOT PUMP	■ D 170
■ D24 : BEARING MUST BE CHANGED	■ D 180
■ D25 : TEMP SENSOR-1	■ D 190
■ D26 : NO CONNECT	■ D 200
■ D27 : DATE AND TIME	■ D 210
■ D28 : DISABLE WRITE	■ D 220
■ D29 : INPUT POWER	■ D 230
■ D30 : EEPROM CHECKSUM	■ D 240
■ D31 : CODING	■ D 250
■ D32 : NO CABLE INSIDE	■ D 260
■ D38 (37) : TEMP SENSOR-2	■ D 270
■ Default not indicated by the controller	■ D 280

Note: In the present chapter, the letter **M** located at the top of the page indicates that the corresponding section does not exist in the User's Manual.

Safety instructions related to maintenance



It is important to isolate the machine from the electrical power supply source before any interventions inside the equipment (for maintenance reasons).

Before any maintenance operations, check the pumping conditions of the installation: toxicity, possible corrosion of the pumped gases. Depending on the case, we recommend:

- to purge the pumping installation with dry nitrogen before any intervention
- to wear gloves, protective goggles and breathing masks, if necessary
- to ventilate the room well and disassemble the equipment under a fume hood.

Before restart, follow all the safety instructions concerning start-up.



The controller should never be switched off as long as the rotor is moving (speed = 0 rpm).

Safety instructions related to maintenance

Back-up bearings

When the pump is running, the rotor is levitated magnetically. There is therefore no friction between moving and fixed parts.

When the pump is stopped from the controller, the back-up bearings are not used. The rotor remains levitated by magnetic bearings.

Only the back-up bearings require maintenance: they are designed to withstand many accidental shut-downs, or many landings of the rotor on the bearings at full speed. These accidental shut-downs occur only in exceptional circumstances: broken power supply cable, strong shocks, faulty electronics. **It is advisable to check the bearing counter and provide ball bearings maintenance, when needed.**

The bearing counter

Life time of these bearings depends on the duration and number of landing. The initial percentage displayed by the controller is 100.00%.

When this percentage reaches 0%, the pump can't restart and the back-up bearings have to be changed.

The decrementation of the counter is done by:

- a landing after a magnetic bearing trouble, nearly 0.20% per landing;
- a landing at 9000 rpm after a prolonged power failure, nearly 0.04%.

However, the decrementation depends on the bearings rotation duration:

- if the braking valve is not connected or,
 - if the gas supply is closed on it or,
 - if there are no exhaust or inlet isolation valves or,
 - if these valves are not driven by the controller,
- the counter can count down 30% since the first landing.**

The internal memory of the controller informs the operator when the bearings require maintenance by displaying:

D 24: BEARINGS MUST BE CHANGED

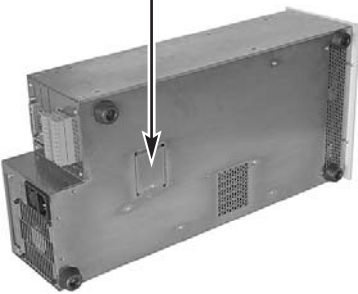
Diagnosis and troubleshooting

The screen is blocked on a display
(At start-up or during operation) **D 30**

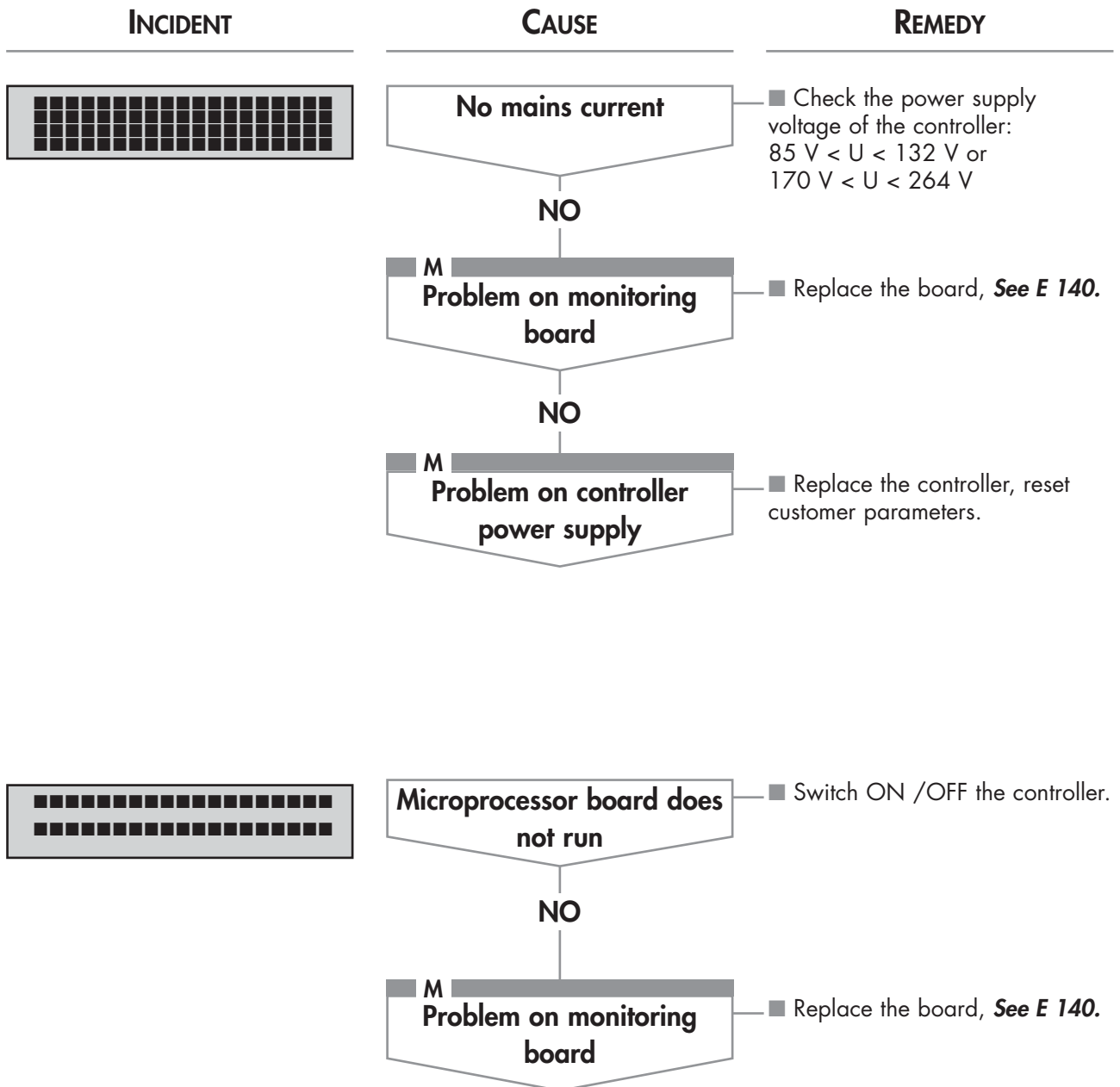
The default is indicated by the controller **D 40 to
D 270**

The default is not indicated by the controller . . . **D 280**

Screen blocked on a display

INCIDENT	CAUSE	REMEDY
<p>Display remains OFF after power ON</p>	<p>Controller not powered</p>	<ul style="list-style-type: none"> ■ Check that the controller is powered. ■ Check the power supply voltage: $85\text{ V} < U < 132\text{ V}$ or $170\text{ V} < U < 264\text{ V}$
	<p>NO</p>	<ul style="list-style-type: none"> ■ Check the fuses: 2 fuses 16A located under the controller (Acces panel).
	<p>Defective fuses</p>	<p>NO</p> 
	<p>M</p> <p>Controller trouble</p>	<ul style="list-style-type: none"> ■ Replace the controller, reset customer parameters. <p>⚠ Isolate the product from its various energy sources before any maintenance operations.</p>

Screen blocked on a display



Screen blocked on a display

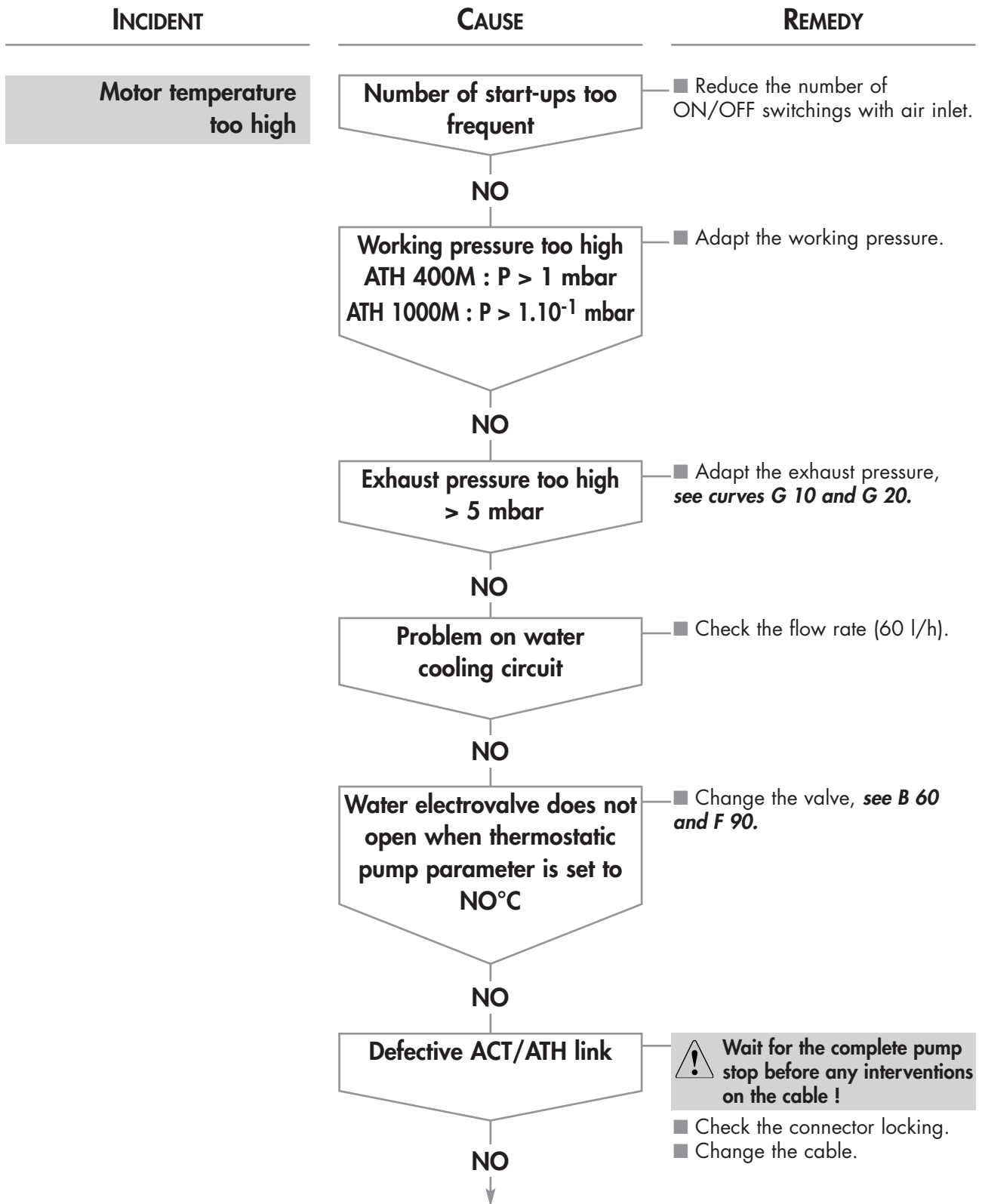
INCIDENT	CAUSE	REMEDY
<p>ACT 1000 M V2.XX ----- MEMORY FAULT</p>	<p>The pump is not identified after controller initialisation</p>	<p>■ See D 250.</p>
<p>ACT 1000 M V2.XX ----- WDOG CONVERTER</p>	<p>The microprocessor runs on itself</p>	<p>■ Stop the pump, Switch the controller ON/OFF. Restart the pump.</p>
	<p>NO</p>	
	<p>M Problem on monitoring board</p>	<p>■ Change the board, see E 140.</p>
	<p>NO</p>	
	<p>M Problem on controller power supply</p>	<p>■ Replace the controller, reset customer parameters.</p>

DO1 : POWER OVERHEAT

INCIDENT	CAUSE	REMEDY
<p>Controller temperature too high</p>	<p>Bad mains voltage</p>	<ul style="list-style-type: none"> ■ Check the voltage: 85 V < U < 132 V or 170 V < U < 264 V
	<p>NO</p>	
	<p>Bad controller cooling</p>	<ul style="list-style-type: none"> ■ Check that the air admissions are not blocked . ■ Respect a free space of 15mm above and under the controller.
	<p>NO</p>	
	<p>Fan is not running</p>	<ul style="list-style-type: none"> ■ Check the fan power supply.
	<p>NO</p>	<ul style="list-style-type: none"> ■ M ████████████████████ ■ Change the fan.
	<p>Ambient temperature too high > 50°C</p>	<ul style="list-style-type: none"> ■ Ventilate the controller environment.
<p>NO</p>		
<p>M ████████ Problem on variator board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i> 	
<p>NO</p>		
<p>M ████████ Problem on controller power supply</p>	<ul style="list-style-type: none"> ■ Replace the controller, reset customer parameters. 	

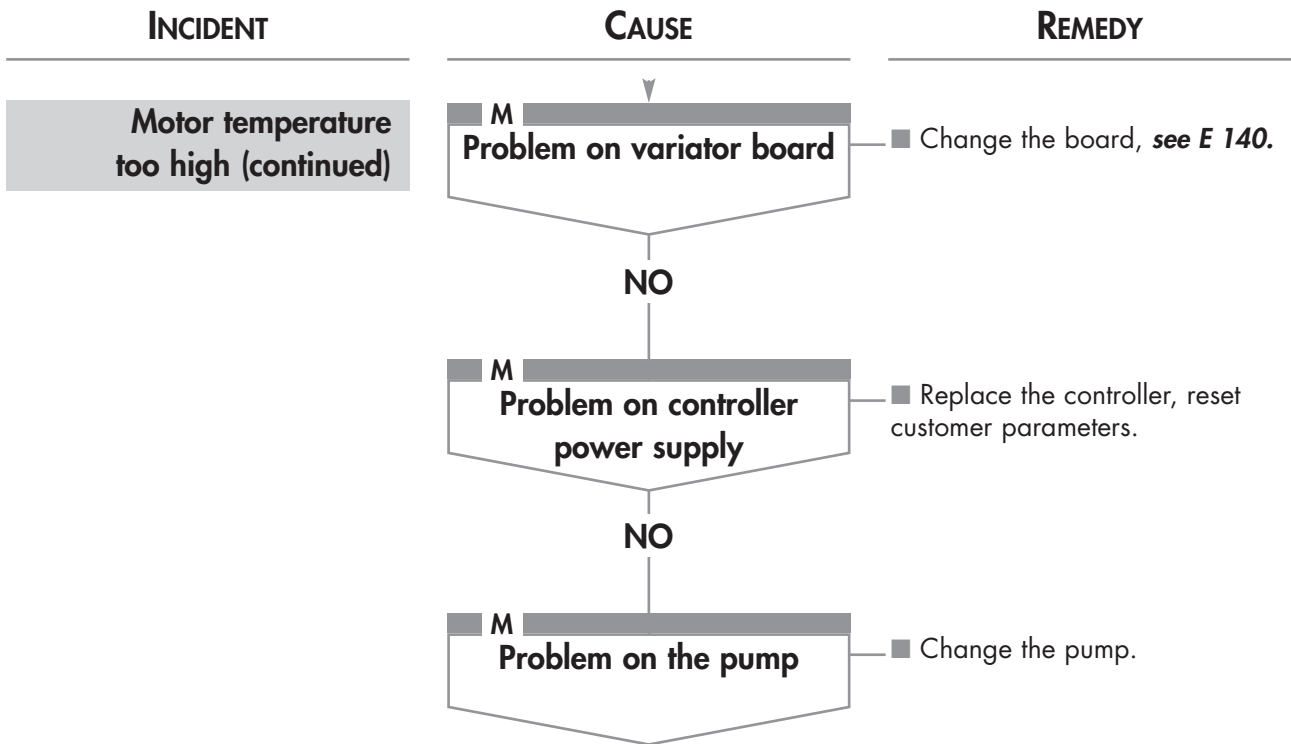
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DO2 : MOTOR CONTROL OVERHEAT



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DO2 : MOTOR CONTROL OVERHEAT



DO3 : MOTOR CONTROL OVERHEAT

INCIDENT	CAUSE	REMEDY	
<p>Controller temperature too high</p>	<p>Bad controller cooling</p>	<ul style="list-style-type: none"> ■ Chek that the air admissions are not blocked. ■ Respect a free space of 15mm above and under the controller. 	
	<p>NO</p>	<p>Number of start-ups too frequent</p>	<ul style="list-style-type: none"> ■ Reduce the number of ON/OFF switchings with air inlet.
	<p>NO</p>	<p>Working pressure too high ATH 400M : $P > 1 \text{ mbar}$ ATH 1000M : $P > 1.10^{-1} \text{ mbar}$</p>	<ul style="list-style-type: none"> ■ Adapt the working pressure.
	<p>NO</p>	<p>Exhaust pressure too high $> 5 \text{ mbar}$</p>	<ul style="list-style-type: none"> ■ Adapt the exhaust pressure, see G 10 and G 20.
	<p>NO</p>	<p>M Problem on variator board</p>	<ul style="list-style-type: none"> ■ Change the board, see E 140.
	<p>NO</p>	<p>M Problem on controller power supply</p>	<ul style="list-style-type: none"> ■ Replace the controller, reset customer parameters.

D04 : HALL SENSOR

INCIDENT	CAUSE	REMEDY
<p>Wrong information coming from motor stator</p>	<p>Default on Hall effect sensors of motor</p>	<ul style="list-style-type: none"> ■ Try to restart the pump: Local mode: pressing «start». Remote mode: open and close the «start» contact.
	<p>NO</p>	<p>⚠ Wait the pump isn't running.</p>
	<p>Defective ACT/ATH link</p>	<ul style="list-style-type: none"> ■ Switch OFF the controller and restart it.
	<p>NO</p>	<p>⚠ Wait for the complete pump stop before any interventions on the cable !</p>
	<p>M Problem on variator board</p>	<ul style="list-style-type: none"> ■ Check the connector locking ■ Change the cable.
<p>NO</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i> 	
<p>M Problem on the monitoring board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i> 	
<p>NO</p>	<ul style="list-style-type: none"> ■ Change the pump. 	
<p>M Problem on the pump</p>	<ul style="list-style-type: none"> ■ Change the pump. 	

D04 + other defaults

INCIDENT	CAUSE	REMEDY
<p>Display: D04 - D05</p>	<p>Motor information default</p>	■ See page 1
<p>Display: D04 - D05 - D11 - D25 - D26 - D31</p>	<p>ACT/ATH link cable disconnected</p>	■ See D 250


DOS : OVERCURRENT OR SENSOR

INCIDENT	CAUSE	REMEDY
<p>Motor stator overcurrent</p>	<p>Default on Hall effect sensors of motor</p>	<ul style="list-style-type: none"> Try to restart the pump: Local mode: pressing «start». Remote mode: open and close the «start» contact.
	<p>NO</p>	<p>! Wait the pump isn't running.</p>
	<p>Defective ACT/ATH link</p>	<ul style="list-style-type: none"> Switch OFF the controller and restart it.
	<p>NO</p>	<p>! Wait for the complete pump stop before any interventions on the cable !</p>
	<p>M Problem on variator board</p>	<ul style="list-style-type: none"> Check the connector locking. Change the cable.
<p>NO</p>	<ul style="list-style-type: none"> Change the board, <i>see E 140.</i> 	
<p>M Problem on the monitoring board</p>	<ul style="list-style-type: none"> Change the board, <i>see E 140.</i> 	
<p>NO</p>	<ul style="list-style-type: none"> Change the pump. 	
<p>M Problem on the pump</p>		

DOG : EXTERNAL SAFETY

INCIDENT	CAUSE	REMEDY
<p>The external safety contact is activated</p>	<p>Problem on a safety device wired by the user</p>	<ul style="list-style-type: none"> ■ Test the external safety devices and repair the fault (contact 1 - 9) on Remote Control connector. ■ Try to restart the pump: Local mode: pressing «start». Remote mode: open and close the «start» contact.
	<p>NO</p>	<ul style="list-style-type: none"> ■ Remove the plug: the default should disappear.
	<p>NO</p>	<p>M</p> <ul style="list-style-type: none"> ■ Check the value of internal resistance, ACT stopped: <p>If resistance (contact_{1.9}) < 5 Ω, change interface board, see E 140.</p> <p>If resistance (contact_{1.9}) > 5 Ω, change the monitoring board, see E 140.</p>

D11 : MAG SUSPENSION

INCIDENT	CAUSE	REMEDY	
<p>Mechanical or electrical problem</p>	<p>Rotor does not run</p>	<ul style="list-style-type: none"> ■ Change the pump. 	
	<p>NO</p>	<p>Defective ACT/ATH link</p>	<p> Wait for the complete pump stop before any interventions on the cable !</p> <ul style="list-style-type: none"> ■ Check the connector locking. ■ Change the cable.
	<p>NO</p>	<p>Connectors problems Pump, cable, controller</p>	<ul style="list-style-type: none"> ■ Check that no pin is twisted or broken. ■ Change the cable.
	<p>NO</p>	<p>M Problem on magnetic bearings boards</p>	<ul style="list-style-type: none"> ■ Change the both magnetic bearings boards, <i>see E 140.</i>
	<p>NO</p>	<p>M Problem on the monitoring board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i>
	<p>NO</p>	<p>M Problem on controller</p>	<ul style="list-style-type: none"> ■ Replace the controller, reset the customer parameters.
	<p>NO</p>	<p>M Problem on the pump</p>	<ul style="list-style-type: none"> ■ Change the pump.

D11 + other defaults

INCIDENT	CAUSE	REMEDY
<p>Display: D11 - D31</p>	<p>Incompatibility between the pump and the controller</p>	<p>■ See D 250</p>
<p>Display: D11 - D32</p>	<p>Magnetic bearings boards not powered</p>	<p>■ See D 260</p>
<p>Display: D11 - D15 - D18</p>	<p>Positioning out of tolerance</p>	<p>■ See D 260</p>
<p>Display: D11 - D14 - D15 - D16 - D17 - D18</p>	<p>Impossible positioning</p>	<p>■ See D 260</p>

D12 : POWER

INCIDENT	CAUSE	REMEDY
<p>Secondary voltage too high</p>	<p>Mains voltage problem</p>	<p>■ Check the voltage: $85\text{ V} < U < 132\text{ V}$ or $170\text{ V} < U < 264\text{ V}$</p>
	<p>NO</p>	
	<p>M Problem on variator board</p>	<p>■ Change the board, <i>see E 140.</i></p>
<p>NO</p>		
<p>M Problem on controller power supply</p>	<p>■ Change the controller, reset the customer parameters.</p>	

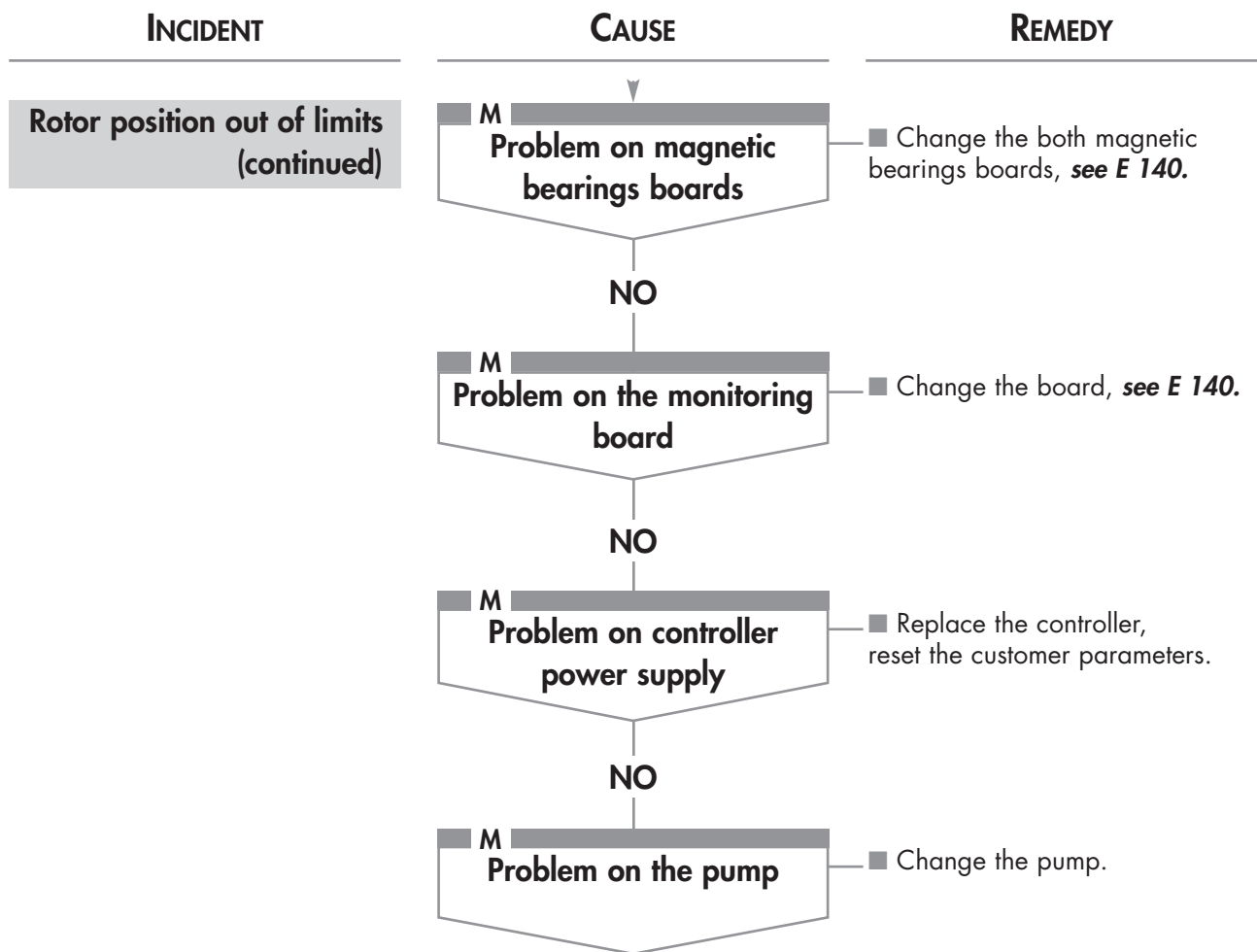
D13 : POWER OVERCURRENT

INCIDENT	CAUSE	REMEDY
Overcurrent	<p>Mains voltage problem</p>	<ul style="list-style-type: none"> Check the voltage: 85 V < U < 132 V or 170 V < U < 264 V
	NO	
	<p>Defective ACT/ATH link</p>	<p>⚠ Wait for the complete pump stop before any interventions on the cable !</p> <ul style="list-style-type: none"> Check the connector locking. Change the cable.
	NO	
	<p>M Problem on variator board</p>	<ul style="list-style-type: none"> Change the board, <i>see E 140</i>.
	NO	
<p>M Problem on controller power supply</p>	<ul style="list-style-type: none"> Change the controller, reset the customer parameters. 	
NO		
<p>M Problem on the pump</p>	<ul style="list-style-type: none"> Change the pump. 	

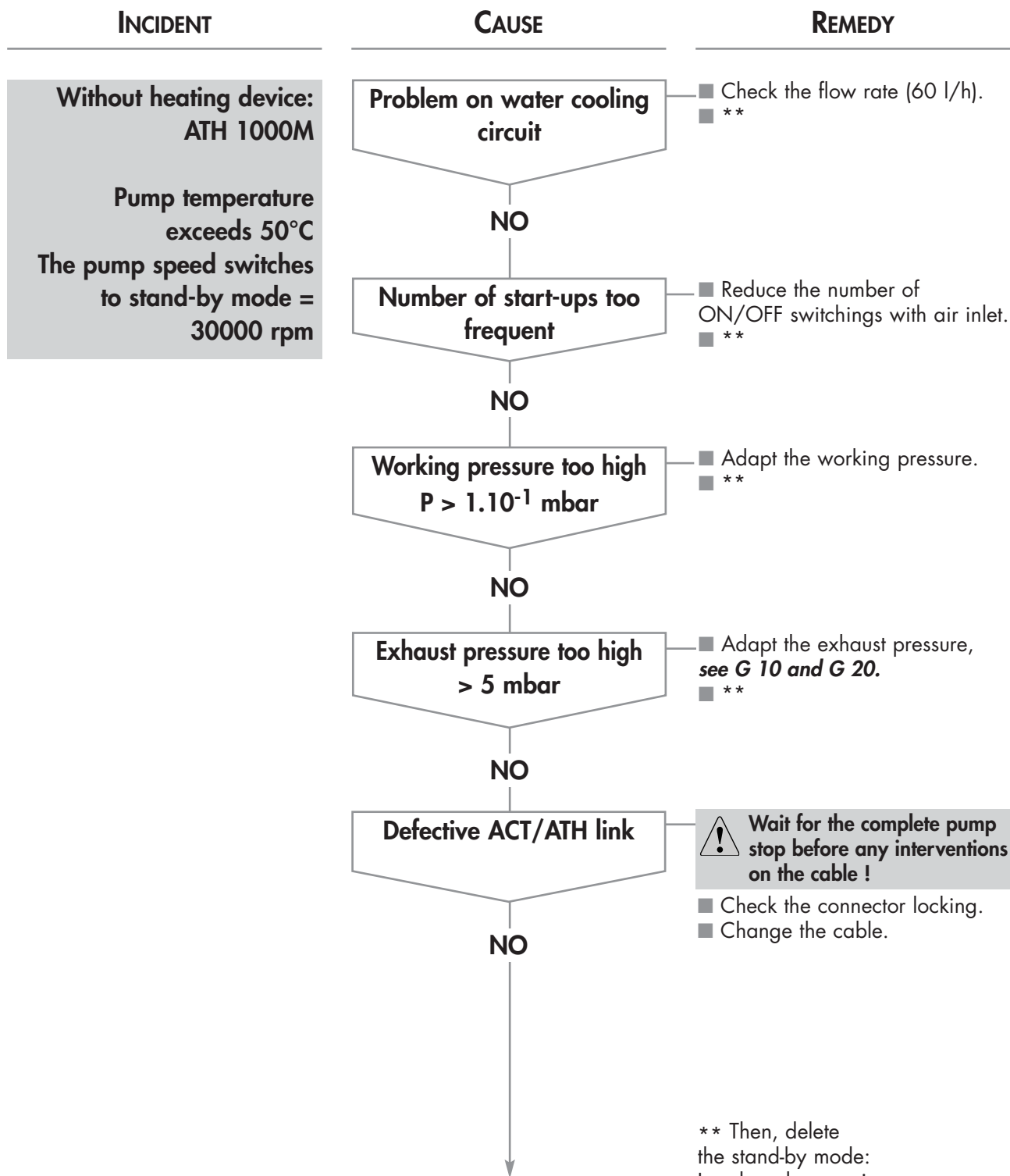
D14 - D15 - D16 - D17 - D18


INCIDENT	CAUSE	REMEDY
<p>Rotor position out of limits</p>	<p>Bad pump fixation</p> <p>NO</p>	<ul style="list-style-type: none"> ■ Check the pump fixation rigidity regarding to the chamber, inlet bellow prohibited. ■ Try to restart the pump: Local mode: pressing on «start». Remote mode: open and close the «start» contact.
	<p>Vibrations on the frame</p> <p>NO</p>	<ul style="list-style-type: none"> ■ Check if there are no vibrations generated by the frame, for exemple, equipement installed on a floating stone. ■ Try to restart the pump: Local mode: pressing on «start». Remote mode: open and close the «start» contact.
	<p>Defective ACT/ATH link</p> <p>NO</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p>⚠ Wait for the complete pump stop before any interventions on the cable !</p> </div> <ul style="list-style-type: none"> ■ Check the connector locking. ■ Change the cable.

D14 - D15 - D16 - D17 - D18




D21 * : PUMP OVERHEAT-1



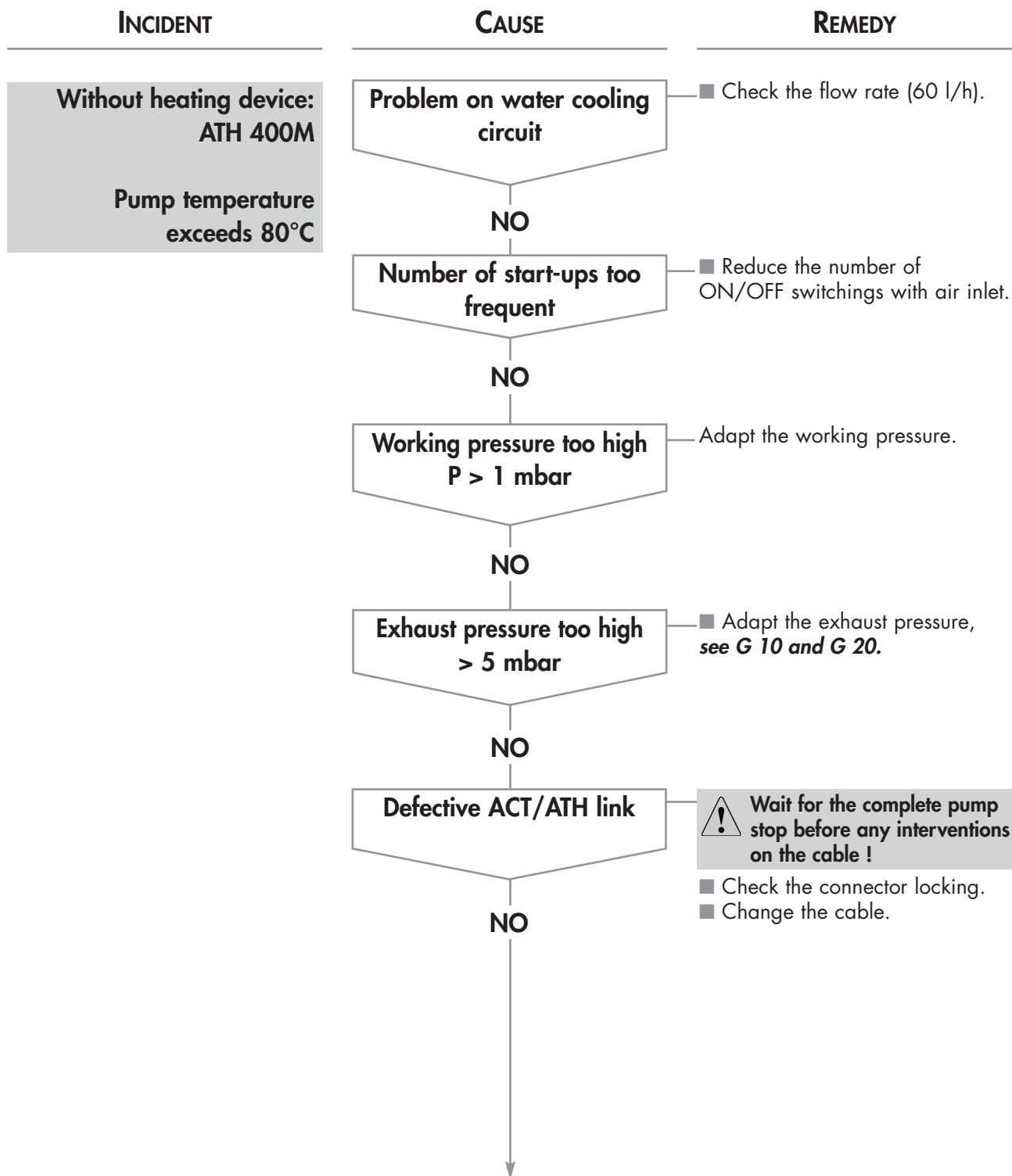
 * 2 different messages for D21: Pump-overheat 1 or 2


D21 * : PUMP OVERHEAT-1

INCIDENT	CAUSE	REMEDY
<p>Without heating device: ATH 1000M</p> <p>Pump temperature exceeds 50°C The pump speed switches to stand-by mode = 30000 rpm</p>	<p>M</p> <p>Problem on the monitoring board</p>	<p>■ Change the board, <i>see E 140.</i></p>
	<p>NON</p>	
	<p>M</p> <p>Problem on interface board</p>	<p>■ Change the board, <i>see E 140.</i></p>
	<p>NON</p>	
	<p>M</p> <p>Problem on controller</p>	<p>■ Replace the controller, reset the customer parameters.</p>
	<p>NON</p>	
	<p>M</p> <p>Problem on the pump</p>	<p>■ Change the pump.</p>

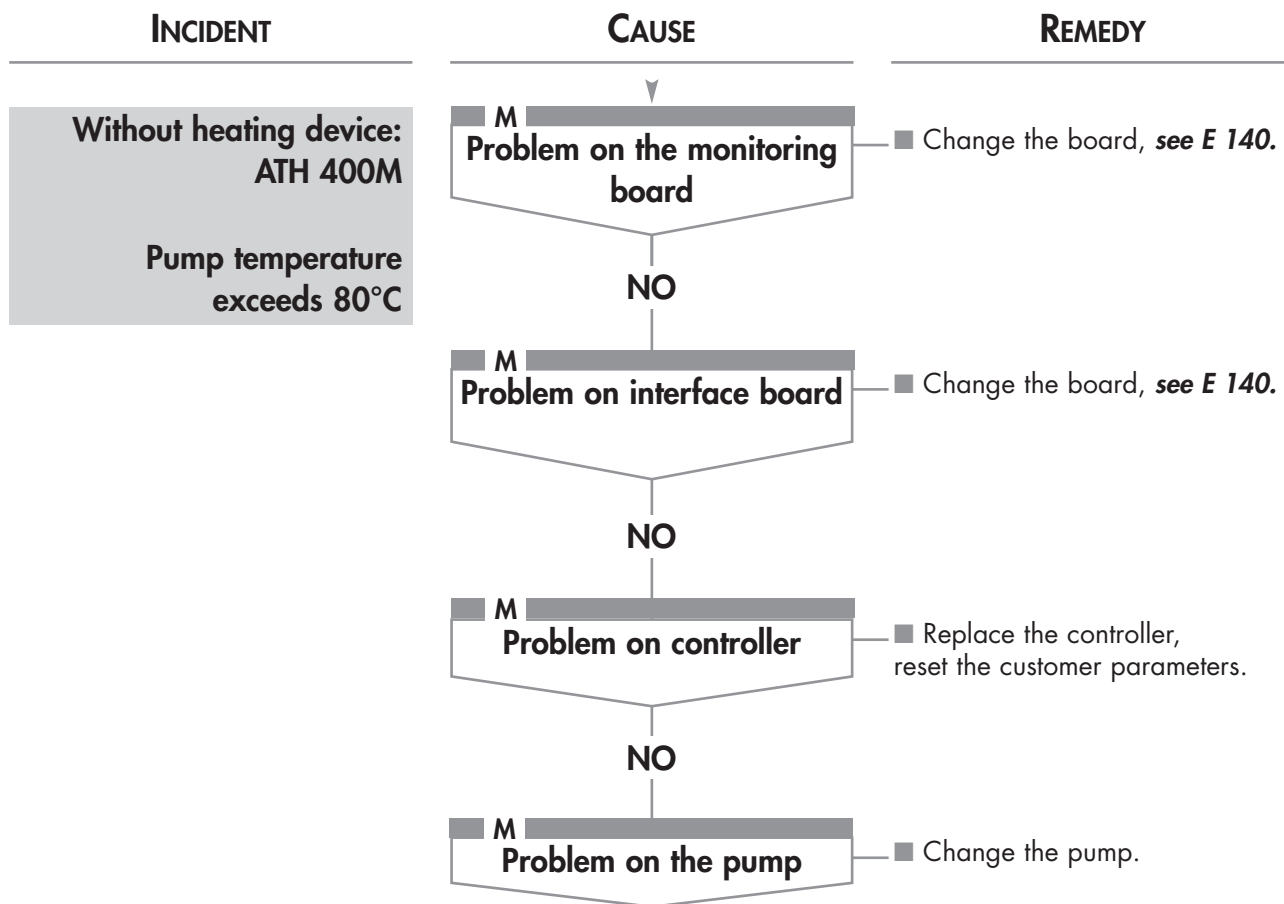
 * 2 different messages for D21: Pump-overheat 1 or 2


D21 * : PUMP OVERHEAT-1



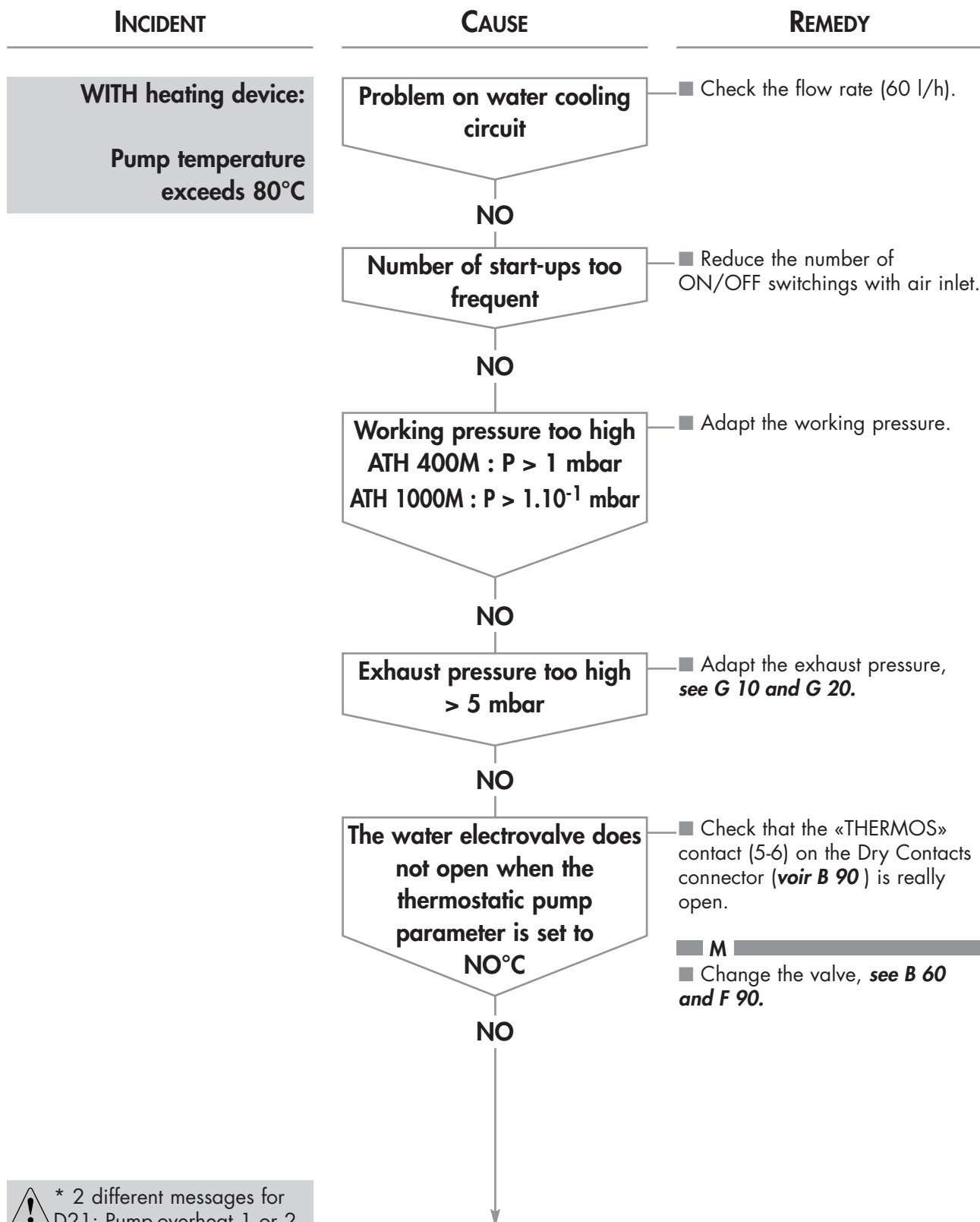
 * 2 different messages for
D21: Pump-overheat 1 or 2


D21 * : PUMP OVERHEAT-1



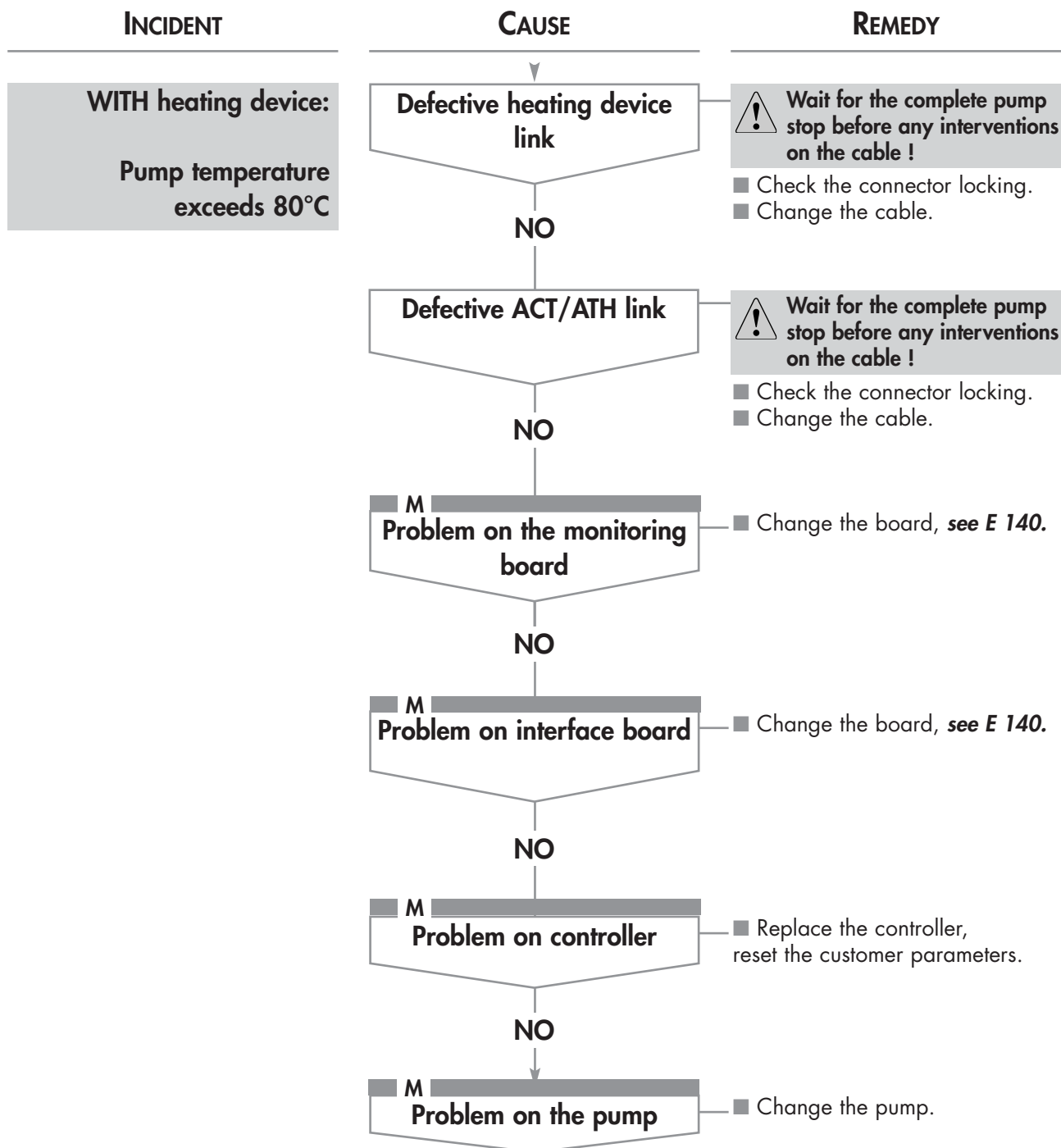
 * 2 different messages for D21: Pump-overheat 1 or 2


D21 * : PUMP OVERHEAT-1




 * 2 different messages for D21: Pump-overheat 1 or 2


D21 * : PUMP OVERHEAT-1



 * 2 different messages for D21: Pump-overheat 1 or 2

D21 * : PUMP OVERHEAT-2

INCIDENT	CAUSE	REMEDY
<p>Heating device temperature exceeds 80°C</p>	<p>Problem on water cooling circuit</p>	<ul style="list-style-type: none"> ■ Disconnect the mains plug of heating device cable and check that the water electrovalve opens. ■ Check the flow rate (60 l/h).
	NO	
	<p>The water electrovalve does not open when the thermostatic pump parameter is set to NO°C</p>	<ul style="list-style-type: none"> ■ Check that the «THERMOS» contact (5-6) on the Dry Contacts connector (<i>voir B 90</i>) is really open.
	NO	
	<p>Defective heating device link</p>	<p> Wait for the complete pump stop before any interventions on the cable !</p> <ul style="list-style-type: none"> ■ Check the connector locking. ■ Change the cable.
	NO	
	<p>M Defective T2 sensor</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 150</i>.
NO		
<p>M Problem on the monitoring board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140</i>. 	
NO		
<p>M Problem on interface board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140</i>. 	

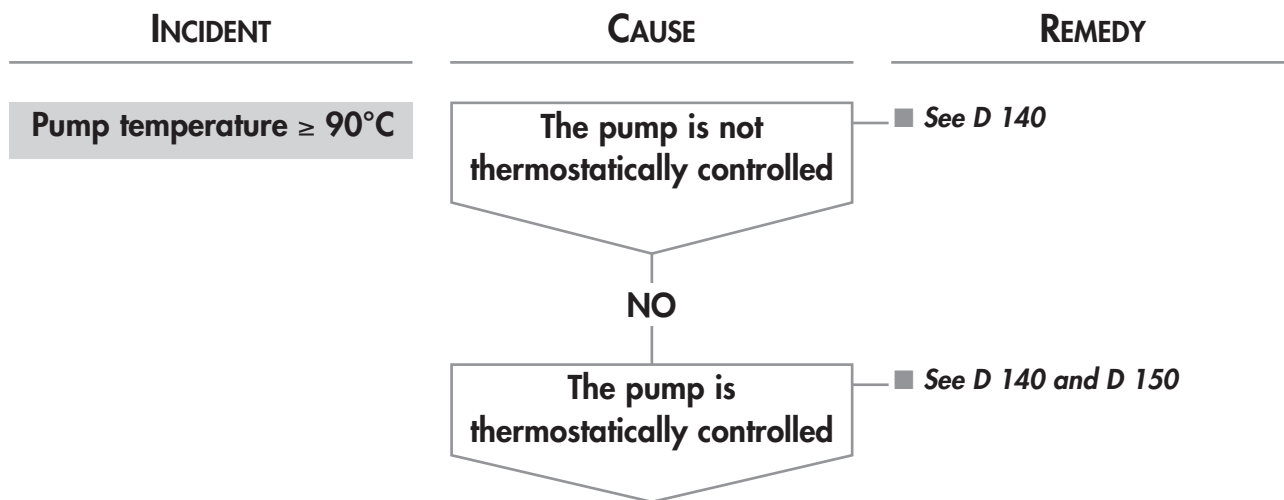
 * 2 different messages for D21: Pump-overheat 1 or 2

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D22 : CONTROLLER OVERHEAT

INCIDENT	CAUSE	REMEDY
<p>Controller temperature exceeds 60°C</p>	<p>Mains voltage problem</p>	<ul style="list-style-type: none"> ■ Check the voltage: 85 V < U < 132 V or 170 V < U < 264 V
	<p>NO</p>	
	<p>Bad controller cooling</p>	<ul style="list-style-type: none"> ■ Check that the air admissions are not blocked. ■ Respect a free space of 15mm above and under the controller.
	<p>NO</p>	
	<p>The fan does not run</p>	<ul style="list-style-type: none"> ■ Check the fan power supply.
	<p>NO</p>	<ul style="list-style-type: none"> ■ M ■ Change the fan.
	<p>Ambient temperature too high > 50°C</p>	<ul style="list-style-type: none"> ■ Ventilate the controller environment.
<p>NO</p>		
<p>M Problem on variator board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i> 	
<p>NO</p>		
<p>M Problem on controller power supply</p>	<ul style="list-style-type: none"> ■ Replace the controller, reset the customer parameters. 	







D23 : HOT PUMP



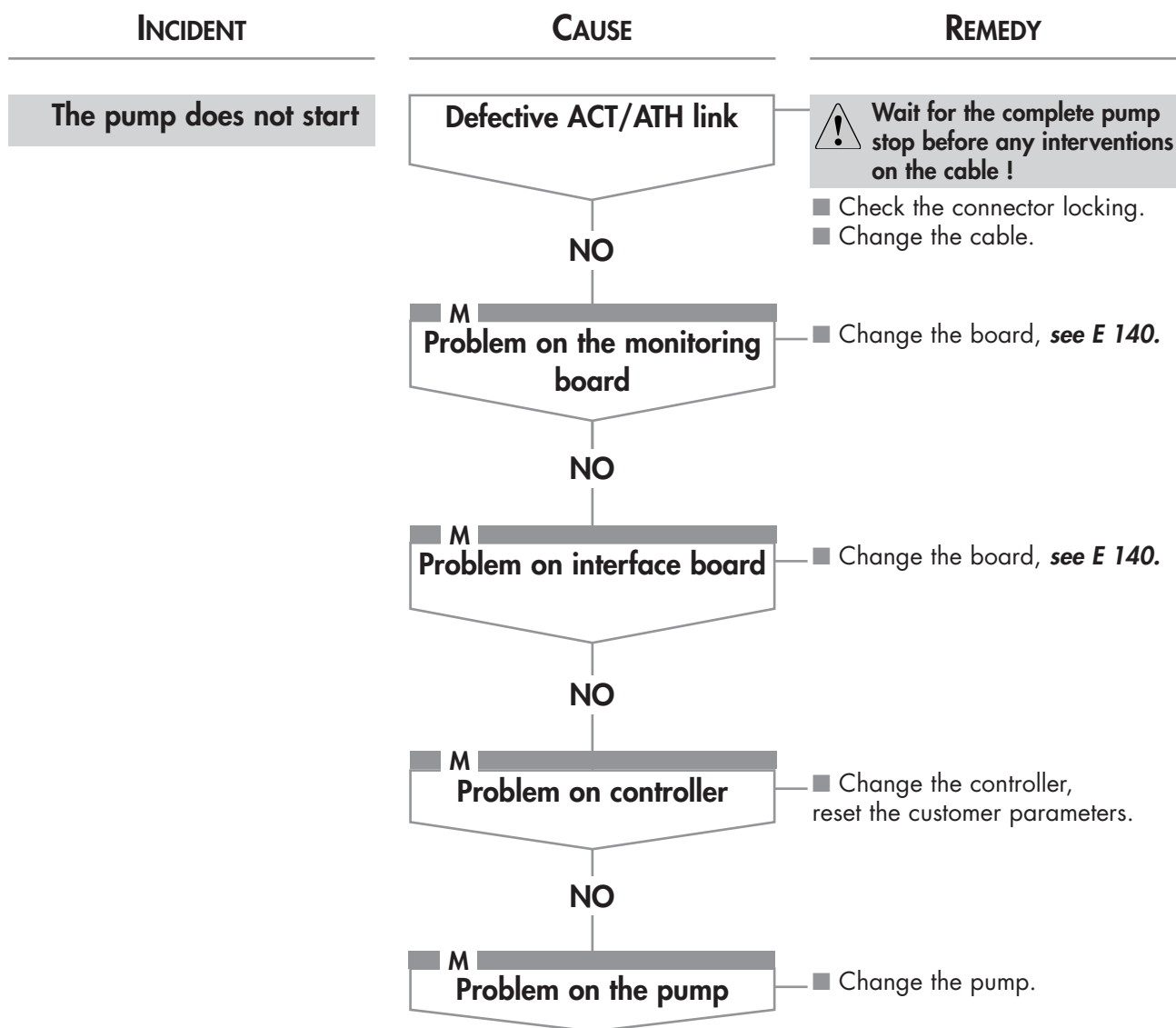
D24 : BEARING MUST BE CHANGED

INCIDENT	CAUSE	REMEDY
<p>The authorized number of landings has been reached</p>	<p>Emergency bearings are damaged</p>	<p>M</p> <ul style="list-style-type: none"> ■ Change the emergency bearings, <i>see E 20</i>. ■ Reset the bearing counter on the «PARAMETER», select «RESET» then «CONVERTER» controller menu: code «C» 65510, then ENTER, code «D» 65500, then ENTER, then valid with the «PREVIOUS» key.


D25 : TEMP SENSOR-1

INCIDENT	CAUSE	REMEDY	
<p>The controller stops the pump, PUMP-TEMP1=0, the pump can't restart.</p>	<p>Sensor reading default</p>	<p> Wait the pump isn't running.</p> <ul style="list-style-type: none"> Switch OFF the controller and restart. 	
	<p>NO</p>	<p>Defective ACT/ATH link</p>	<p> Wait for the complete pump stop before any interventions on the cable !</p> <ul style="list-style-type: none"> Check the connector locking. Change the cable.
	<p>NO</p>	<p> Problem on the monitoring board</p>	<ul style="list-style-type: none"> Change the board, see E 140.
	<p>NO</p>	<p> Problem on interface board</p>	<ul style="list-style-type: none"> Change the board, see E 140.
	<p>NO</p>	<p> Problem on controller</p>	<ul style="list-style-type: none"> Replace the controller, reset the customer parameters.
	<p>NO</p>	<p> Problem on the pump</p>	<ul style="list-style-type: none"> Change the pump.

D26 : NO CONNECT



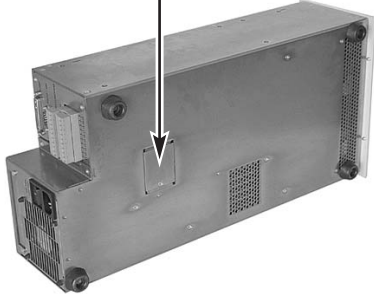
D27 : DATE AND TIME

INCIDENT	CAUSE	REMEDY
<p>The pump is running but the display is not correct</p>	<p>Incorrect parameters settings</p>	<ul style="list-style-type: none"> Reset the date on the «PARAMETER» controller menu.
<p>The pump does not start</p>	<p>Controller in storage mode</p>	<ul style="list-style-type: none">  Wait the pump isn't running. Switch OFF the controller power supply and restart.
	<p>NO</p>	
	<p>M Memory problem</p>	<ul style="list-style-type: none"> Reset the controller: in the menu «PARAMETER», select «RESET» then «CONVERTER»: code «A» 65530, then ENTER, code «B» 65520, then ENTER. Valid with the «PREVIOUS» key. Then reset the customer parameters.
	<p>NO</p>	
	<p>M Problem on the monitoring board</p>	<ul style="list-style-type: none"> Change the board, <i>see E 140</i>.
	<p>NO</p>	
	<p>M Problem on controller power supply</p>	<ul style="list-style-type: none"> Change the controller, reset the customer parameters.

D28 : DISABLE WRITE

INCIDENT	CAUSE	REMEDY
<p>Datas are not recorded by the controller</p>	<p>Memory problem</p> <p>NO</p> <p>M Problem on the monitoring board</p> <p>NO</p> <p>M Problem on controller power supply</p>	<p>■ Reinitialize the controller: pump stopped, switch OFF the controller power supply and restart.</p> <p>■ M ■</p> <p>■ Reinitialize the controller: in the menu «PARAMETER», select «RESET» then «CONVERTER»: code «A» 65530, then ENTER, code «B» 65520, then ENTER. Valid with the «PREVIOUS» key. Then reset the customer parameters.</p> <p>■ Change the board, <i>see E 140</i>.</p> <p>■ Change the controller, reset the customer parameters.</p>

D29 : INPUT POWER

INCIDENT	CAUSE	REMEDY
<p>Mains power supply failure</p> <p>Imminent landing of the spindle</p>	<p>Controller not powered</p> <p>NO</p> <p>Defective fuses</p> <p>NO</p> <p>M Problem on the controller</p>	<ul style="list-style-type: none"> ■ Check that the controller is powered. ■ Check the power supply voltage: 85 V < U < 132 V or 170 V < U < 264 V ■ Check the fuses: 2 fuses 16A located under the controller (Acces panel). <div style="text-align: center;">  </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>! Isolate the product from its various energy sources before any maintenance operations.</p> </div> <ul style="list-style-type: none"> ■ Replace the controller, reset customer parameters.

D30 : EEPROM CHECKSUM

INCIDENT	CAUSE	REMEDY
<p>Memory erased</p>	<p>M Problem on the monitoring board</p> <p style="text-align: center;">NO</p> <p>M Problem on the controller</p>	<p>■ Change the board, <i>see E 140.</i></p> <p>■ Replace the controller, reset customer parameters.</p>

D31 : CODING

INCIDENT	CAUSE	REMEDY	
<p>No handshake between pump and controller</p>	<p>Incompatibility between pump and controller</p>	<ul style="list-style-type: none"> ■ Check the couple ATH 400M and ACT 600M or, ATH 1000M and ACT 1000M. ■ Replace the non-conform model. 	
	<p>NO</p>	<p>Defective ACT/ATH link</p>	<p>⚠ Wait for the complete pump stop before any interventions on the cable !</p> <ul style="list-style-type: none"> ■ Check the connector locking. ■ Change the cable.
	<p>NO</p>	<p>M Problem on the monitoring board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i>
	<p>NO</p>	<p>M Problem on interface board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i>
	<p>NO</p>	<p>M Problem on controller power supply</p>	<ul style="list-style-type: none"> ■ Change the controller, reset the customer parameters.

D32 : NO CABLE INSIDE

INCIDENT	CAUSE	REMEDY
<p>No magnetic levitation</p>	<p>M</p> <p>Internal connections on magnetic bearing boards disconnected</p>	<p>■ Check the electrical connections inside of the controller: magnetic bearing boards connectors properly plugged.</p>
	<p>NO</p> <p>M</p> <p>Problem on flat wires</p>	<p>■ Change the flat wires connected on the magnetic bearing boards, one after the other.</p>


D38 (37) : TEMP SENSOR-2

INCIDENT	CAUSE	REMEDY
<p>PUMP-TEMP2=0, Wrong information from T2 sensor</p>	<p>Defective thermostatic control link</p>	<p>⚠ Wait for the complete pump stop before any interventions on the cable !</p> <ul style="list-style-type: none"> ■ Check the connector locking. ■ Change the cable.
	<p>NO</p>	
	<p>M Defective T2 sensor</p>	<ul style="list-style-type: none"> ■ Change the sensor, <i>see E 160.</i>
	<p>NO</p>	
	<p>M Problem on the monitoring board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i>
	<p>NO</p>	
	<p>M Problem on interface board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i>

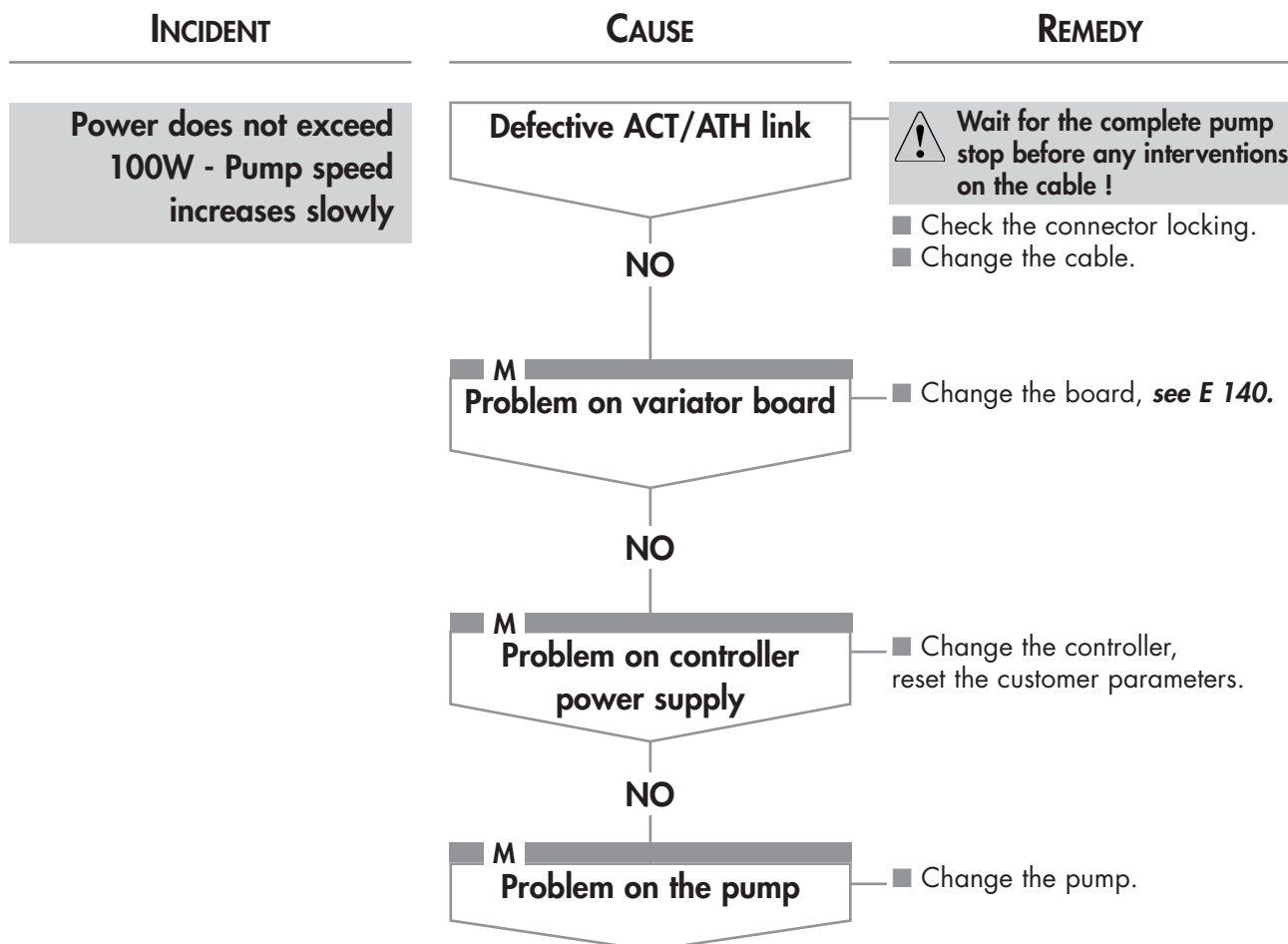
Default not indicated by the controller

The pump starts only in standby mode	page 2
Power does not exceed 100W	page 3
Over 9000 rpm the pump starts to vibrate	page 4
The pump does not reach the expected speed .	page 5
The thermostatic temperature is not reached . . .	page 7
Control keys are disactivated	page 8
Continuous controller initialization	page 9
Partial and repetitive controller initialization . . .	page 10

Default not indicated by the controller

INCIDENT	CAUSE	REMEDY
<p>The pump starts only in Standby mode</p>	<p>Electronic problem</p>	<p> Wait the pump isn't running.</p> <ul style="list-style-type: none"> ■ Pump stopped, switch OFF the controller and restart.
	<p>NO</p>	
	<p>Remote connector wiring</p>	<ul style="list-style-type: none"> ■ Check that the contact 4 -12 of the Remote plug is open.
	<p>NO</p>	
	<p>M Memory problem</p>	<ul style="list-style-type: none"> ■ Reinitialize the controller: in the menu «PARAMETER», select «RESET» then «CONVERTER»: code «A» 65530, the ENTER, code «B» 65520, then ENTER. Valid with the «PREVIOUS» key. Then reset the customer parameters.
<p>NO</p>		
<p>M Problem on the monitoring board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i> 	
<p>NO</p>		
<p>M Problem on interface board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i> 	

Default not indicated by the controller

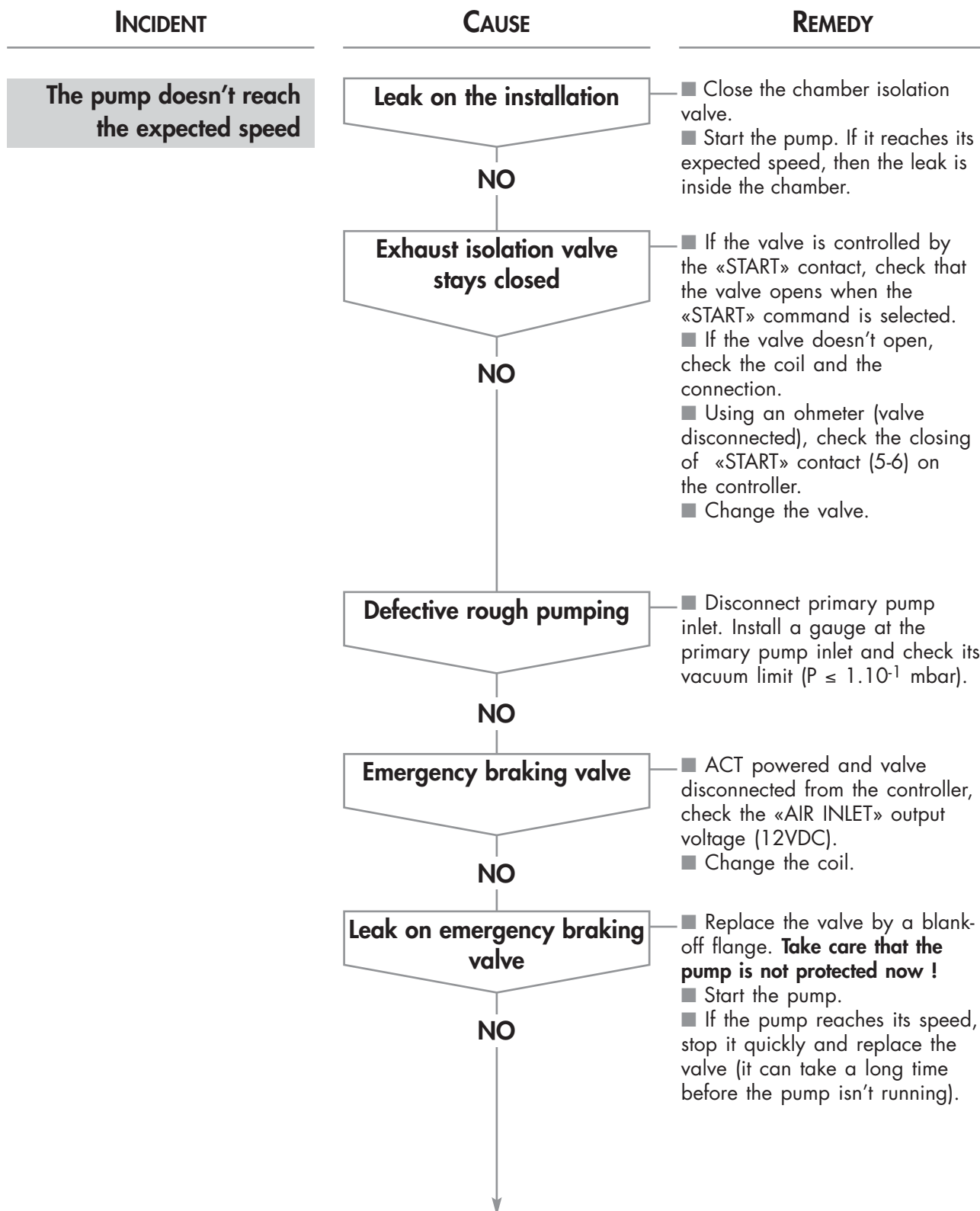


Default not indicated by the controller

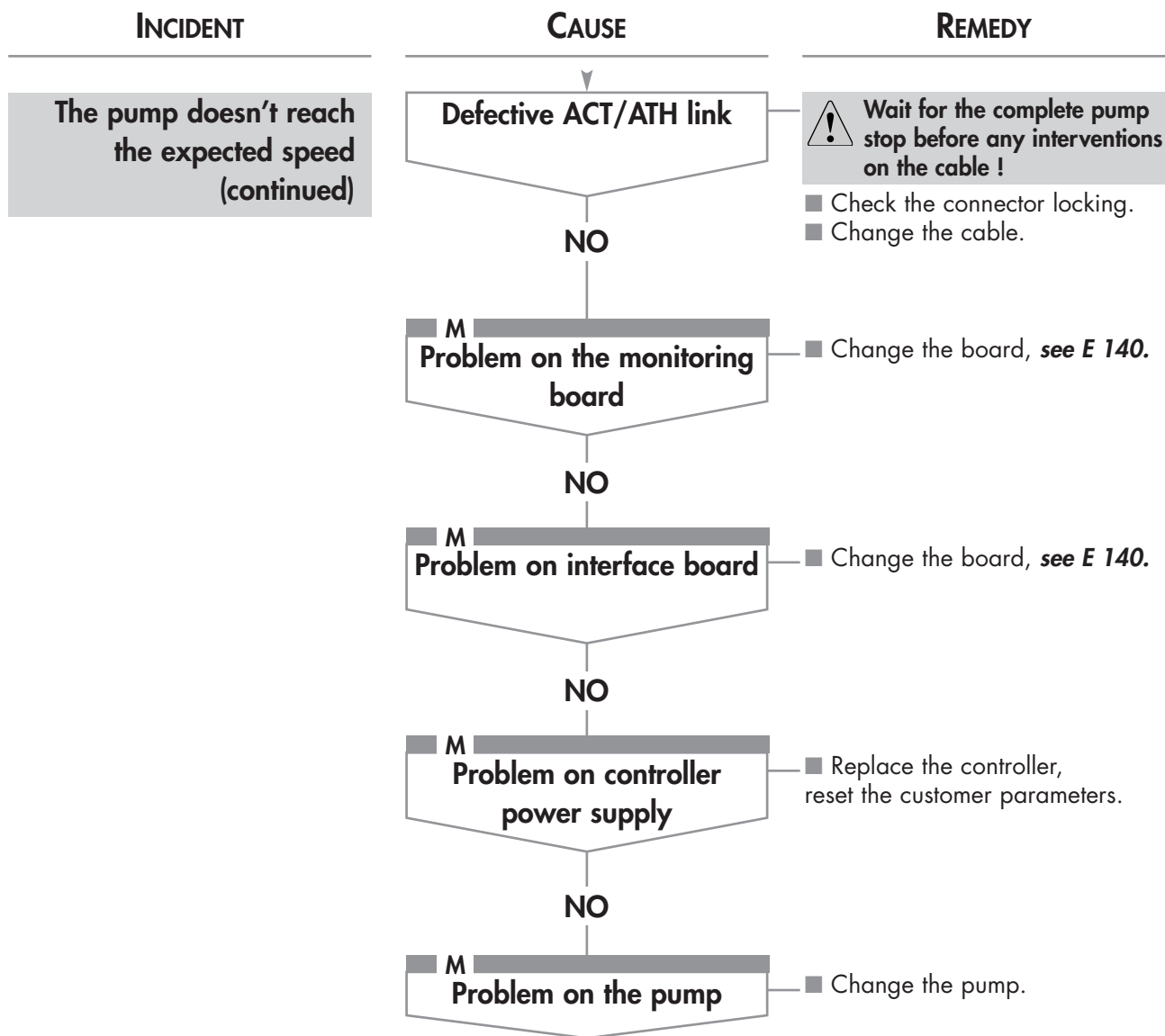
INCIDENT	CAUSE	REMEDY	
<p>Over 9000 tr/mn, pump vibrations</p>	<p>Incorrect pump fixation</p>	<ul style="list-style-type: none"> ■ Check the pump fixation rigidity regarding to the chamber, inlet bellow prohibited. 	
	<p>NO</p>	<p>Vibrations on the frame</p>	<ul style="list-style-type: none"> ■ Check if there are no vibrations generated by the frame, for exemple, equipement installed on a floating stone. ■ Try to restart the pump: Local mode: pressing on «start». Remote mode: open and close the «start» contact.
	<p>NO</p>	<p>Defective ACT/ATH link</p>	<p>⚠ Wait for the complete pump stop before any interventions on the cable !</p> <ul style="list-style-type: none"> ■ Check the connector locking. ■ Change the cable.
	<p>NO</p>	<p>Connectors problems Pump, cable, controller</p>	<ul style="list-style-type: none"> ■ Check that no pin is twisted or broken. ■ Change the cable.
	<p>NO</p>	<p>M Problem on magnetic bearing boards</p>	<ul style="list-style-type: none"> ■ Change the both magnetic bearing boards, <i>see E 140</i>.
	<p>NO</p>	<p>M Problem on controller power supply</p>	<ul style="list-style-type: none"> ■ Replace the controller, reset the customer parameters.
	<p>NO</p>	<p>M Problem on the pump</p>	<ul style="list-style-type: none"> ■ Change the pump.

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Default not indicated by the controller



Default not indicated by the controller



Default not indicated by the controller

INCIDENT	CAUSE	REMEDY
<p>The thermostatic temperature is not reached</p>	<p>Leak on the water valve</p>	<ul style="list-style-type: none"> ■ Close the water line. If the temperature increases, there is a leak on the water line. ■ Change the valve.
	NO	
	<p>Heating band not correctly powered</p>	<ul style="list-style-type: none"> ■ Using an ohmeter, check the closing of «THERMOSTAT» contact on the controller (5-6 : Dry Contact). ■ Check the mains presence on power supply cable. ■ On thermostatic control connector, check the power supply of the heating band: <ul style="list-style-type: none"> - between pins C - G: 115 V, Band resistance 100 Ω - between pins B - H: 230 V, Band resistance 400 Ω. ■ Change the thermostatic control cable.
	NO	
	<p>M Defective T2 sensor</p>	<ul style="list-style-type: none"> ■ Change the sensor, <i>see E 160.</i>
NO		
<p>M Problem on the monitoring board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i> 	
NO		
<p>M Problem on interface board</p>	<ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i> 	

Default not indicated by the controller

INCIDENT	CAUSE	REMEDY
Control keys disactivated	«REMOTE» contact closed	<ul style="list-style-type: none"> ■ Using an ohmeter, check that the «REMOTE» contact (3-11) of Remote Control connector is open (See B 100). ■ Check that the control keys on front panel are activated by unplugging the «REMOTE CONTROL» connector.
	NO	
	<div style="border: 1px solid black; padding: 2px;"> M Problem on the monitoring board </div>	<ul style="list-style-type: none"> ■ Change the board, see E 140.
	NO	
	<div style="border: 1px solid black; padding: 2px;"> M Problem on front panel </div>	<ul style="list-style-type: none"> ■ Change the front panel, see E 140.
NO		
<div style="border: 1px solid black; padding: 2px;"> M Problem on interface board </div>	<ul style="list-style-type: none"> ■ Change the board, see E 140. 	

Default not indicated by the controller

INCIDENT	CAUSE	REMEDY	
<p>Continuous controller initialization</p>	<p>Problem of magnetic levitation</p>	<ul style="list-style-type: none"> ■ Remove the blocking plug. ■ Check manually the free rotation of the rotor and the axial clearance. 	
	<p>NO</p>	<p>Defective ACT/ATH link</p>	<p>⚠ Wait for the complete pump stop before any interventions on the cable !</p> <ul style="list-style-type: none"> ■ Check the connector locking. ■ Change the cable.
	<p>NO</p>	<p>M Problem on magnetic bearing boards</p>	<ul style="list-style-type: none"> ■ Change the both boards, see E 140.
	<p>NO</p>	<p>M Problem on the monitoring board</p>	<ul style="list-style-type: none"> ■ Change the board, see E 140.
	<p>NO</p>	<p>M Problem on interface board</p>	<ul style="list-style-type: none"> ■ Change the board, see E 140.
	<p>NO</p>	<p>M Problem on controller power supply</p>	<ul style="list-style-type: none"> ■ Replace the controller, reset the customer parameters.
	<p>NO</p>	<p>M Problem on the pump</p>	<ul style="list-style-type: none"> ■ Change the pump.

Default not indicated by the controller

INCIDENT	CAUSE	REMEDY
<p>Partial and repetitive initialization</p> <p>(Presence of display back-lighting, magnetic levitation for just a while, complete stop and back-lighting again)</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;">Internal controller connection problem</p> </div> <p style="text-align: center;">NO</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;">Problem on the monitoring board</p> </div> <p style="text-align: center;">NO</p> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Problem on controller power supply</p> </div>	<p>M</p> <ul style="list-style-type: none"> ■ Check the connection of all the flat cables on the boards. <p>M</p> <ul style="list-style-type: none"> ■ Change the board, <i>see E 140.</i> <p>M</p> <ul style="list-style-type: none"> ■ Replace the controller, reset the customer parameters.

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Maintenance instructions

■ Maintenance-related safety recommendations. . . .	■ E 10
■ Presentation of the various maintenance operations on the magnetic bearings pump.	■ E 20
■ Disassembly of the pumping cell ATH 400M/MT	■ E 30
■ Disassembly of the pumping cell ATH 1000M/MT	■ E 31
■ Disassembly of the cooler.	■ E 40
■ Disassembly of the ball bearings.	■ E 50
■ Disassembly/Reassembly of the pump frame ATH 400M/MT	■ E 60
■ Disassembly/Reassembly of the pump frame ATH 1000M/MT	■ E 61
■ Reassembly of the ball bearings	■ E 70
■ Reassembly of the cooler	■ E 80

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Note: In the present chapter, the letter **M** located at the top of the page indicates that the corresponding section does not exist in the User's Manual.

Technical Reference Manual ATH 400M / ATH 1000M

Maintenance instructions

■ Reassembly of the pumping cell ATH 400M/MT.	■ E 90
■ Reassembly of the pumping cell ATH 1000M/MT.	■ E 91
■ Functionnal test	■ E 100
■ Cleaning parts	■ E 110
■ Use of the test software	■ E 120
■ Maintenance counter resetting	■ E 130
■ Internal components access of ACT 1000M/600M controllers	■ E 140
■ Heating band maintenance	■ E 150

Note: In the present chapter, the letter **M** located at the top of the page indicates that the corresponding section does not exist in the User's Manual.

Maintenance-related safety recommendations

This chapter describes the main preventive maintenance operations.



Standard precautions before any maintenance operations: switch off the machine by setting the main switch to "0" and disconnect the mains lead.



CAUTION: before any operations, check the pumping conditions of the system: potential toxicity, corrosion, radioactivity of the pumped gases.



The products are free of leaks when shipped from the factory, for normal operating conditions. The user is responsible for maintaining the level of tightness, especially when pumping dangerous gases.



Contact with the rotor of the turbomolecular pump can lead to cuts: it is highly recommended that protective gloves should be worn.

Depending on the circumstances, we recommend:

- to purge the installation with dry nitrogen before any intervention.
- to wear gloves, goggles and breathing masks if necessary.
- to ventilate the room well and disassemble the equipment under a fume hood.

After a complete maintenance operation, it is recommended to perform an helium leaktightness test.

Similarly, follow all the safety instructions concerning start-up.

Presentation of the various maintenance operations on the magnetic bearings pump

The full maintenance procedure for the magnetic bearings pump has been split into several key stages. Details of these stages can be found in the specific sheets listed below.

Depending on the type of maintenance, see the corresponding sheets.

Disassembly of the pumping cell on the ATH 400M/MT	E 30
Disassembly of the pumping cell on the ATH 1000M/MT	E 31
Disassembly of the cooler	E 40
Disassembly of the ball bearings	E 50
Disassembly / reassembly of the pump frame	E 60
Reassembly of the ball bearings	E 70
Reassembly of the cooler	E 80
Reassembly of the pumping cell on ATH 400M/MT	E 90
Reassembly of the pumping cell on ATH 1000M/MT	E 91

Presentation of the various maintenance operations on the magnetic bearings pump

Icons used



1.5 mm Allen key



2 mm Hexagonal key wrench



3 mm Hexagonal key wrench



4 mm Hexagonal key wrench



10 mm Hexagonal key wrench



27 mm offset ring wrench



20 mm stud



Screwdriver for countersink-head screw



Special tool (included in the tool kit)

Disassembly of the pumping cell ATH 400M/MT

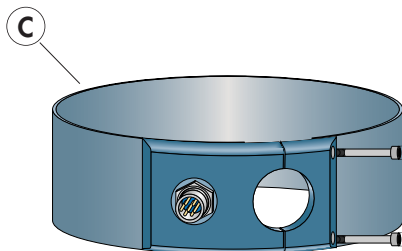


Before starting any operations, the user must read the safety recommendations and the maintenance precautions (see E 10).

Tools needed

- Tool kit (see F 11)
- Hot air gun

Removal of the heating cover



Position the pump vertically, with the inlet upwards

Undo the attachment nut from the heating belt connector, if the pump has one (MT version).
Undo the attachment screws from the heating cover, and pass the connector inside.
Remove the cover (C).

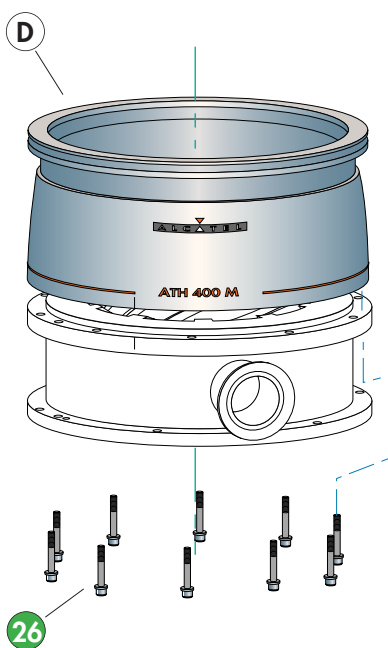


Disassembly of the pumping cell ATH 400M/MT

Disassembly of the inlet housing and the pumping cell

3

Remove the attachment screws (26), mark the inlet housing and the Holweck stator, then free the housing.
Gently extract the housing (D) upwards, taking care not to damage the pumping cell.



Remove the spacers and the half-stators (25).
Not all the spacers have the same thickness, and the fins on the stators are not inclined to the same extent on the various stages.

To avoid mixing them, we recommend rebuilding the stator by successively stacking the spacers and half-stators in the order of disassembly, which will allow the various parts to be replaced in the correct order when reassembling.



Remove the first spacer, remove the first two half-stators, remove the second spacer, etc.



Carefully stack the spacers and half-stators in the order encountered during disassembly.



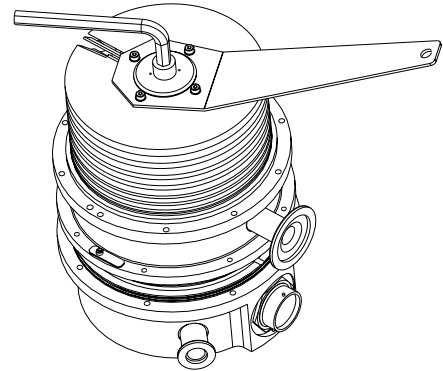
It is essential not to mix components from different pumping cells

Disassembly of the pumping cell ATH 400M/MT

Disassembly of the rotor



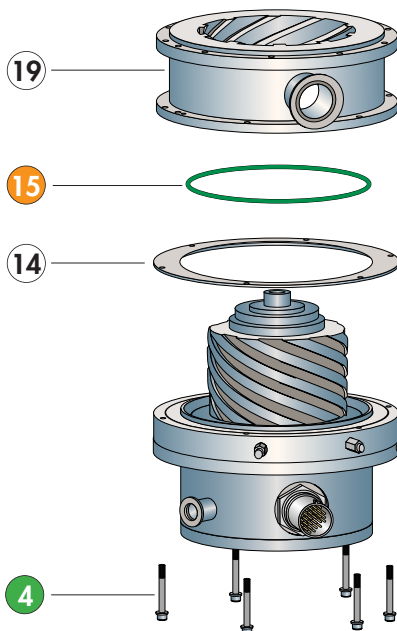
Fix the holding wrench on the rotor. Remove the screw and the clamping ring. Heat the rotor with a hot air gun to a temperature of about 50°C. Extract the rotor upwards. Remove the inlet housing O-ring.



Disassembly of the Holweck stator



Remove the attachment screws (4) from the Holweck stator (19) then pull it upwards. Also remove the thermic spacer ring (14) and its O-ring (15).



Cleaning of parts

E 110

Reassembly of the pumping cell

E 90

Disassembly of the pumping cell ATH 1000M/MT



Before starting any operations, the user must read the safety recommendations and the maintenance precautions (see E 10).

Tools needed

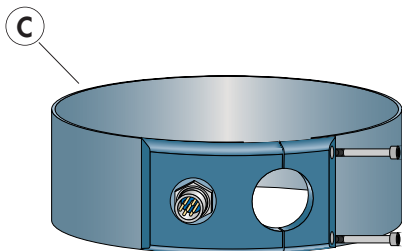
- Tool kit (*see F 11*)
- Hydraulic pump kit (*see F 11*)
- Hot air gun

Removal of the heating cover



Position the pump vertically, with the inlet upwards

Undo the attachment nut from the heating belt connector, if the pump has one (MT version). Undo the attachment screws from the heating cover, and pass the connector inside. Remove the cover (C).

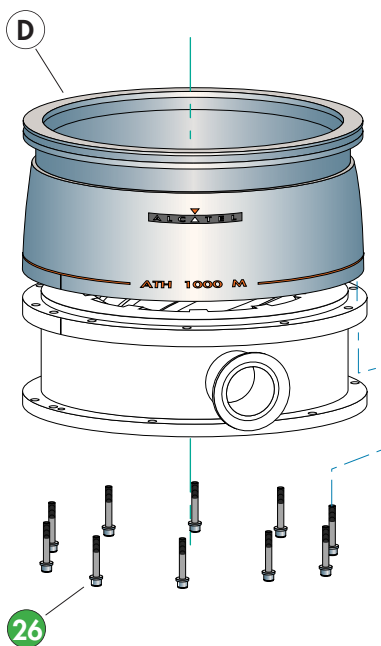


Disassembly of the pumping cell ATH 1000M/MT

Disassembly of the inlet housing and the pumping cell

4

Remove the attachment screws (26), mark the inlet housing and the Holweck stator, then free the housing. Gently extract the housing (D) upwards, taking care not to damage the pumping cell.



Remove the spacers and the half-stators (25). Not all the spacers have the same thickness, and the fins on the stators are not inclined to the same extent on the various stages. To avoid mixing them, we recommend rebuilding the stator by successively stacking the spacers and half-stators in the order of disassembly, which will allow the various parts to be replaced in the correct order when reassembling.



Remove the first spacer, remove the first two half-stators, remove the second spacer, etc.



Carefully stack the spacers and half-stators in the order encountered during disassembly.



It is essential not to mix components from different pumping cells.

Disassembly of the pumping cell ATH 1000M/MT

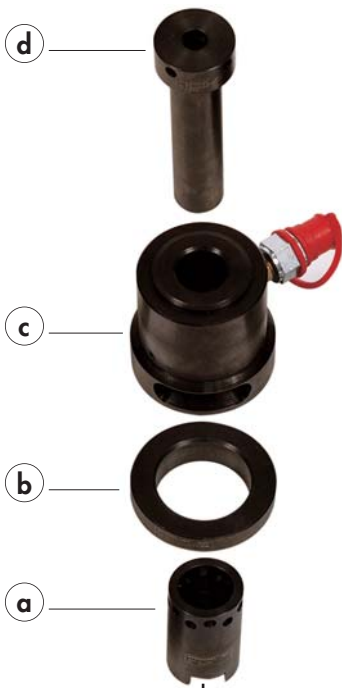
Disassembly of the rotor

S

Fit the tool (a) at the base of the rotor cell. Next place the equipped hydraulic jack (c) on the strut (b). Bring the brace (d) into contact with the stud (23) and tighten it by hand until it comes into contact with the shaft.



! Loosen the brace (d) by a quarter of a turn

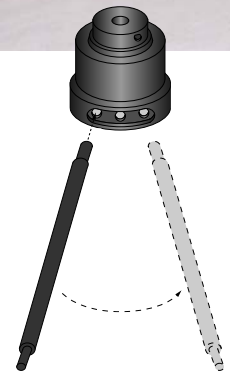


Connect the hose from the hydraulic pump to the hydraulic jack (c) and bring the pump to a pressure of 41 MPa.



Use the spindle (e) to undo the stud counterclockwise by moving the spindle to the end of its travel twice.

Release the pressure and push back the jack piston by hand. Remove all the tooling, then the nut (24) and the stud (23).



Heat uniformly the rotor with a hot air gun to a temperature of about 50°C. Extract the rotor upwards using the rotor wrench or gloves.

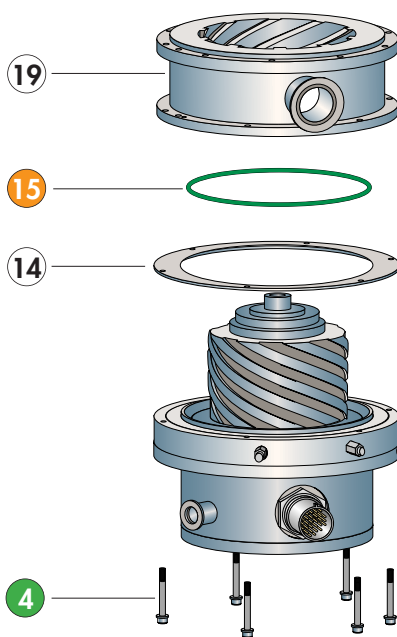
Remove the housing O-ring (20).

Disassembly of the pumping cell ATH 1000M/MT

Disassembly of the Holweck stator



Remove the attachment screws (4) from the Holweck stator (19) then pull it upwards
Also remove the thermic spacer ring (14) and its O-ring (15).



Cleaning of parts

E 110

Reassembly of the pumping cell

E 91

Disassembly of the cooler



Before starting any operations, the user must read the safety recommendations and the maintenance precautions (see E 10).

Before this operation, it is necessary to

➔ disassemble the pumping cell (see E 30 or E 31).

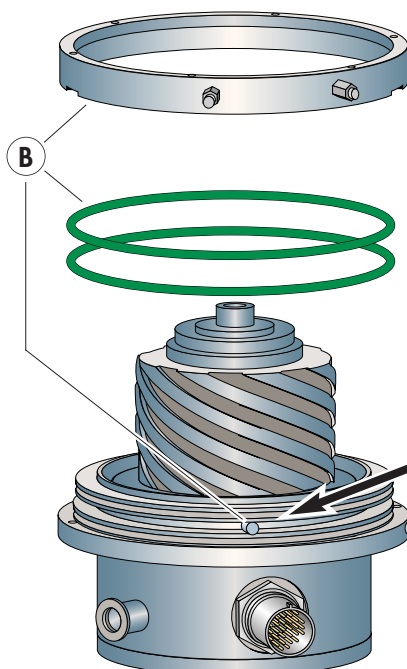
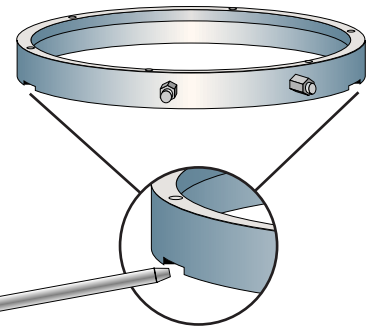
Tools needed

- Tool kit (see F 11)
- 2 flat screwdrivers

Disassembly of the cooler



Place the two screwdrivers in the slots provided and remove the cooling ring.



Remove the two O-rings

Remove the pin

Cleaning the parts **E 110**

Reassembly of the cooler **E 80**

If necessary, disassembly of the bearings. **E 50**

Disassembly of the ball bearings



Before starting any operations, the user must read the safety recommendations and the maintenance precautions (see E 10).

Before this operation, it is necessary to

➔ disassemble the pumping cell (see E 30 or E 31).

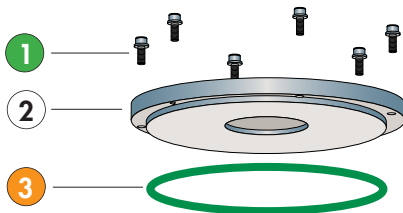
Tools needed

- Tool kit (See F 11)

Disassembly of the rear end cap



(ATH 400M)



Fit the shaft squeezing tool on the shaft.

Place the pump resting on the tool, with the inlet downwards.



Remove the screws (1), the rear end cap (2) and the O-ring (3).

Disassemble the connectors

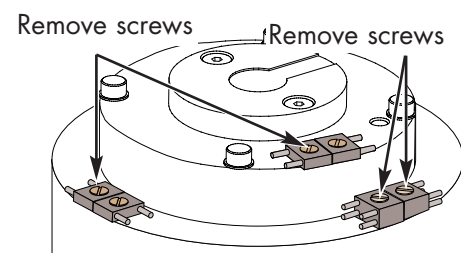


(old pump model)



Mark the three connectors to avoid inverting them when reassembling.

Carefully separate the connectors after removing the attachment screws (one screw on the two pin connectors and 2 screws on the 4 pin connector).

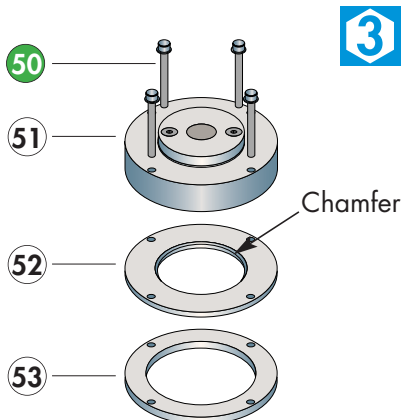


Disassembly of the ball bearings

Disassembly of the axial inductor



Mark off the orientation of these 3 parts and the way of mounting of the spacers.



Now disassemble the axial inductor (51) and the two spacers (52/53).



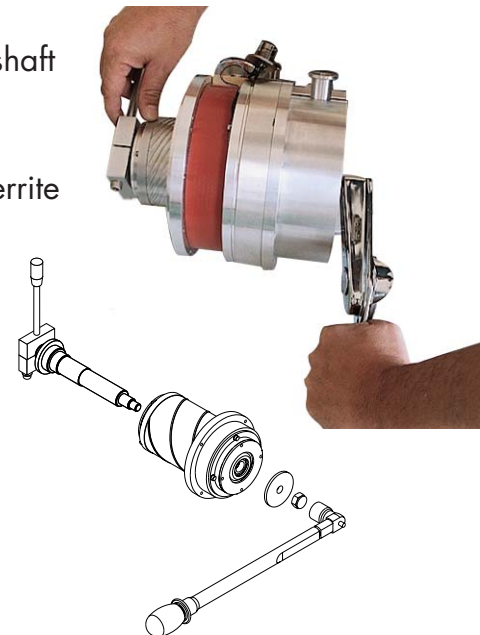
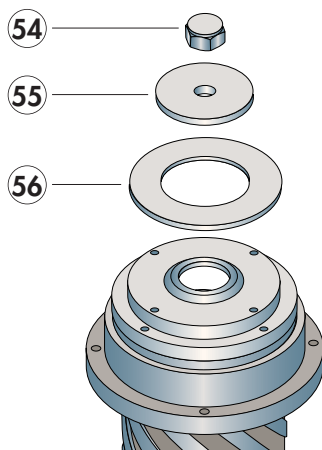
Disassembly of the shaft



Tilt the pump so that the shaft is horizontal.

Loosen and remove the ferrite nut (54).

Remove the disk flywheel (55) and the spacer (56).



Withdraw the shaft towards the inlet side, using the locking wrench to guide the shaft through the various magnetic bearings.



Disassembly of the ball bearings

Disassembly of bearings

Exhaust side 

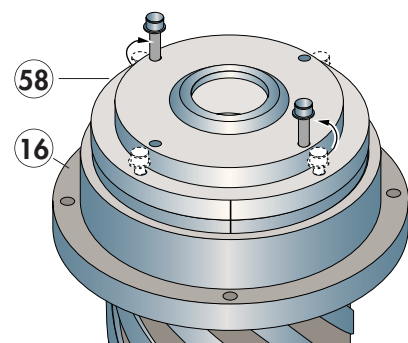
Remove the bearing housing:



Use a marker to mark the angular position of the bearing housing with respect to the spindle (16).

Remove the attachment screws.

Free the bearing housing (58) and extract it, using two Chc M 3 x 25 screws placed in the axial inductor attachment holes.

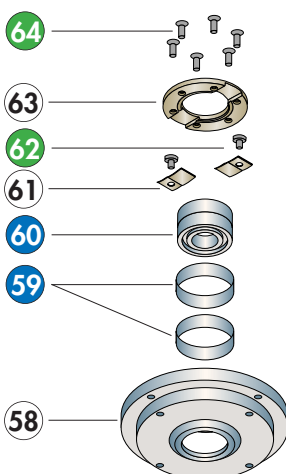


Extract the ball bearings from the bearing housing:

Disassemble the retaining ring (63) and the two preload spring blades (61).

Turn over the bearing housing and press on the ball bearings (60) to free them.

Remove the Borelly blades (59).



Disassembly of the ball bearings

Inlet side



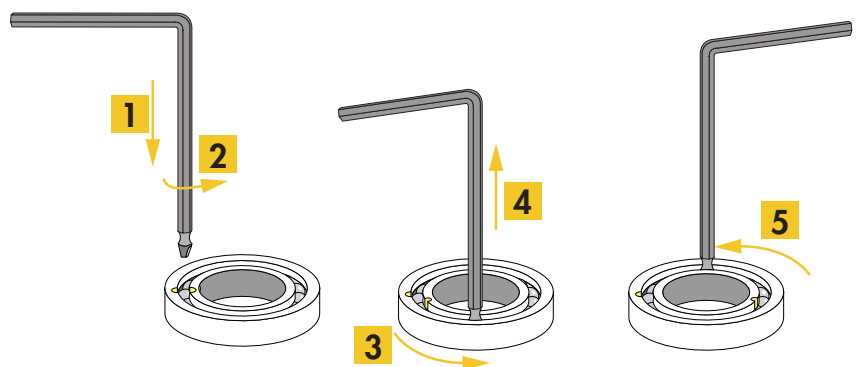
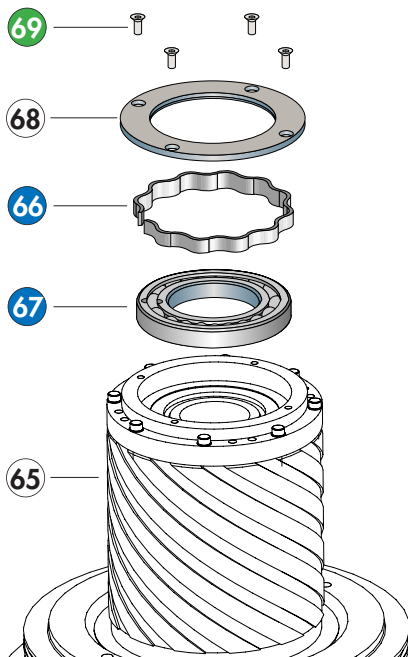
Turn the pump over, with the inlet upwards.

Remove the screws (69) and the spacer (68).

Insert the pointed end of the extractor between two balls, using the slot in the outer ball race **1**.

Turn the extractor by a quarter of a turn to press against both ball races **2**.

Turn the inner ball race by one quarter of a turn **3** and carefully pull the bearing upwards **4**.



Turn the inner ball race by half a turn **5** and carefully pull upwards. Repeat the operation until the bearing and the Borelly blade (66) have been extracted.

To remove the tool from the bearing, use the slot in the outer ball race.

Followed by cleaning operations

E 110

Followed by reassembly of bearings

E 70

Followed by disassembly / reassembly of the bearing support spindle.

E 60 or E 61

Disassembly / reassembly of the pump frame ATH 400M/MT



Before starting any operations, the user must read the safety recommendations and the maintenance precautions (see E 10).

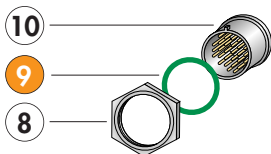
Before this operation, it is necessary to

- ➔ disassemble the pumping cell (see E 30 or E 31)
- ➔ disassemble the ball bearings (see E 50).

Tools needed

- Tool kit (see F 11)

Disassembly of the pump frame

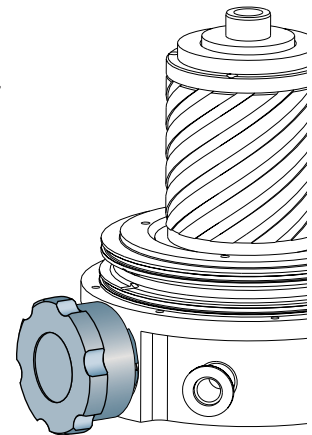


The pump is positioned with the inlet upwards.

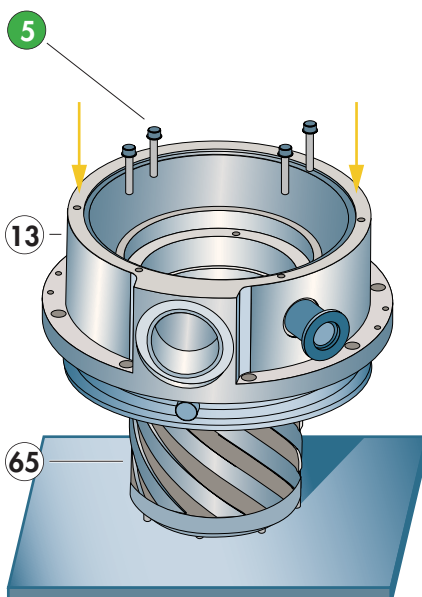
Using the connector wrench, loosen and remove the nut (8) from the connector.

Turn over the pump, resting it on the magnetic bearings (65).

Carefully push the connector (10) into the pump **taking care not to damage the wires**.



Remove the connector O-ring (9).



Unscrew the four attachment screws (5) from the pump frame (13), holding it to avoid it coming loose unexpectedly.

Carefully slide the bearing support (13) downwards **taking care not to catch the wires**.

Followed by cleaning operations

E 110

Disassembly / reassembly of the pump frame ATH 400M/MT

Reassembly of the pump frame

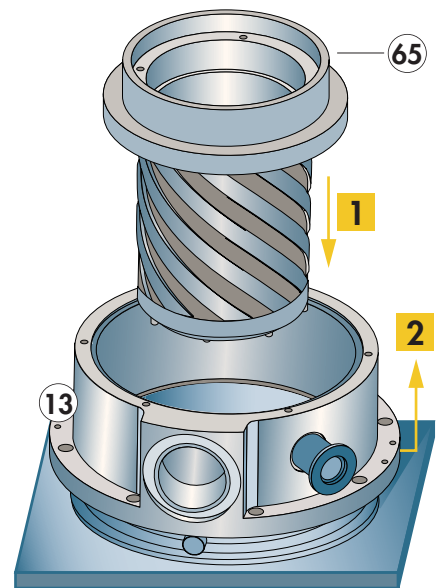


Place the pump frame (13)
on the table.

Insert the magnetic bearings
(65), with the connector
upwards **1**.

Carefully lift the bearing
support **2** **taking care not
to catch the wires.**

Orient the pump frame to
position the connector
opposite the hole and align
the four attachment holes.



Hold the pump frame against the magnetic bearings by
fitting one attachment screw.

Fit the other three screws and tighten them.

Insert the connector and O-ring in its housing and tighten
the nut using the connector wrench.

Followed by reassembly of ball bearings

E 70

Reassembly of the cooler
(if it was disassembled)

E 80

Followed by reassembly of the pumping cell

E 90 or E 91

Disassembly / reassembly of the pump frame ATH 1000M/MT



Before starting any operations, the user must read the safety recommendations and the maintenance precautions (see E 10).

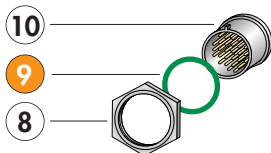
Before this operation, it is necessary to

- disassemble the pumping cell (see E 30 or E 31)
- disassemble the ball bearings (see E 50).

Tools needed

- Tool kit (see F 11)

Disassembly of the pump frame

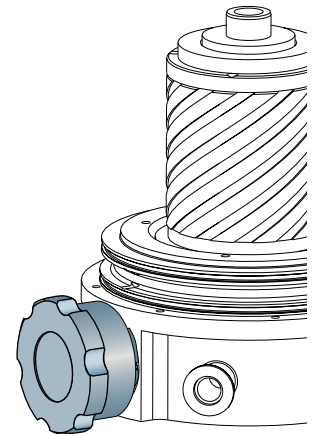


The pump is positioned with the inlet upwards.

Using the connector wrench, loosen and remove the nut (8) from the connector.

Turn over the pump, resting it on the magnetic bearings (65).

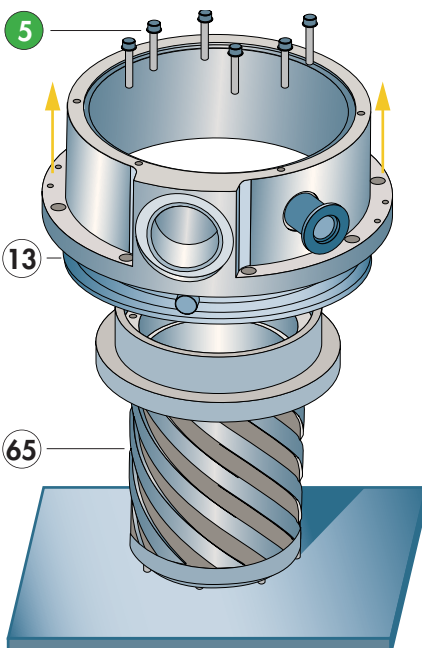
Carefully push the connector (10) into the pump **taking care not to damage the wires**.



Remove the connector O-ring (9).

Unscrew the six attachment screws (5).

Carefully slide the pump frame (13) downwards **taking care not to catch the wires**.



Followed by cleaning operations

E 110

Disassembly / reassembly of the pump frame ATH 1000M/MT

Reassembly of the pump frame



Fit the magnetic bearings (65), with the connector upwards, resting on the workbench.

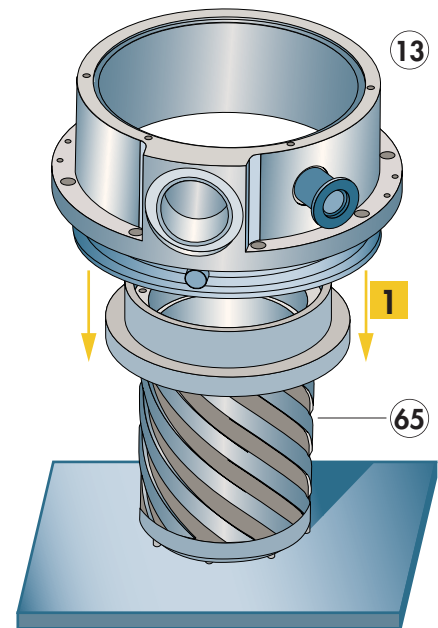
Group the wires and attach them to the magnetic bearings (e.g. with adhesive tape) to avoid them being damaged by the passage of the pump frame.

Carefully lower the bearing support **1** onto the magnetic bearings **taking care not to catch the wires**

and align the attachment holes (the angular position is imposed by the attachment holes).

Fit the six screws (5) and assemble the parts

Insert the connector and O-ring in its housing and tighten the nut using the connector wrench.



Followed by reassembly of ball bearings

E 70

Reassembly of the cooler
(if it was disassembled)

E 80

Followed by reassembly of the pumping cell

E 90 or E 91

Reassembly of the ball bearings



Before starting any operations, the user must read the safety recommendations and the maintenance precautions (see E 10).

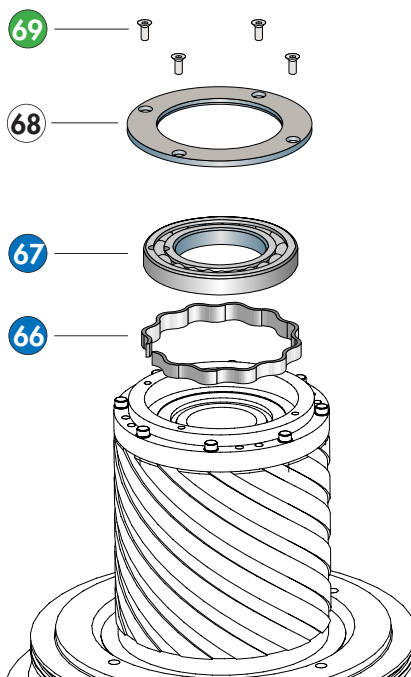
Before this operation, it is necessary to

➔ clean the parts (see E 110).

Tools needed

- Tool kit (see F 11)
- Seal kit (see F 11)
- Bearing kit (see F 11)
- Lubrication syringe (see F 20)

Reassembly of the bearing on the pumping cell side



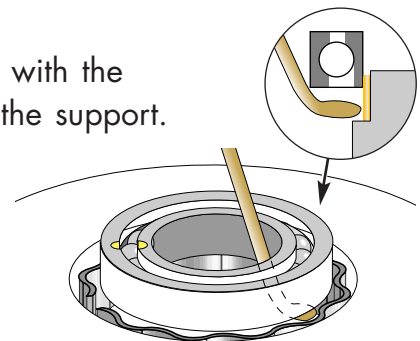
Turn up the pump frame fitted with the magnetic bearings resting on the support.

Place the Borelly blade (66) in the slot in the bearing. Orient the ball bearing (67) with the notch facing upwards.

Use a seal extractor to help bring the blade flush against the bore.

Slide the bearing into place (without forcing to avoid damaging the Borelly blade).

Reassemble the spacer (68) with the four screws (69).



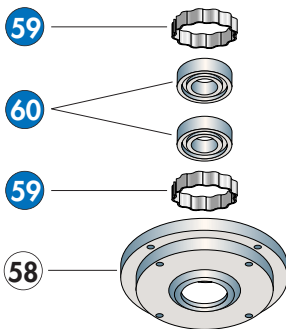
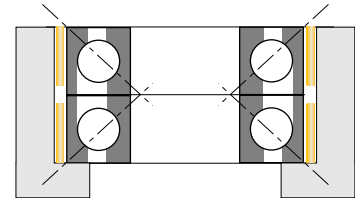
Pay attention to the direction of the ring (note the bevelled holes for the screws).

Reassembly of the ball bearings

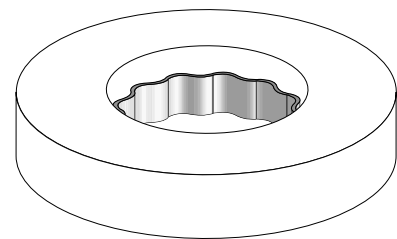
Exhaust side

S

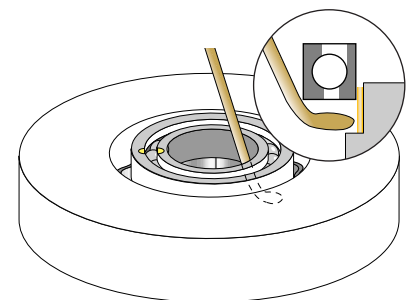
! Pay attention to the direction in which the two oblique contact bearings are assembled: the indications on the diagram opposite must be followed.



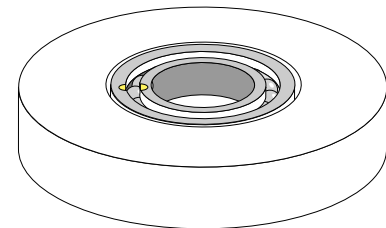
Place a Borelly blade (59) in the bore of the bearing housing (58).



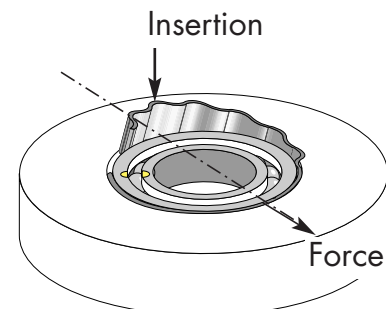
Insert a ball bearing (60). Use the seal extractor to help place the blade flush against the bore. Slide the ball bearing into place.



Insert the second bearing (60) before the second Borelly blade until it touches the first ball bearing.



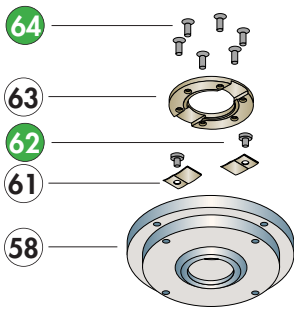
Slide the second Borelly blade (59) between the outer ball race and the bore, pressing firmly. Work by turning, taking care not to deform the blade.



To simplify assembly, exert a force on the ball bearing opposite the insertion point of the Borelly blade. Move the force depending on the point where the blade is inserted.

Reassembly of the ball bearings

Reassembly of the bearing housing



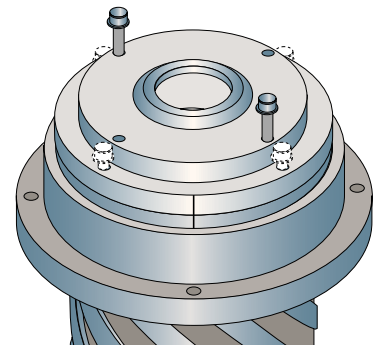
Refit the preload springs (61) and the spacer (63). Check that the ball race turns freely.

Turn up the pump resting on the magnetic bearings.



Reassemble the bearing housing (58) on the pump body, holding it using two Chc screws, as during disassembly.

Respect the marking point. Orient and fix the bearing housing with the four screws.



Pay attention to the direction of the bearing housing (it contains the magnetic inductor)
Take care not to catch the connection wires.

Reassembly of the ball bearings

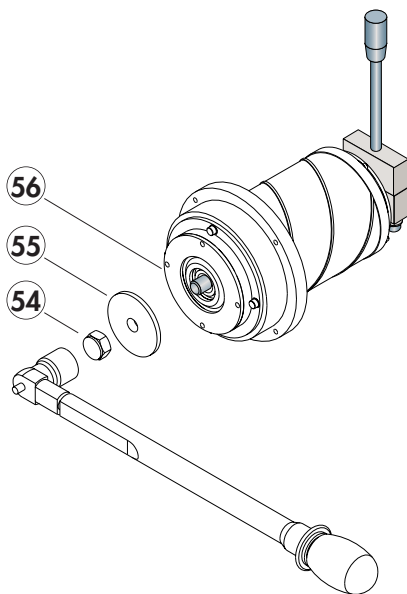
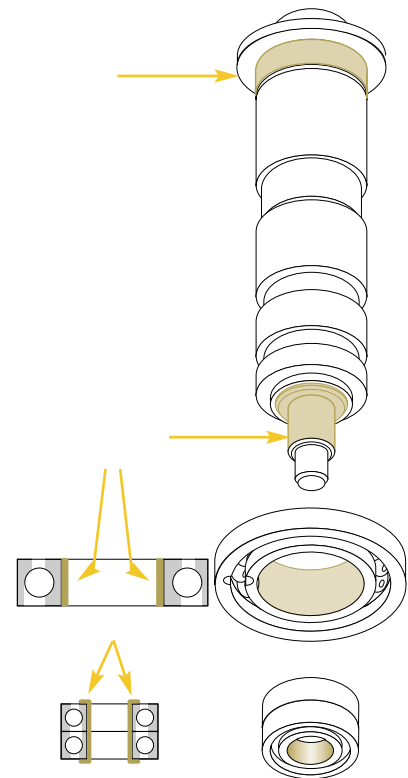
Reassembly of the shaft



Check that the shaft is clean (*see E 110*).

Check that the bearing surfaces are clean and unaltered (uniform, smooth nitrided surface).

Apply a thin film of grease (taken from the lubrication syringe) on the parts in contact with the bearings and on the inner ball races.



Fit the locking wrench to handle the shaft.

Place the pump with its axis vertical, resting on the bearing support, and refit the shaft.



Take care not to damage the sensor and inductor surfaces.

Tilt the pump so that the axis is horizontal.

At the pump exhaust, fit the spacer (56) (take care to place the chamfer on magnetic bearing side) and reassemble the disk flywheel (55) (bronze shoulder facing bearing). Fit the ferrite nut (54) and tighten with a torque wrench (**Clamping torque: 18 N.m**).

Reassembly of the ball bearings

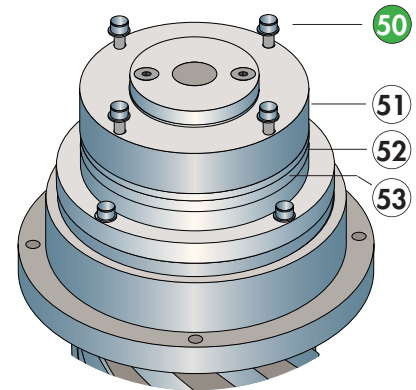
Reassembly of the axial inductor



Place the pump in the vertical position, resting on the locking wrench.

Refit the spacers (52) and (53) and the axial inductor (51)

Fit the attachment screws (50) without tightening them.



Center the spacers:


Fit the centering tool, paying particular attention **to the wires and connectors**.

Align the screw holes with the attachment screws. Turn the knurled knob (a) to ensure that the spacers, the disk flywheel and the axial inductor are concentric.

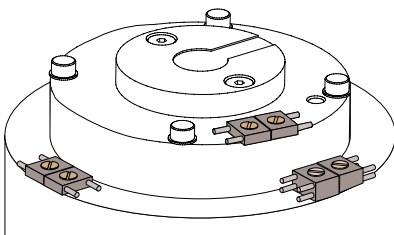
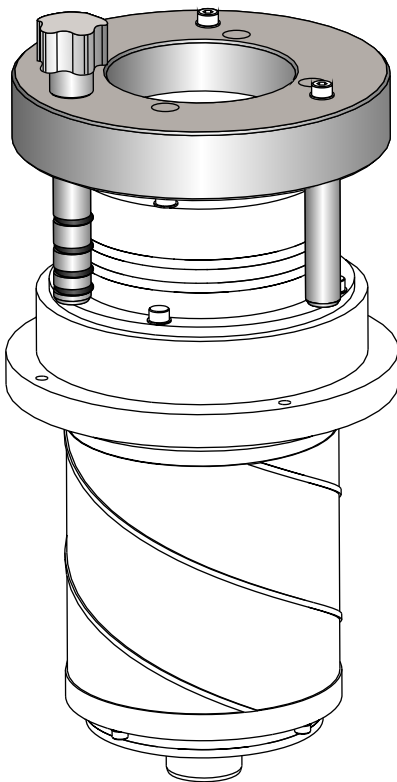


Tighten the attachment screws through the holes provided in the centering tool.

Screw the knurled knob (clockwise) until the seals are free and withdraw the centering tool.

 **The screws used for the four points connectors are longer than those for the two points. Screw them carefully because the connectors are plastic made.**

Connect and attach the electrical connectors, in accordance with the marks made during disassembly (**see E 50**). Fit a new O-ring (3) to the end cap. Refit and attach the end cap (2). Erase all mark points on the axial inductor, bearing housing and on the spacers. Remove the locking wrench.



Reassembly of the ball bearings

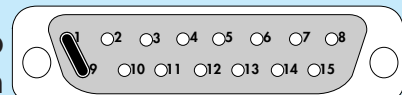
Check that the bearing support is perpendicular with the spindle

S (mass)



This operation requires the presence of a plug on the "Remote control" connector to prevent the pump starting up during testing.

This plug should be made up by the technician



Closing of contact 1-9

Fit the mass and attach it with the screw taken from the tool kit (the mass simulates the weight of the rotor cell).

Connect the ACT to the pump.

Press the main switch to enable magnetic levitation and place the plug on the «Remote Control» connector.



For the safety of the person, from this moment onwards THE PUMP MUST NOT BE STARTED UNDER ANY CIRCUMSTANCES.

The technician must take all precautions to ensure this.

Install the comparator with its magnetic support centered on the mass. Turn the mass **slowly**.

The variation should be < 0.10 mm.

If there is a larger difference, check that the bearing support and spindle are correctly assembled, and that the fins and contact surfaces are in good condition.

Correct the fault.

Repeat the measurement.

If the fault persists, contact the expert service center or Alcatel HVT Annecy.

Followed by reassembly of the cooler (if it was disassembled)

E 80

Followed by reassembly of the pumping cell

E 90 or E 91

Followed by functional tests

E 100

Reassembly of the cooler



Before starting any operations, the user must read the safety recommendations and the maintenance precautions (see E 10).

Before this operation, it is necessary to

➔ clean the parts (see E 110).

Tools needed

- Seal kit (see F 11)

Reassembly of the cooler

Fit the two O-rings after greasing them with vacuum grease.

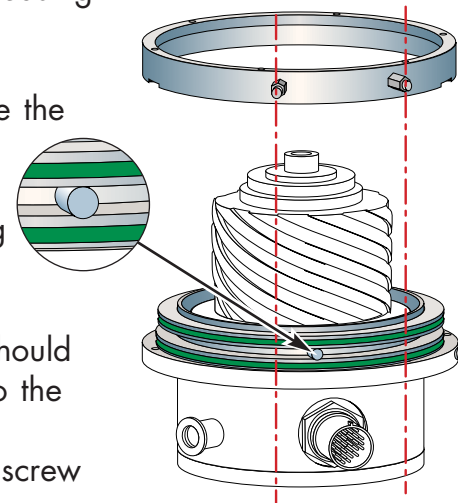
Fit the pin in its slot (above the connector).

Install the water circuit ring with the extraction notches facing downwards.

The inlet / outlet orifices should be centered with respect to the electrical connector.

Check that the attachment screw holes are aligned with the bearing support.

Slide the ring, pressing firmly.



Integrity test



Under water pressure, the cooling circuit ring can lift up, creating an important leak. In this case, proceed to the Holweck stator complete assembly (according to E 90 or E 91 page 1/6) before to perform the leak test.

Place the circuit under water pressure at a pressure of 7 bar for 30 minutes before continuing reassembly.

Check that there are no leaks.

Followed by reassembly of the pumping cell

E 90 or E 91

Followed by functional tests

E 100

Reassembly of the pumping cell ATH 400M/MT



Before starting any operations, the user must read the safety recommendations and the maintenance precautions (see E 10).

Before this operation, it is necessary to

➔ clean the parts (see E 110).

Tools needed

- Tool kit (see F 11)
- Seal kit (see F 11)
- Hot air gun (see F 11)
- Recommended equipment: PC and test software to measure that the spindle is not out of balance.

Reassembly of the Holweck stator

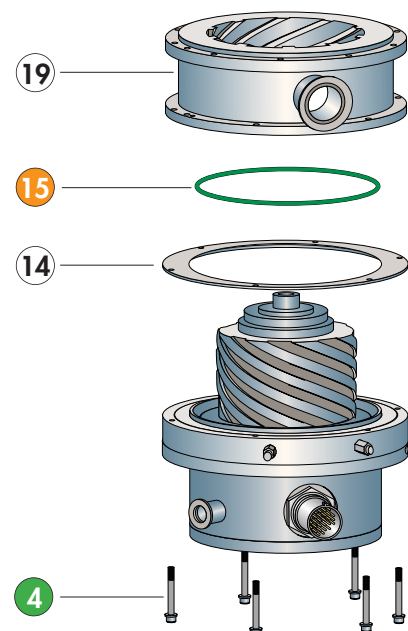


Fit the thermic spacer ring (14) (align the attachment holes) on the bearing support.

Fit the O-ring (15).

Fit the Holweck stator (19), aligning the exhaust with the connector and aligning the attachment holes.

Fit the attachment screws (4) and lock them.



Reassembly of the pumping cell ATH 400M/MT

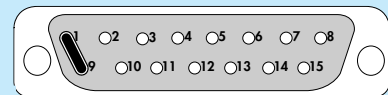
Check that the Holweck stator is perpendicular with the spindle

S (mass)



This operation requires the presence of a plug on the "Remote control" connector to prevent the pump starting up during testing.

This plug should be made up by the technician



Closing of contact 1-9

Fit the mass and attach it with the screw taken from the tool kit.

Connect the ACT to the pump. Press the main switch to enable magnetic levitation and place the plug on the «Remote Control» connector.



For the safety of the person, from this moment onwards THE PUMP MUST NOT BE STARTED UNDER ANY CIRCUMSTANCES.

The technician must take all precautions to ensure this.

Install the comparator with its magnetic support centered on the mass. Turn the mass **slowly**.

The variation should be < 0.10 mm.

If there is a larger difference, check that the bearing support and Holweck stator are correctly assembled, and that the fins and contact surfaces are in good condition. Correct the fault.

Repeat the measurement.

Remove the mass.

If the fault persists, contact the expert Service center or Alcatel HVT Annecy.

Reassembly of the pumping cell ATH 400M/MT

Reassembly of the pumping cell



Fit a new inlet housing O-ring (20) on the pump body.



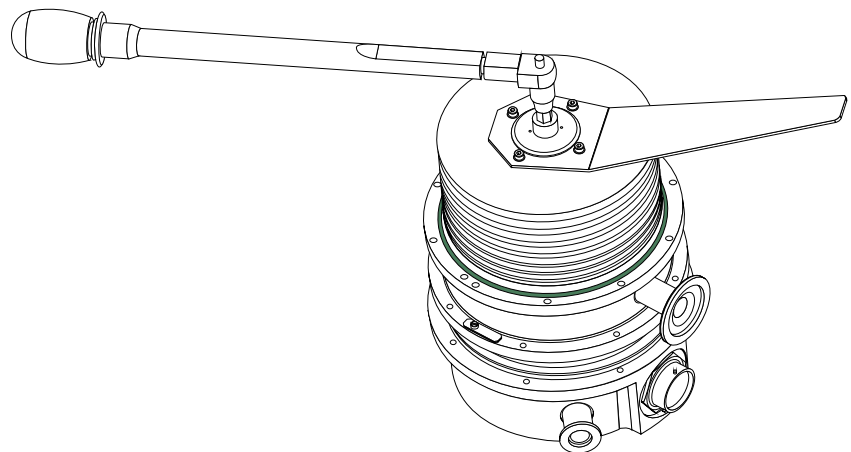
The rotor should be handled with protective gloves.

Heat the rotor with a hot air gun to 50°C at the bore.
Place the rotor on the shaft.

To achieve this, fit it manually on the shaft and lower it until a characteristic noise is heard (contact with the shaft shoulder).

Wait until the rotor is cool, then attempt to remove it (to check the shrink-fitting).

Fit the washer (22), chamfer upwards, and the screw (24').



Immobilise the rotor cell using the rotor wrench.

Tighten with a torque wrench (**Clamping torque: 40 N.m**).

Reassembly of the pumping cell ATH 400M/MT

Spindle rotation test without stator



Replace the pump inlet housing.



Place the pump on a rigid support and attach it firmly to the ground or to a workbench.

Connect the pump to a primary pumping device, and install the emergency braking valve on the DN16 fitting port. Connect the ACT.

Press the main switch of the controller.

Configure the display to show the rotation speed (*see C30*).

Start the pump in rotation at nominal speed and measure the unbalance with a PC and communications software (*see E120 - Use of test software*).

Excessive unbalance is measured

Disassemble the rotor cell and set it at 90° with respect to its initial position.

Replace the rotor cell (*see sheet 3*) and repeat the test.

If the values are not acceptable, return the pump to Alcatel HVT Annecy.

Once the test is complete, stop the pump and wait until rotation stops completely (speed = 0 rpm).
Disconnect the controller.

Reassembly of the pumping cell ATH 400M/MT

Reassembly of the pumping cell

3

Remove the casing and refit the stator / spacer assembly (25) in reverse order of disassembly.

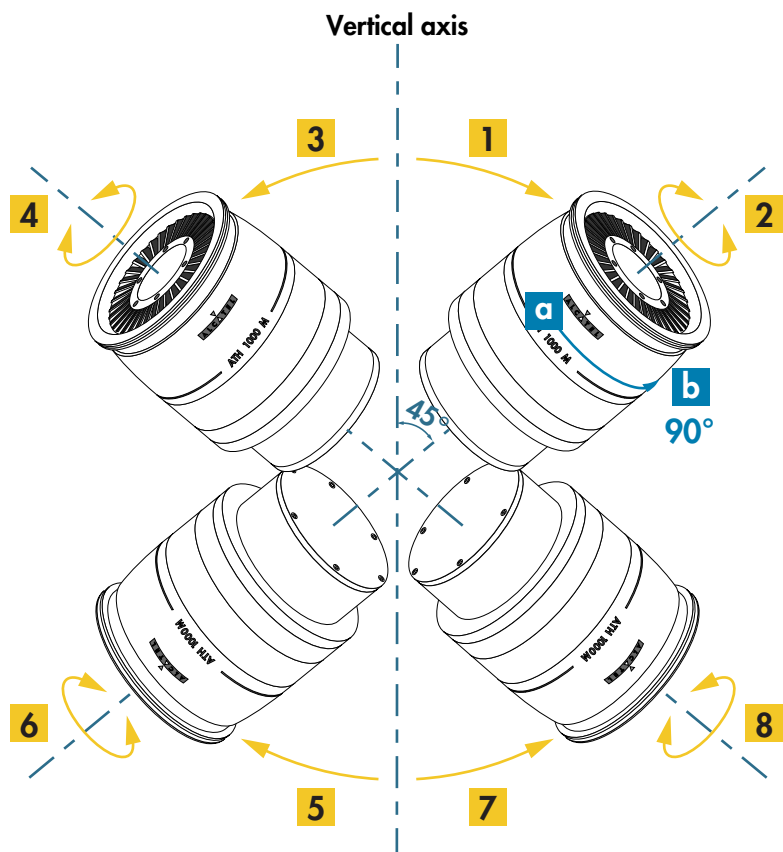
The seal planes on the half-stators must be aligned. The last two half-stators should be shifted through an angle of 90°. Perfect the alignment by applying two flat shims vertically.



Contact with the rotor of the turbomolecular pump may lead to cuts: the use of protective gloves is highly recommended.

Replace the inlet housing (D) in accordance with the marks and fix it, then turn the rotor cell by hand through all positions:

no mechanical noise (rubbing) should be heard.



1 Tilt the pump to nearly 45°.

2 Turn the cell through 360° in both directions

... continue in this way for all positions.

Then try again the test after having turned the pump of 90° on its own axis (Point **a** becomes in **b**)

Reassembly of the pumping cell ATH 400M/MT

Leak test It is useful to perform a leak test before to reassembly the heating cover (*see E 100*).

Reassembly of the heating cover



Fit the heating cover around the pump body.
Insert the connector and fix it to the cover.
Fit and tighten the cover attachment screws.



Do not trap the connection wires.

Followed by functional tests

E 100

Reassembly of the pumping cell ATH 1000M/MT



Before starting any operations, the user must read the safety recommendations and the maintenance precautions (see E 10).

Before this operation, it is necessary to

➔ clean the parts (see E 110).

Tools needed

- Tool kit (see F 11)
- Seal kit (see F 11)
- Hot air gun (see F 11)
- Recommended equipment: PC and test software to measure that the spindle is not out of balance.

Reassembly of the Holweck stator

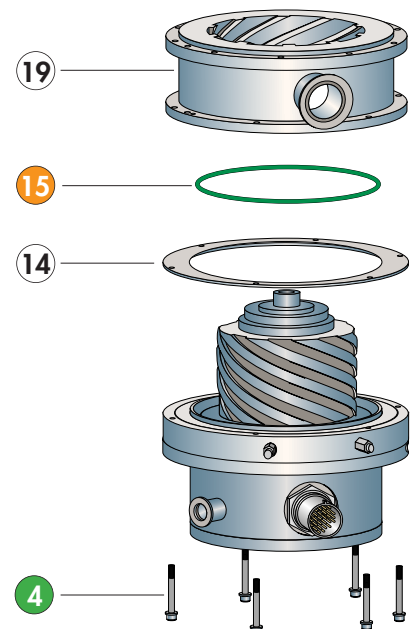


Fit the thermic spacer ring (14) (align the attachment holes) on the bearing support.

Fit the O-ring (15).

Fit the Holweck stator (19), aligning the exhaust with the connector and aligning the attachment holes.

Fit the attachment screws (4) and lock them.



Reassembly of the pumping cell ATH 1000M/MT

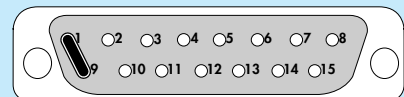
Check that the Holweck stator is perpendicular with the spindle

S (mass)



This operation requires the presence of a plug on the "Remote control" connector to prevent the pump starting up during testing.

This plug should be made up by the technician



Closing of contact 1-9

Fit the mass and attach it with the screw taken from the tool kit.

Connect the ACT to the pump. Press the main switch to enable magnetic levitation and place the plug on the «Remote Control» connector.



For the safety of the person, from this moment onwards THE PUMP MUST NOT BE STARTED UNDER ANY CIRCUMSTANCES.

The technician must take all precautions to ensure this.

Install the comparator with its magnetic support centered on the mass. Turn the mass **slowly**.

The variation should be < 0.10 mm.

If there is a larger difference, check that the bearing support and Holweck stator are correctly assembled, and that the fins and contact surfaces are in good condition. Correct the fault.

Repeat the measurement.

Remove the mass.

If the fault persists, contact the expert Service center or Alcatel HVT Annecy.

Reassembly of the pumping cell ATH 1000M/MT

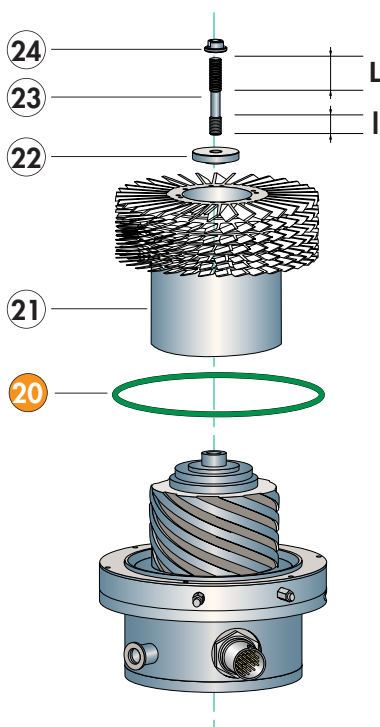
Reassembly of the pumping cell



Fit a new inlet housing O-ring (20) on the pump body.



The rotor should be handled with protective gloves.



Heat the rotor with a hot air gun to 50°C at the bore. Place the rotor on the shaft. To achieve this, fit it manually on the shaft and lower it until a characteristic noise is heard (contact with the shaft shoulder).

Wait until the rotor is cool, then attempt to remove it (to check the shrink-fitting).

Fit the stud (23) into the shaft (take care to the length $L > l$ and L upwards).

Fit the clamping ring (22) and the nut (24).

Place the tool (a) at the base of the rotor cell.

Fit the jack (c) with its stud (b).



Bring the brace (d) into contact with the pin and tighten it. Loosen by a quarter of a turn.

Connect the hose to the hydraulic pump and bring the pump to a pressure of 39 MPa. Use the spindle (e) and tighten clockwise, clamping moderately.



Drop the pressure and push back the jack piston by hand.

Remove the tool before to disconnect the hose.

Reassembly of the pumping cell ATH 1000M/MT

Spindle rotation test without stator



Replace the pump inlet housing.



Position the pump on a sturdy base or attach it firmly to the ground or to a bench.

Connect the pump to a primary pumping device, and install the emergency braking valve on the DN16 fitting port. Connect the ACT.

Press the main switch of the controller.

Configure the display to show the rotation speed (*see C30*).

Start the pump in rotation at nominal speed and measure the unbalance with a PC and communications software (*see E120 - Use of test software*).

Excessive unbalance is measured

Disassemble the rotor cell and set it at 90° with respect to its initial position.

Replace the rotor cell (*see sheet 3*) and repeat the test.

If the values are not acceptable, return the pump to Alcatel HVT Annecy.

Once the test is complete, stop the pump and wait until rotation stops completely (speed = 0 rpm).

Disconnect the controller.

Reassembly of the pumping cell ATH 1000M/MT

Reassembly of the pumping cell

3

Remove the casing and refit the stator / spacer assembly (25) in reverse order of disassembly.

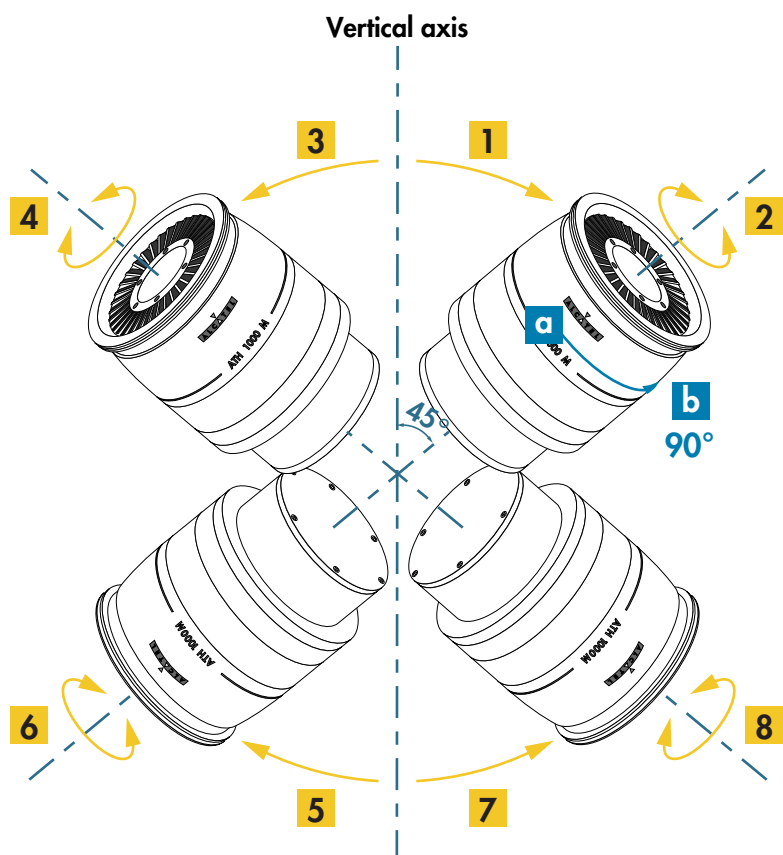
The seal planes on the half-stators must be aligned. The last two half-stators should be shifted through an angle of 90°. Perfect the alignment by applying two flat shims vertically.



Contact with the rotor of the turbomolecular pump may lead to cuts: the use of protective gloves is highly recommended.

Replace the inlet housing (D) in accordance with the marks and fix it, then turn the rotor cell by hand through all positions:

no mechanical noise (rubbing) should be heard.



1 Tilt the pump to nearly 45°.

2 Turn the cell through 360° in both directions

... continue in this way for all positions.

Then try again the test after having turned the pump of 90° on own axis (Point **a** becomes in **b**)

Reassembly of the pumping cell ATH 1000M/MT

Leak test It is useful to perform a leak test before to reassembly the heating cover (*see E 100*).

Reassembly of the heating cover



Fit the heating cover around the pump body.
Insert the connector and fix it to the cover.
Fit and tighten the cover attachment screws.



Do not trap the connection wires.

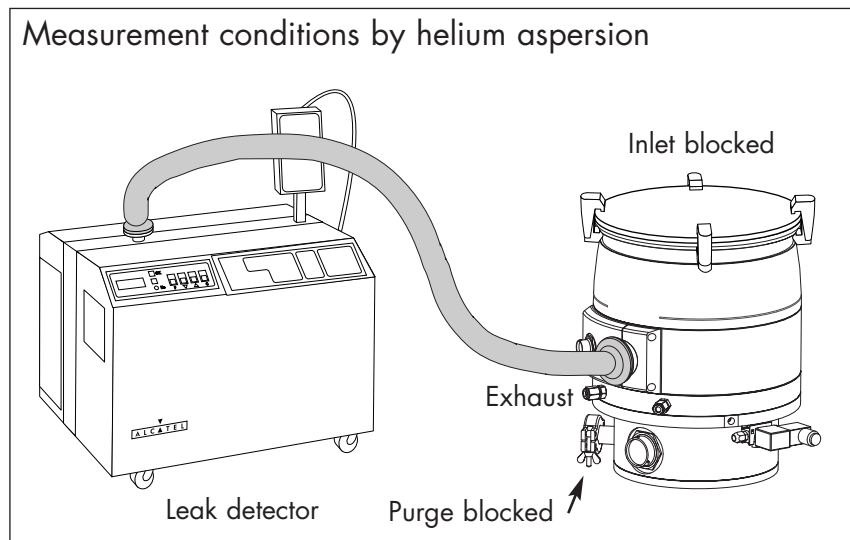
Followed by functional tests

E 100

Test of correct operation

Checking the vacuum leaktightness

Leakage flow: Q



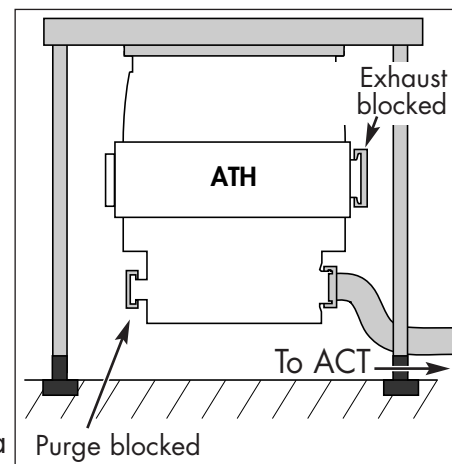
Results of the measurement: $Q \leq 5 \cdot 10^{-8}$ mbar.l/s

Test of landing on back-up bearings



Place the pump on a rigid support and fix it solidly to the floor or to a bench.

- Fix the pump on a rigid support.
- Seal the inlet, exhaust and nitrogen purge.
- Connect the controller.
- Turn on the controller main switch.
- Configure its display screen to show the rotation speed (see C 30).
- Press "START" and perform a rotation test at 3000 rpm,



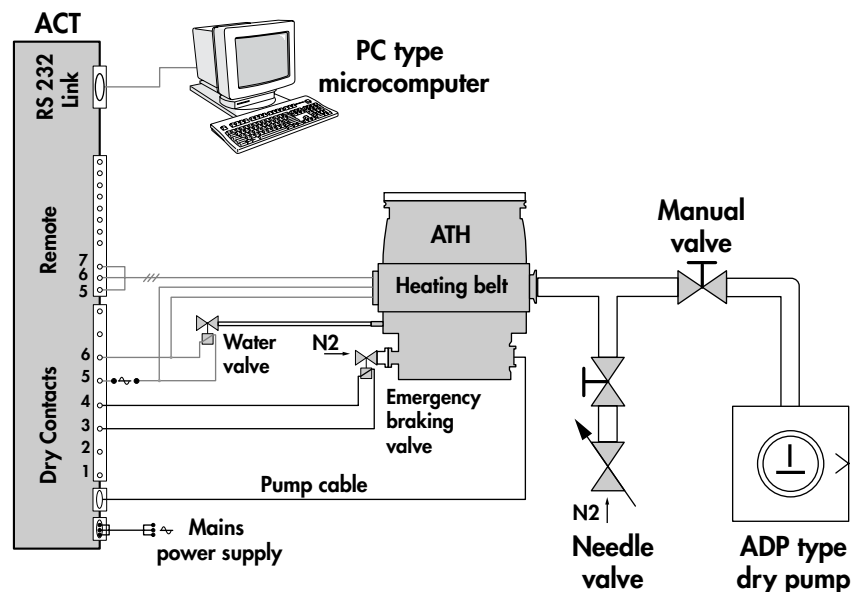
- Press "START" and perform a rotation test at 3000 rpm, then turn off the ACT power at the main switch. The pump will drop onto the back-up bearings without excessive noise, and should slow down gently (duration = 1 min). If it slows down abruptly or noisily, disassemble the pumping cell again and check all the parts.

Test of correct operation

Functional test



Place the pump on a rigid support and fix it solidly to the floor or to a bench.



Connect the primary pump to the turbomolecular pump:

- if ATH 400M/MT: Recommended Alcatel primary pump type ADP 31,
- if ATH 1000M/MT: Recommended Alcatel primary pump type ADP 81.

Install the emergency braking valve on the purge orifice.

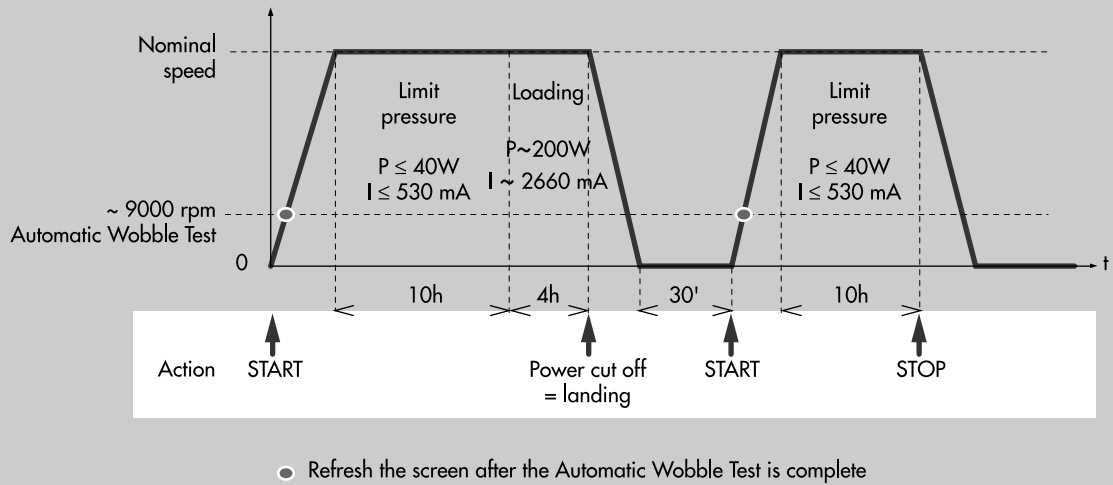
Provide a device comprising a micro-leakage valve to increase the exhaust pressure (load the motor by increasing the power consumption).

The test involves performing pumping cycles (*see sheet 3*), whilst measuring the wobble, "axial and radial displacement of the magnetic shaft" using the communication software (*see E 120*).

For thermostatically controlled models, set the thermostat temperature to 65 °C.

Test of correct operation

Pumping cycles for the functional test



Cleaning of parts



We wish to emphasize the critical points of certain solvents (flash point, evaporation rate) for which the user must take the appropriate safety precautions.

Please read the safety recommendations given on sheet **E 10**.



When cleaning the parts, avoid any contact with the reaction by-products (deposits, powder, etc.) which are highly corrosive: use protective gloves, and possibly a breathing mask.

Cleaning kit See **F 20**: Ingredients and consumable products.

Cleaning of parts

Parts to clean	Step 1 Cleaning	Step 2 Verification	Step 3 Reconditioning	Step 4 Finishing
Inlet housing (D)	Apply the cleaning procedure according to the process used in our service centre. ⚠ Protect the screen printing and marking on the housing	Inspect the seal seats: they must be smooth, with no scratches	Recondition the seal seats with a pad or with fine abrasive paper.	Clean with alcohol and bake at 60 °C.
"Rotor" pumping cell (21)	Soak the parts in a bath of solvent such as SYDOL** for 15 minutes. Blow the parts dry with filtered dry air. Soak in a bath of alcohol for 15 minutes. Dry the parts in a furnace at 100 °C for 1 hour.	Check that the surfaces are clean, especially the rotor thrust surfaces and the bore.	Recondition the surfaces with a fine abrasive pad if necessary. (Caution: do not touch the bore.).	Clean with alcohol and bake at 60 °C.
"Stator" pumping cell (25)	Soak the parts in a bath of solvent such as SYDOL** for 15 minutes. Blow the parts with filtered dry air. Soak in a bath of alcohol for 15 minutes. Dry the parts in a furnace at 100 °C for 1 hour.	Correct general state.	Recondition the surfaces with a fine abrasive pad if necessary.	Clean with alcohol and bake at 60 °C.
Holweck stator (19)	Apply the cleaning procedure according to the process used in our service centre. ⚠ Do not unstick the heating belt; protect the markings.	Correct general state: no significant scratches. Inspect the seal seat surfaces.	Recondition the surfaces with a fine abrasive pad if necessary.	Clean with alcohol and bake at 60 °C.

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Cleaning of parts

Parts to clean	Step 1 Cleaning	Step 2 Verification	Step 3 Reconditioning	Step 4 Finishing
Magnetic bearings (65)	Use a cloth. ⚠ Do not use alcohol (resin). Protect the marking.	Inspect the state of the varnish on the internal surfaces and the state of the reversed dynamic seal. Inspect the state of the sensor and inductor surfaces. Remove all traces of corrosion. Check that the wires are properly connected.	Recondition the surfaces with a fine abrasive pad. Coat the internal surfaces with transparent ORAPI varnish using a paintbrush.	Varnish and bake at 60 °C.
Pump frame and water cooling (13)	Use a clean cloth, dry or with water. ⚠ Do not use alcohol on the parts coated with varnish	Check the state of the varnish: it must be uniform with no scratches. Inspect the state of the seal seat surfaces (smooth with no pitting). Otherwise replace the part.	Eliminate all traces of varnish using an abrasive pad. Recoat with spray-on red varnish, protecting surrounding zones.	Varnish and bake at 60 °C.
Thrust washer (22)		Check the state of the thrust faces: they must be smooth with no traces of corrosion. Otherwise, replace the washer.	If slight traces are present, use a fine abrasive pad.	Clean with alcohol and bake at 60 °C.
Shaft (70)	Clean with a dry lint-free cloth.	Check the state of the thrust faces opposite the rotor. The nitrided surfaces must be clean, uniform, with no chips. The varnish must not be scratched.	Recondition the corroded surfaces, then apply spray-on varnish after protecting the nitrided surfaces and the cell thrust face.	Varnish and bake at 60 °C.
Other parts	Use alcohol and a cloth ⚠ Protect the marking.	Check the general state of the parts, no traces of corrosion	Recondition with a fine abrasive pad.	Clean with alcohol.
Ferrite nut (54)	⚠ Protect the marking.	The ferrite must not be cracked.		Clean with alcohol.
Axial inductor (51)	Clean with a dry cloth. ⚠ Protect the marking.	Check the general state, eliminate traces of corrosion. ⚠ Be careful with the sensor.	Recondition with a fine abrasive pad.	Clean with alcohol.

Use of the test software

Wobble measurement



This program contains several menus.
This sheet only explains the "Read analog inputs" wobble measurement menu.

Use of the other menus whilst the pump is operating is not recommended.

Running the program

Place the floppy disk in the drive.

Go to "DOS" and display **C:>**.

Type **A:** and press "Enter". The display becomes **A:\>**

If the ACT uses version 2.01 of the software, type:

cd □ **V2-01** then confirm by pressing "Enter".

Next enter the file name:

ACT 1000M or **ACT 600M** and press "Enter".

If the ACT uses version 2.03 of the software, type

cd □ **V2-03** then confirm by pressing "Enter".

Next enter:

NEW 1000M or **NEW 600M** and press "Enter".

The following screen is displayed:

```

ALCATEL CIT - Division Technologie du Vide
              - Concepteur   G.JULLIAN
-----
TEST COFFRET CFU1002 via RS232 NOV 96
Configuration de la liaison série
Test des sorties ana. ou log.
Accès en manuel
Lecture des Entrées Logiques
Lecture des Entrées Analogiques
Lecture des Sorties Logiques
Lecture E2PROM
Saisir le numéro de la pompe
Ecriture E2PROM (config. usine)
Ecriture RAM convertisseur
Test des Entrées-Sorties (carte PC)
Saisir le Nom de l'opérateur
Saisir le Numéro du convertisseur
Lancement du programme d'init
Lancement du programme de cyclage
Impression du compte-rendu
  
```

Use of the test software

Select the “**Read analog inputs**” menu using the arrow keys and confirm with the “**Enter**” key.
The following screen is displayed:

Reading of axis displacements {

\		LECTURE DES ENTREES ANAL			
PARAMETRES		COURANT	MAXIMUM	MINIMUM	
ROT.SPEED	RPM	1727	2436	0	
ROT.SPEED	Hz	29	41	0	
MOTOR LOAD	W	0	165	0	
RADIAL U13	µm	2	9	0	
RADIAL W13	µm	2	5	0	
RADIAL U24	µm	9	15	0	
RADIAL W24	µm	13	14	0	
AXIAL Z12	µm	0	2	0	
MOTOR VOLT	V	75	75	75	
MOTOR AMP.	mA	0	2200	0	
CONS. VIT.	mU	5462	5462	5452	
≥1.PUMP	°C	35	35	33	
≥.CONU	°C	26	26	26	
≥2.PUMP	°C	0	0	0	

Maximum displacement measurement values obtained during the pumping cycle since the last screen refresh.

Whilst running up to speed, i.e. from 0 to 9000 rpm, the maximum values should not exceed the limits shown in the table below (before Automatic Wobble Test).

When the speed of 9000 rpm is reached, refresh the screen by pressing “**Esc**” then “**Enter**”.

All the values on the table are cleared.

During the following phase, starting at 9500 rpm and up to nominal speed, throughout the cycle, the recorded values are displayed: the maximum values should not exceed the values in the table below (after Automatic Wobble Test).

Do not take into account values recorded during stop phases (deceleration of the pump).

To return to the main menu, type “**Esc**”.

To leave the application completely, enter “**Esc**” again.

Use of the test software

	Maximum axial and radial displacement values for the magnetic shaft (wobble measurement)	
	Before automatic wobble control from 0 to 9000 rpm	After AWC automatic wobble control from ~9500 rpm to nominal speed
V 13	50 μm	25 μm
W 13	50 μm	25 μm
V 24	50 μm	15 μm
W 24	50 μm	15 μm
Z 12	30 μm	15 μm

Updating the maintenance counters

The maintenance counters are updated using the RS 232 serial link. A PC and the test software are needed.



This program contains several menus.

This sheet only describes updating the counters through the "Manual access" menu.

Use of the other menus whilst the pump is operating is not recommended.

This procedure is valid for controllers with version V2-03 of the software.

Running the software

Place the floppy disk in the drive.

Go to "DOS" and display **C:>**.

Type **A:** and press "Enter". The display becomes **A:\>**

Type: **cd** □ **V2-03** then confirm by pressing "Enter".

Next enter:

NEW 1000M or **NEW 600M** and press "Enter".

```

ALCATEL CIT - Division Technologie du Vide
             - Concepteur   G.JULLIAN
-----
TEST COFFRET CFU1002 via RS232 NOV 96
Configuration de la liaison série
Test des sorties ana. ou log.
Accès en manuel
Lecture des Entrées Logiques
Lecture des Entrées Analogiques
Lecture des Sorties Logiques
Lecture E2PROM
Saisir le numéro de la pompe
Ecriture E2PROM (config. usine)
Ecriture RAM convertisseur
Test des Entrées-Sorties (carte PC)
Saisir le Nom de l'opérateur
Saisir le Numéro du convertisseur
Lancement du programme d'init
Lancement du programme de cyclage
Impression du compte-rendu

```

Select the "Manual access" menu using the arrow keys and confirm by pressing "Enter".

Updating the maintenance counters

The following screen is displayed:



Update procedure For the syntax of commands and responses, *see also B 120*.

Pump counter Type: **#000SET10,XXXXX,<CR>**
 where **XXXXX** is the pump operating time in hours, **<CR>** carriage return or ASCII code 13.
 Display: **#000,OK**

Controller counter Type: **#000SET11,YYYYY,<CR>**
 where **YYYYY** is the controller operating time in hours.
 Display: **#000,OK**

Back-up bearing counter Type: **#000SET33,MMM,<CR>**
 where **MMM** is the percentage value of the bearing counter (from 0 to 100 %)
 Display: **#000,OK**

To return to the previous menu, type "**Esc**".
 To leave the application completely, type "**Esc**" again.

After about 10 minutes (counter reset time), check from the controller display that the new values have been taken into account.

Access the "**Display - Service**" menu, *see C 30 page 4/4*.

Internal components access of ACT 1000M/600M controllers

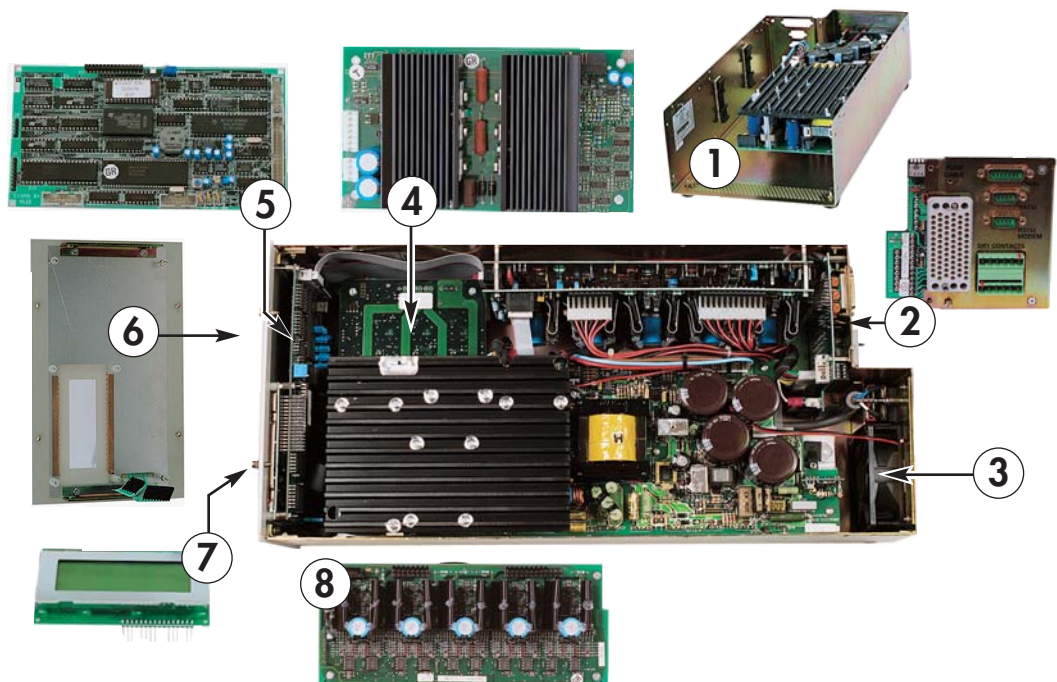
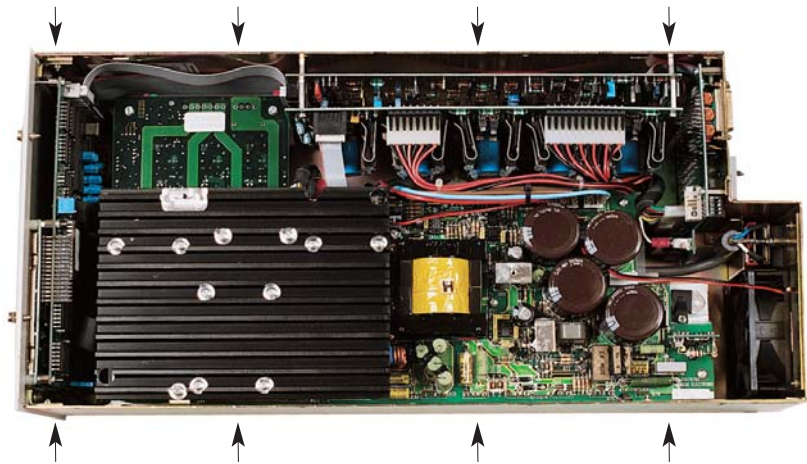


Before any intervention, the user will have been taken care of safety rules and intervention precautions (sheet E 10).

Isolate the controller from the energy source (ON/OFF switch at the rear) and disconnect the power cable before intervention in side (electrical shock hazard).

Controller dismantling

Unscrew and remove all the screws located on top of each side well. Remove the top cover.

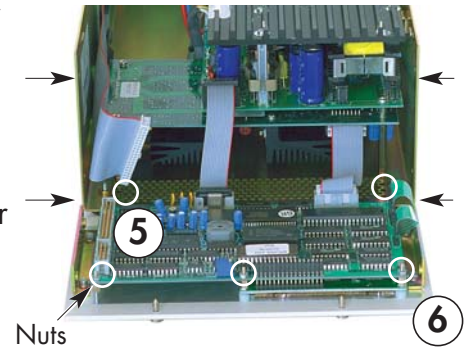


Internal components access of ACT 1000M/600M controllers

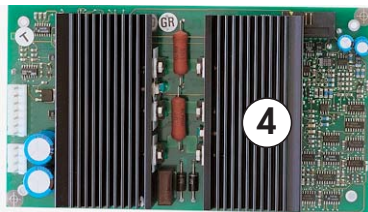
Monitor board access



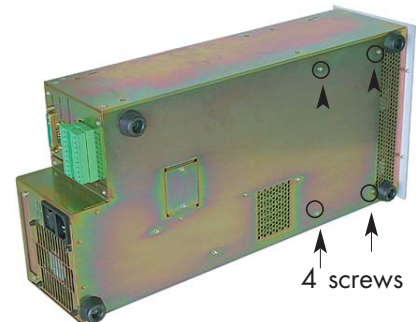
Dismantle the front panel by removing the screws located on each side well. Remove the 4 wirings. Remove the 5 nuts and 2 wirings extract the monitor board.



Variator board access



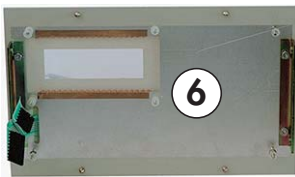
The variator board is fixed on the small columns which are also holding the power supply board. Two holes drilled across the board cooler allow to introduce a cruciform screwdriver to have easy access to the fixing screws of the board. Remove the 4 screws located at the bottom.



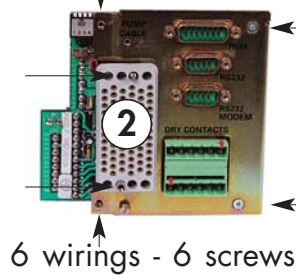
Internal components access of ACT 1000M/600M controllers

The other boards have to be removed by unscrewing the corresponding fixing screws and nuts.

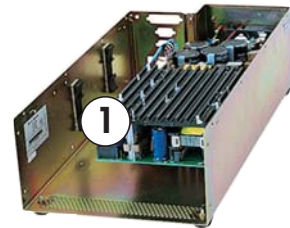
Equipped front panel



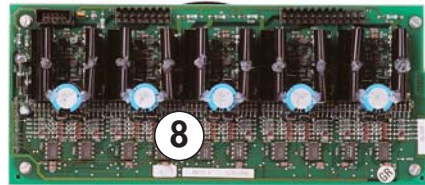
Interface board



Power supply controller



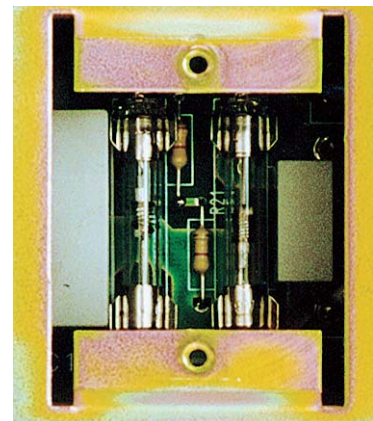
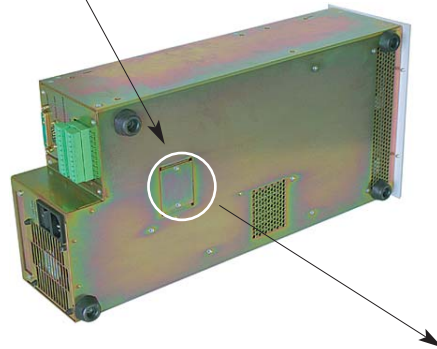
Equipped display



5 wirings - 4 screws

Fuses access

They are located at the bottom, near the mains connector of the unit.



Maintenance of the heating belt



Before any intervention, the user must read the safety recommendations and precautions for intervention (See E 10).

Tools needed

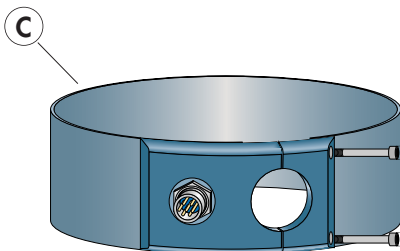
- Tool kit (see F 11)
- Soldering iron
- Heatshrink sleeving

Disassembling the thermal cover



Place the pump vertically, with the inlet upwards.

Unscrew the attachment nut from the heating belt. Unscrew the attachment screws from the thermal cover, and pass the connector inside. Remove the cover (C).



Maintenance of the heating belt

Removing the heating belt



Remove the attachment screws for the temperature sensor and the earth connection.

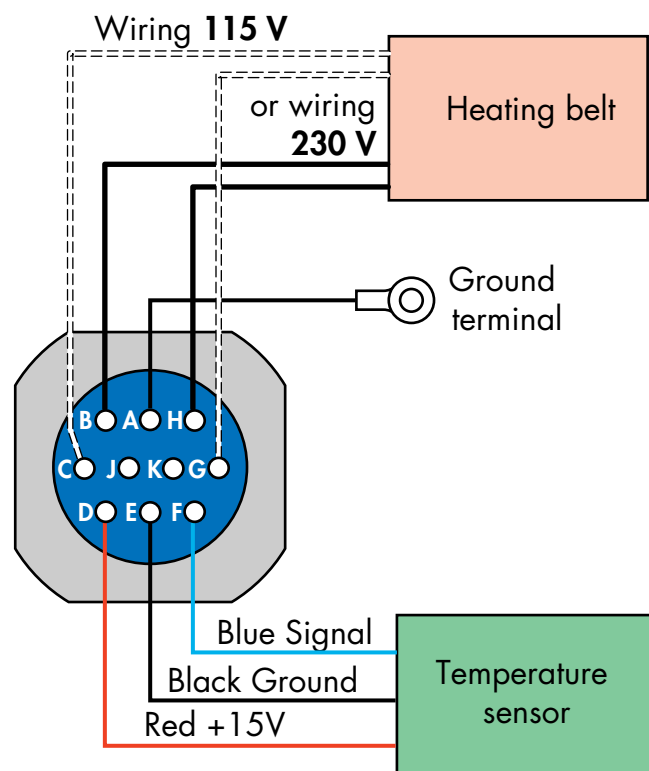
Unstick the heating belt from the Holweck stator by pulling manually.

Remove excess glue from the stator.

Desolder the power leads from the heating belt electrical connector.

Preparing the new belt

Solder the power leads to the heating belt, wired according to the voltage, as follows:



Maintenance of the heating belt



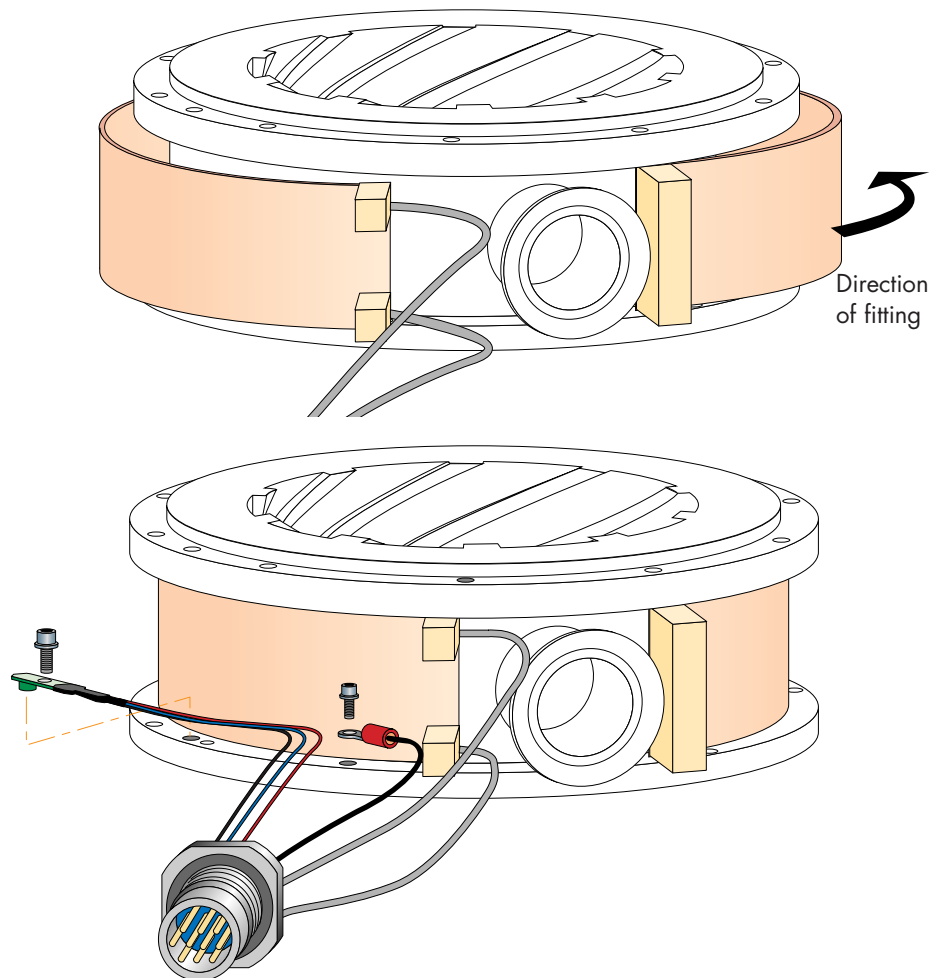
If the inlet housing has been removed, check that the foam blocks glued on the belt will not prevent the housing attachment screws from being fitted.

Fitting the belt



Partly remove the protection on the back of the belt, opposite the electrical leads.

Start to stick the end of the belt at the end, to the right hand side of the exhaust fitting, then apply around the stator.



Fit the temperature sensor in its housing on the stator and screw together. Also attach the earth connection.

Maintenance of the heating belt

Refitting the thermal cover



Fit the thermal cover around the pump body.
Insert the connector and fix it on the cover.
Fit and tighten the cover clamp screws.



Do not catch the connection leads.

Test of correct operation

Using an ohmmeter, measure the resistance between pins:
C and G: ~ 100 Ω , 115 V wiring
B and H: ~ 400 Ω , 230 V wiring.
Check that there is no electrical connection between pins C and G (or B and H) and the pump earth.
If the test is not correct, re-check the electrical wiring.