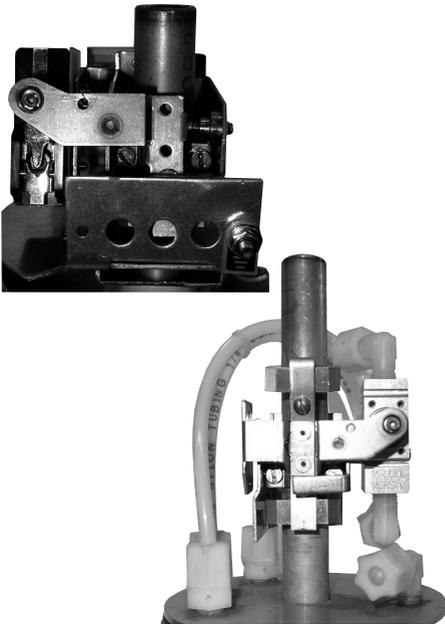


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## Switch devices for HEP Sensilevel level controls

### Installation and Maintenance Instructions

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1. Safety information
2. Installation
3. Differential and switching level setting
4. Switch replacement
5. Switch mechanism replacement
6. Maintenance
7. Trouble shooting

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# 1. Safety information

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A safe operation of SENSILEVEL products is assured when they are properly installed, commissioned, used and maintained by qualified personnel according to the operation instructions. Compliance with installation and safety general instructions must also be observed during piping and plant erection together to an appropriate use of equipment and facilities for safety the Directive European Machinery 2006/42/EC.

## 1.1 Type of application

The suitability of Sensilevel has to be verified for the specific usage and application according to product tag and technical specifications and to installation and maintenance instructions.

## 1.2 Accessibility

Ensure safe access and, if the case, a safe and properly protected platform before working on the product. Use suitable lifting mechanisms as necessary.

## 1.3 Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

## 1.4 Hazardous gases or liquids in the pipeline

Consider the present or previous content of the pipeline paying attention to inflammable materials, substances dangerous to health and to extremes of temperature.

## 1.5 Dangerous environment

Take account of areas at risk of explosion, lack of oxygen (e.g. tanks or pits), dangerous gases, temperature extremes, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

These products comply with the requirements of the European Directive 2014/34/EU (ATEX) for the use of equipments in potentially explosive atmospheres. In a classified area do not access the housing when powered and do not use tools that could cause sparks.

## 1.6 System

Consider the possible effects of the planned work on the whole system. Some operations (e.g. closure of on/off valves, electrical isolation) may put other parts of the system or personnel at risk? Hazards might include closure of vents or isolation of protective devices or jeopardize controls or alarms. Ensure that isolation valves are gradually turned on and off to avoid system shocks.

## 1.7 Pressure

Ensure that all parts exposed to pressure are isolated or adequately vented to atmospheric pressure. Consider double isolation (double block and venting) and blocking or labelling of closed valves. Do not assume a system is de-pressurized even when the pressure gauge reads zero.

## 1.8 Temperature

To avoid the risk of burns, wait until temperature has normalized after isolation.

## 1.9 Tools and consumables

Before starting a work, ensure the availability of appropriate tools and/or consumables. Use Spirax Sarco replacement parts only.

## 1.10 Protective clothing

Consider whether you and/or other personnel need protective clothing, against for example chemical products, high or low temperatures, noise, falling objects and hazards to eyes and face.

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## 1.11 Permit of work

All works must be carried out or supervised by a competent staff, properly trained on product operation and maintenance. Should a formal authorization to work be required, this must be respected. Otherwise, it is recommended that a manager is kept informed on work progress and, if necessary, that an assistant with safety main responsibility is nominated. It is advisable to affix an hazard warning poster.

## 1.12 Material handling

The manual handling of large dimension and/or heavy material can cause risk of injury (improper manual handling can cause spinal injury). It is recommended to evaluate the risks by considering the assignment, the individual, the load and the environment and to use an appropriate material handling method.

## 1.13 Other risks

During normal operation the product surface could be very hot. The surface temperature of some products operating at limit conditions can reach a value of 200°C. Several products do not provide auto-drainage. Take it in account for their disassembly or removal from the plant.

## 1.14 Freezing

The non auto-drainage products have to be protected from damage caused by freeze where they are exposed to temperatures under freezing point.

## 1.15 Disposal

Unless otherwise indicated in the instructions manuals, this product can be recycled. Therefore, provided appropriate precautions will be taken, there is no potential ecological risk after its disposal.

## 1.16 Returning products

According to European Community laws on Health, Safety and Environmental Protection, upon returning products for their testing and/or repairs to Spirax Sarco, customers and distributors are reminded that they must supply the necessary information on hazards and precautions to be taken with regard to the presence of contaminated product residues or instrument damage which may present a health and/or environmental safety hazard. Information must be supplied in writing and include instructions for any substance classified as hazardous.

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## 2. Installation

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### 2.1 Mounting the device

Mount the instrument on the equipment by means of the appropriate connections (threaded or flanged) so that the housing of the switch mechanism is turned upwards and its axis is vertical (a maximum deviation of 3° is admissible).

The process connection tubes to instruments fitted with external chamber must be rectilinear and full-flow. The length of the tubes must be kept to a minimum to ensure proper circulation of the liquid. Suitable support systems are to be used so as to avoid undesirable forces on the chamber and relative attachments.

The level controls with external chamber operating with liquids which tend to leave deposits must have union tees or cross fittings in order to allow periodical cleaning of the tubes.

A drain valve (preferably with rectilinear flow) will also be useful when cleaning the float chamber and process connection tubes.

All the on-off valves must be full-flow and completely open during operation in order to avoid irregular or incorrect triggering of the level control device.

Leave a space of at least 200 mm free above the housing in order to enable it to be removed.

### 2.2 Connecting the switches

**Caution:** power or compressed air to the control must be disconnected before removing the switch housing.

To access the switch mechanisms, remove the cover of the housing unscrewing the upper screw for the standard housing (Fig. 1), or else unscrewing, in an anticlockwise direction, the cover itself, after having loosened the locking screw for the explosion-proof housing (Fig. 2).

The base of the housing is fitted with a threaded connection and may be rotated through 360°, loosening the screw located in the lower part (with the exception of the type 4 explosion-proof housing which cannot be rotated).

### 2.3 Power connections

Be certain that all wiring conforms to all local electrical codes.

Carry out the connections to the switch mechanisms, referring to the diagrams shown in Fig. 3.

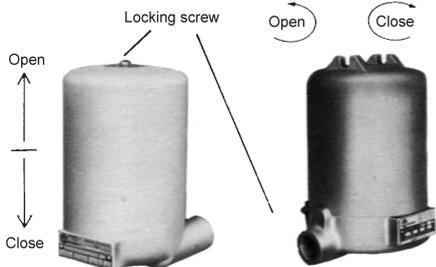
The wires must be passed through the threaded connection, then into the space between the base and the plate below the switch mechanism, and finally connected to the terminals, preferably by means of suitable lead-in wires.

Cut the excess wires so that they do not interfere with the switch mechanism or with the housing.

The passage through the threaded connection must then be sealed so as not to jeopardise the degree of protection or safety of the housing.

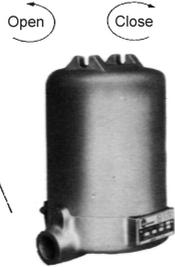
The connections to the switch mechanism can be made without the need to remove it from its housing. Bring the switch mechanism back to the position preset in the factory, should it have been moved during installation.

Check the coupling between base and cover, and ensure that the seal, if provided on the basis of the degree of protection required, is correctly mounted, before closing the housing once again.



Type 1 and 2 housing (standard)

Fig. 2a



Type 3 and 4 housing (antideflagrante)

Fig. 2b

**Contact status as function level**

	Closed contact	Open contact
Increasing level	2-3 and 5-6	1-2 and 4-5
Decreasing level	1-2 and 4-5	2-3 and 5-6

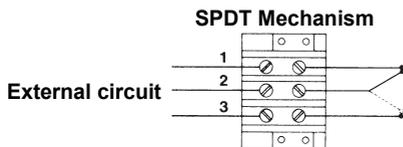
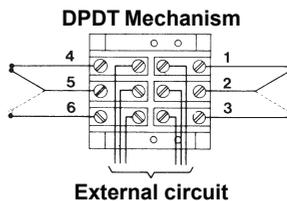
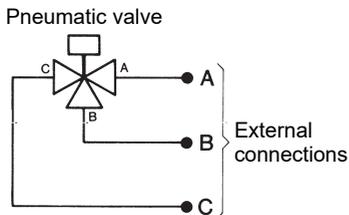


Fig. 3 - Wiring diagram of switch mechanism



**2.4 Pneumatic connections**

Connect the instrument to the pneumatic circuit with reference to the diagrams shown at Fig. 4 in order to obtain the function required from the pneumatic switch (three-way valve, two-way valve, selector, deviation). The tubes must be connected to the 1/4" NPT connections located on the base of the housing, which are indicated by the letters A, B and C and are already connected inside the housing to the three-way pneumatic switch.



**Contact status as a functional level**

Connection	3 way N.O.	2 way N.C.	3 way N.O.	3 way N.C.
A	plugged	inlet	bleed	inlet
B	inlet	plugged	inlet	bleed
C	outlet	outlet	outlet	outlet

Fig. 4 - Pneumatic switch diagram

## - 4. Differential and switching level setting -

In order to fully understand the descriptions given below, note the following definitions:

- **High level:** level of liquid at which the switch mechanism is triggered when the level is rising.
- **Low level:** level of liquid at which the switch mechanism is triggered when the level is falling.
- **Differential:** difference between high and low level.

The differential for the floating controls may be field adjusted by means of the relative nuts. The differential and the switching points for displacer controls with wide differential can be adjusted in the field by moving the displacers upwards or downwards on the suspension cable. For displacer controls with fixed differential, however, only the actuation point can be adjusted in the field, by moving the displacer upwards or downwards on the suspension cable.

### Adjusting the differential and switching points for float controls (electric switches 1, 2 and 3)

The instrument is normally set in the factory to the minimum differential (there must be slight clearance between the pair of nuts which hold the magnetic piston). The range of the differential can be increased, even once the instrument is installed, by lowering only the lower pair of nuts, thus achieving an increase upwards of the maximum switching level. The differential can be regulated within the following limits:

- For the Sensilevels with only one switch mechanism type 1, 2 and 3, the differential can be increased up to a maximum of 50 mm beyond the value set in the factory.
- For the Sensilevels with two switch mechanisms, the differential can be increased up to a maximum of 25 mm beyond the value set in the factory.
- For the Sensilevels with three switch mechanisms, the differential is fixed according to the minimum value set in the factory.

In order to change the original calibration of the differential, where possible, follow the procedure described below carefully. The devices calibrated on request for interface control (point of separation between two non-mixable liquids with different mass density) are supplied with a fixed differential, therefore no regulation can be performed. All the general suggestions do however apply.

### A - Preliminary operations to modify the differential

- 1 - Disconnect the electric connections at the housing.
- 2 - Remove the enclosing tube as well as the entire housing by means of the hexagonal nut (41 mm) beneath the base. In this way the magnetic piston and the relative locking nuts can be reached directly (see Fig. 5).
- 3 - Remove the two upper nuts and the guide washer after having noted the exact position from the top of the threaded rod.
- 4 - Extract the magnetic piston from the threaded rod.
- 5 - Note the exact position of the lower nuts from the top of the threaded rod.

### B - Modification of the differential

In order to modify the setting, i.e. to change the switching levels of the instrument, it is sufficient to change the position of the nuts which attach the magnetic piston along the rod. Bear in mind that a change by 1 mm in the position of the nuts along the rod corresponds to the same change in the switching level. Therefore in order to increase the differential, lower the pair of lower nuts by as many millimetres as necessary for bringing the differential from the value set in the factory to the required value.

**Warning:** the distance between the two pairs of nuts must never be smaller than the distance defined in the factory.

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## C - Restoring working conditions

After having set the new position of the nuts in relation to the required differential, re-instate the working conditions as follows:

- 1 - Tighten the lower nut and lock nut.
- 2 - Re-insert the magnetic piston.
- 3 - Position the pair of upper nuts to the dimension noted before dismantling and tighten them completely so as to avoid possible loosening during operation.
- 4 - Reconnect the external connections at the housing.

## D - Adjusting the switching level

This operation is performed by changing the position of the switch mechanism. In the devices fitted with one or two switches of types 1, 2 and 3, it is possible to move the mechanism/s up to 50 mm upwards when the device is fitted with only one switch mechanism and up to 25 mm when it is fitted with two mechanisms. This operation is required when the switching values are to be raised without modifying the process attachments. In order to move the mechanism, the fastening screw (Fig. 7) has to be loosened in order to enable the switch to run freely along the enclosing tube.

Then attach the mechanism in the new position. For the lower mechanism the plate locking screw also has to be removed.

### Attention:

When the switches are moved upwards the possibility of increasing the differential is reduced by the same value of the movement made (e.g. if on a SENSILEVEL fitted with only one switch mechanism, the latter has been moved upwards by 20 mm, it is possible to increase the differential by only 30 mm instead of 50 mm).

**After having modified the differential and/or the switching level, check, by moving the float by hand, that the switch commutates properly.**

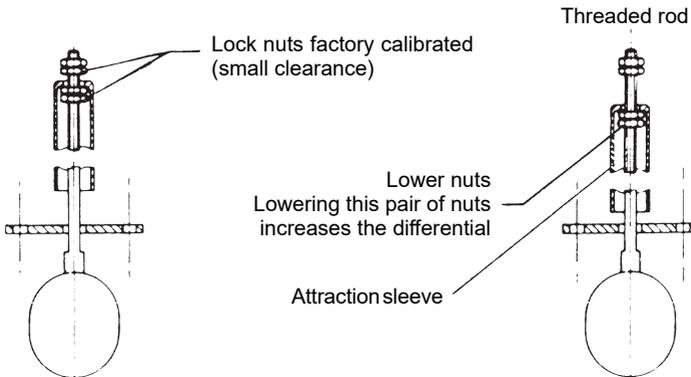


Fig. 5

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## 5. Switch replacement

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### A - Electrical switch mechanism

Disconnect power, remove the cover of the housing and proceed as follows:

- 1 - Disconnect the external connections of the terminal board, noting the position of the individual wires. Also note the position of the mechanism on the enclosing tube.
- 2 - Loosen the plate locking screw (only for the lower mechanism) and the fixing screw (see Fig. 7) and extract the switch mechanism from the enclosing tube.
- 3 - Replace the switch mechanism and re-assemble by following the process of points 2 and 1 in reverse.
- 4 - Actuate by hand the magnet-holder arm, making sure that it moves freely and that the switch is actuated properly.
- 5 - Reconnect the electric wires ensuring that they do not interfere with the movement of the mechanism nor with the housing.

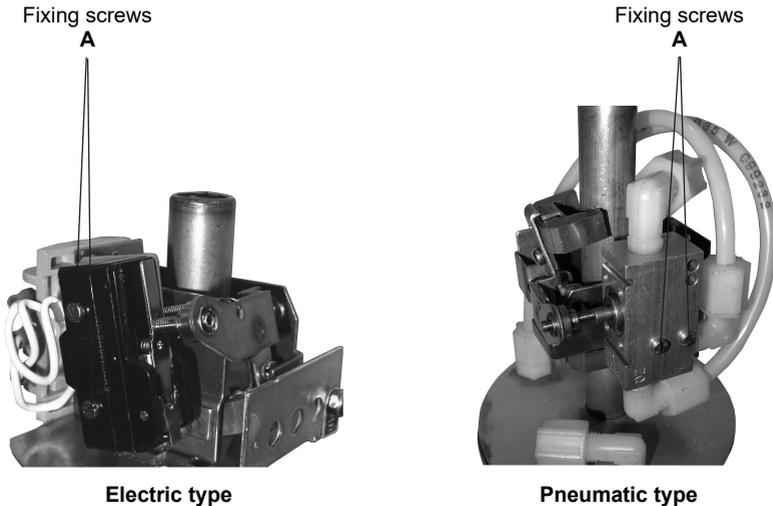


Fig. 6 - Switch mechanism

### B - Pneumatic switch mechanism

Switch off the supply of compressed air, remove the cover of the housing and proceed as follows:

- 1 - Disconnect the tubes from the valve and note the position of the mechanism on the enclosing tube.
- 2 - Loosen the screw for fastening the mechanism (Fig. 6) and remove the latter from the enclosing tube.
- 3 - Replace the switch mechanism and re-assemble by following the instructions of points 2 and 1 in reverse.
- 4 - Actuate the magnet-holder arm by hand, making sure that it moves freely and that the valve is actuated properly.
- 5 - Reconnect the tubes to the valve, ensuring that they do not interfere with the movement of the mechanism nor with the housing.

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## 6. Switch replacement

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### A - Electrical switch

- 1 - Remove switch wires from the terminal board.
- 2a - Mercury switch (see Fig. 7)  
Remove the glue that seals the mercury bulb to the clips; then remove the switch.
- 2b - Microswitch  
Remove the fixing screws (see Fig. 6) and then the switch.
- 3 - Replace the old switch with the new one and reassemble by performing above actions 2a or 2b and 1 reversely.
- 4 - Manually check the lever of the magnet holder ensuring that the switch opens and closes correctly. If necessary make adjustments with screw "C" (see Figs. 6 and 7).

### B - Pneumatic switch

- 1 - Remove pipes from the valve.
- 2 - Remove the locking screw "D" (Fig.7) and then the valve.
- 3 - Replace the old valve with the new one and reassemble by performing above actions 2 and 1 reversely.
- 4 - Manually check the lever of the magnet holder ensuring that the switch opens and closes correctly. If necessary make adjustments with screw "C" (see Figs. 6 and 7).

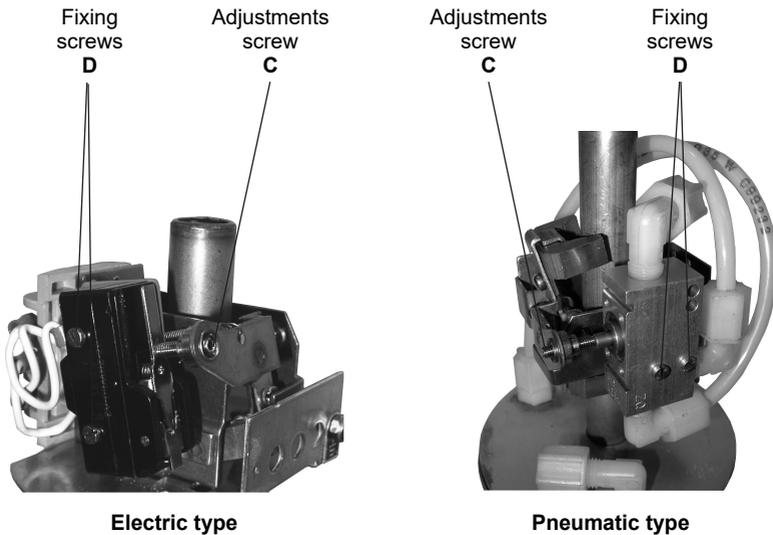


Fig. 7 - Electrical and pneumatic switches

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# 7. Maintenance

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Periodic inspection is necessary to ensure the control is kept in good working order. We recommend that a systematic program of Preventative Maintenance be implemented at installation. The following precautions are important and will keep your control in top operating condition.

## **A - Keep SENSILEVEL control clean**

To prevent the damaging action of damp and dust, do not leave the cover off longer than absolutely necessary.

There is no need to lubricate any component of the SENSILEVEL control.

Bleed the float chamber at least once a day, to prevent the build-up of deposits and scale, which would prejudice the efficiency of the control.

In models without an external chamber, keep the float free, and make sure that the displacers are free of scale and deposits.

Every six months, check the float chamber; this is extremely important in making certain that, notwithstanding the daily bleed, there are no residues and scale inside the chamber. It is advisable to inspect the float for corrosion. If it shows signs of corrosion, replace it immediately.

## **B - Check the switches monthly**

Disconnect the power to the control and remove the switch housing.

### **1 - Connections**

Check that the connections to the switch (whether electric or pneumatic) are in order.

### **2a - Microswitches**

Check the alignment between the adjusting screw "C" and the microswitch actuating lever (Fig. 7).

Make sure that the microswitch switches properly, by manually actuating the magnet carriage.

### **2b - Pneumatic switches**

Check that the adjusting screw "C" and the valve's control switch "E" are aligned (Figs. 6 and 7).

Make sure that the valve switches properly, by manually actuating the magnet carriage.

Checks for ensuring that the switches operate properly should be made also in the event of potentially damaging events such as, for example, short circuits, electrical discharges, or over-pressures.

When the controls are exposed to excessive heat or damp, the insulation of the wires will tend to dry and become fragile, thus provoking short circuits. We recommend to replace any damaged cables or wiring. Vibration may loosen the screws of the terminal blocks and the terminals. Check that all screws are tightened properly. Do not lubricate the switch pins, as they have been designed to operate dry; oil would attract dust and dirt, which are detrimental to efficient operation.

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## 8. Trouble shooting

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Sensilevel level controls are designed for long life and trouble free operation. However, should you suspect a malfunction, the following steps should be followed to diagnose the problem.

- 1 - Has the level control been installed properly?
- 2 - Is the level control being operated within the specified pressure, temperature and liquid density limits indicated on the nameplate of the control?
- 3 - Are the electrical and pneumatic connections in good order? Is the power "ON"?
- 4 - Are the voltage and current, that is, the servo control pressures, within the limits fixed for the switches, as specified on the nameplate?
- 5 - Do the connections to the switch correspond with both the instructions provided and the system's general diagrams?
- 6 - Is the controlled equipment functional and wired properly?
- 7 - Is the switch mechanism fixed in the enclosing tube in the position set at the factory?
- 8 - Is the switch damaged?  
Check that the switch is not cracked and that there is no corrosion on the terminals, or on the wire leads. If there is any physical damage, the switch must be replaced.
- 9 - Does the switch function when operated manually?  
Using a non-conductive tool, manually move the magnet carriage, which must not offer any resistance. This manual movement of the carriage will cause the switch to actuate. Check continuity of the contact with a suitable instrument.
  - a) **Microswitches:** make certain that the actuation lever of the microswitch is not bent, and that the adjusting screw is positioned in the centre of the lever.
  - b) If the magnet does not make a complete stroke towards the enclosing tube in which it is fitted:  
**Remedy 1** - The pin seatings are too narrow and brake the oscillating arm. Loosen one of the two pin seatings by about  $\frac{1}{4}$  of a turn. Leave a little lateral clearance between the pins and their seatings.  
**Remedy 2** - If the magnet binds on the walls of the enclosing tube, adjust the pin seatings so that the magnet is centred in the tube. To achieve this, use a screwdriver to loosen the pin seating where the magnet binds against the enclosing tube. Tighten the pin seating on the opposite side to a corresponding degree. One of the two seatings is hidden by the mercury bulb; in order to make the adjustment, this must therefore be removed from the two fixing clips.
- 10 - Is the chamber of the level control free of dirt and scale?
  - a) - Inspect the enclosing tube for dents on the outside of the tube (the tube must not be bent).
  - b) - Inspect the inside part of the tube for corrosion, dirt or scale.
  - c) - Check that the attraction sleeve and stem are not corroded, bent, or affected by scale build-up.
  - d) - The lock nut settings of each level control are factory calibrated individually. Make sure the lock nuts have not been loosened and that their position is such as to move the attraction sleeve in and out of the magnetic field following a change in the liquid level.
  - e) - Make certain that the float has not been pierced (i.e. it floats) and that it is free of corrosion.
  - f) - Inspect the interior of the chamber and process connection and make sure it is free of dirt and scale.

11 - If the above inspections and checks do not trace the fault, contact our local engineer or our Service Department, providing a complete description of functioning and the defect encountered. A diagram of the connections and the layout of the installation will be required.

Contacting us, or ordering spare parts, always indicate the Serial Number of the control. This number is printed on the nameplate fixed to the base of the switch housing.

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## **SERVICE**

For technical support, please contact our local Sales Engineer or our Head Office directly:

### **Spirax Sarco S.r.l. - Technical Assistance**

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## **LOSS OF GUARANTEE**

**Total or partial disregard of above instructions involves loss of any rights to guarantee.**

**Spirax-Sarco S.r.l. - Via per Cinisello, 18 - 20834 Nova Milanese (MB) - Tel.: 0362 49 17.1 - Fax: 0362 49 17 307**