

# User guide

## DIAPHRAGM SEALS



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## 1. Important information

The instrument described in this manual has been designed and produced in conformity to the following current standards. All components are submitted to severe quality and traceability controls. The quality management system is certified according to the ISO 9001 standard. This manual contains important information about the use and the installation of the pressure switch in safe conditions. Therefore, the following instructions must be read carefully before using the instrument.

*The instrument works in safe conditions when correctly selected and installed in the system and when the rules concerning the product as well as the maintenance procedures established by the manufacturer are respected.*

*The staff charged with the selection, installation and maintenance of the instrument must be able to recognize the conditions that may negatively affect the instrument's ability to work and which may lead to premature breakage. The staff must therefore be technically qualified and properly trained, and must carry out the procedures called for in the plant regulations.*

NUOVA FIMA instruments are designed and manufactured according to the safety rules included in the safety international standards in force. Some of these standards are included in this manual and they must be acknowledged and observed in order to proceed to the installation and the setting at work of the instrument.



Warning

- **The manufacturer disclaims all responsibility in case of damages caused by the improper use of the product and by the non-respect of the instructions reported in this manual.**
- **Follow carefully the specific safety rules in case of measuring oxygen pressure, acetylene, inflammable or toxic gas or liquids.**
- **Disconnect the instruments only after depressurization of the system.**
- **The process fluids residues remaining in the instruments which have been removed could affect people, the environment and the system. It is strongly advisable to take proper precautions to prevent any damage.**



Attention

- **Before installation, the most suitable instrument should be selected according to the working conditions, the range, the working temperature and the compatibility between the material used and the process fluid.**
- **The product warranty is no longer valid in case of non-authorized modifications and of misapplication of the product.**
- **The user is totally responsible for the instrument installation and maintenance.**

In order to verify the working and manufacturing features of the instruments read the catalogue sheets in the most up-dated edition available online on [www.nuovafima.com](http://www.nuovafima.com)



### 1.1 Intended use

The diaphragm seal is designed to measure the process fluid pressure in the following cases: when the process fluid temperature is non-compatible to the instrument sensing element, when the process fluid may corrode the inner parts of the measuring instrument in contact with the fluid, when the fluid is highly viscous or it contains solid suspensions, when it solidifies at temperature changes.

## 2. Installation

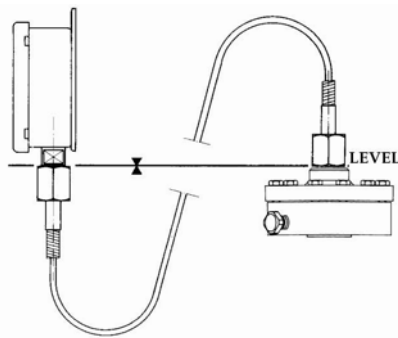
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## DIAPHRAGM SEALS

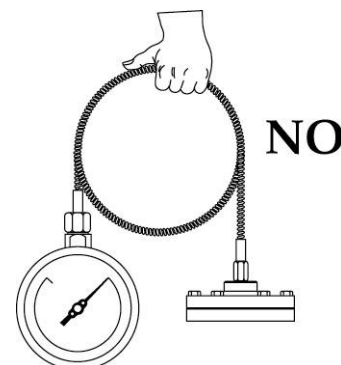
Before installation, the chemical compatibility between the process medium and the wetted parts has to be verified. A description about the instrument material is laser-printed both on the upper and lower body of the instrument and on the seal label.

Carefully remove the diaphragm protection just before starting the mounting procedure. Chemical corrosion process starts by producing scratches on the diaphragm while crashing pressure on the membrane concentric waviness may affect the entire system.

The capillary and its welded joints must not be twisted or pulled. Do not carry the instrument by the capillary. Capillary kinking and/or fracture may produce an inner bore throttling that may increase the response time or may affect the instrument compromising its functioning permanently. The capillary can be bent by a minimum radius of 150mm and should be protected from vibrations by fastening it properly. The different level position between the instrument and the diaphragm seal produces a hydrostatic effect on the instrument and a variation in the instrument indication range as a consequence. If this occurs please advise during order, otherwise the instrument has to be reset on site. A shut-off valve between the diaphragm seal and the system is recommended



(root valve) to make the instrument maintenance procedure easier.



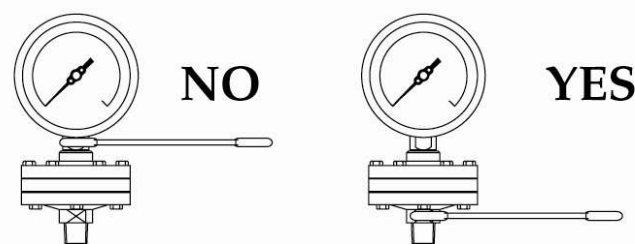
### 2.1 Threaded process connection

If the process connection thread is cylindric, a ring seal should be mounted between the two tightening plane faces to obtain a secure sealing.

If the pressure connection thread is conic, the male connection must be wrapped with a PTFE tape and then it must be wrenched at least by 5 complete threads, to the socket to obtain a secure sealing before coupling.

**Warning – Use the diaphragm wrench grip and not the gauge one in order to prevent any filling fluid leakage.**

In case of threaded connection with exposed membrane it is necessary to use a gasket which better complies with the chemical environment and the working ambient temperature.



### 2.2 Flanged process connections or wafer

It is necessary to choose the most appropriate seal taking into account its chemical and thermal compatibility as well as the flange tightness surface finishing type and degree. Particular care must be taken during the positioning of the seal between the diaphragm and the pressure process connection in order to prevent any accidental direct contact between the seal and the diaphragm which may be damaged and, subsequently, cause a leakage of the process fluid.



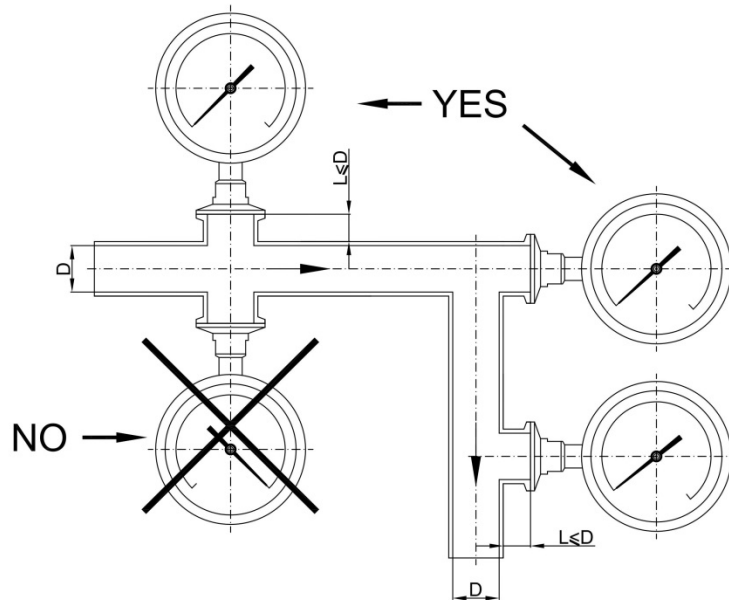
### 2.3 Food process connection

Normally, the mounting devices such as rings, clamps, nuts, flanges, seals and O-rings are not included in the supply and not described in this manual. Seals and O-rings must be selected among those approved for the food industry.

## Instruments marked as

Instruments provided with a DIN11851 connection should be installed using special seals such as those supplied by Siersema Componenten System (S.K.S.) B. V. or seals type ASEPTO-STAR k-flex produced by Kieselmann GmbH.

Instruments provided with a process connection complying with the ISO 2853 (IDS/ISS) standards should be installed using a “T-seal” seal type supplied by Combifit International B.V. In the picture below shows how to install it correctly in order to assure a proper functioning and cleanliness of the instrument. Improper installation may produce residual media which could speed the corrosion process and affect a proper cleaning procedure.



### 2.4 In line process connection

First, install the welded stub, then fix the diaphragm seal inside the housing through the supplied studs.

**WARNING: the seal is generally metallic and the seal seat is created by pressure when installing it for the first time. Proceed to the studs clamping carefully.**

### 2.5 Commissioning

Root valves, when supplied, must be opened slowly. Verify that the connection is watertight and that the accessories are installed and fixed correctly.

## 3. Working limits

### 3.1 Ambient temperature

The one recommended for the assembled instrument.

### 3.2 Process medium connection

This instrument operates in safe conditions when the process medium temperature is between  $-45$  and  $+400^{\circ}\text{C}$  according to the filling liquid (see table), to the diaphragm material and to the process connection.

For temperatures higher than the limits described in this manual please contact our Technical Assistance.

Filling liquid	Working temperature	
	min	max
Silicon oil <b>Type “F”</b>	-90°C (-130°F)	150°C (302°F)
Silicon oil <b>Type “A”</b>	-45°C (-49°F)	150°C (302°F)
Silicon oil <b>Type “B”</b>	-40°C (-40°F)	250°C (482°F)
Silicon oil <b>Type “C”</b>	-10°C (14°F)	350°C (662°F)
Silicon oil <b>Type “D”</b>	-10°C (14°F)	400°C (716°F)
Fluoridated liquid <b>Type “E”</b>	-40°C (-40°F)	150°C (302°F)
Food liquid <b>Type “G”</b>	-10°C (14°F)	200°C (392°F)

If the instrument is used to measure high temperatures peaks, the instrument can be provided with a remote capillary or with a cooling turret. When a diaphragm seal provided with a cooling tower is installed on an insulated pipe, make sure that the insulating layer does not hide the tower's radiant surface not to affect its function.

**Capillaries** - Capillaries transmit remotely the pressure values detected by the diaphragm. They are available in different lengths from 0,5 to 6m for the uncovered version or coated by a flexible stainless-steel armour.

**Cooling tower** - The cooling tower is used when instruments are directly installed or when process fluid temperature is higher than 100°C and up to 250°C.

### **3.3 Materials**

- As for diaphragm seals coated with PTFE the process medium maximum temperature cannot be higher than, 150°C (302°F)
- As for PVC diaphragm seals the maximum temperature must be 60 °C, at a maximum pressure of 1 bar.
- As for food clamp diaphragm seals the maximum temperature can be 130°C for 1 hour during the cleaning and sterilization phases and 150°C if autoclavable.
- As for food diaphragm seals for homogenizers the maximum temperature can be 150°C for 1 hour during cleaning and sterilization.

### **3.4 Working pressure**

The instrument must be selected with a working pressure value between 25% and 75% of the full-scale range. The full scale range must be the double the working pressure. If the instrument is provided with a black small triangle placed on the dial full scale range, the working pressure could be 90% in case of pulsating pressures and 100% for static pressures.

**Accuracy** - At 20°C ± from 0,5 to 1% depending on the diaphragm seal type to be added to the accuracy class of the indication instrument.

### **3.5 Overpressure**

The overpressure value is the same as the one intended for the assembled instrument. Special overpressures are listed on the instrument dial or label.

### **3.6 Response time**

The diaphragm seal involves a response time which is proportional to the filling liquid viscosity and to the connection length between the diaphragm and the instrument. A capillary would involve an increase in the response time.

## **4. Wrong uses**

### **4.1 Failure for corrosion**

When the diaphragm material is attacked by chemical substances contained in the fluid to measure, a failure for corrosion could occur. In this case the material is weakened and a punctiform leak or a crack could take place. The diaphragm is thin so it works under mechanical stress. Therefore, the chemical compatibility with the fluid to measure must be considered. None of the common materials can be immune from a chemical attack which depend on several elements such as: concentration, temperature and mix of different chemical substances.

## 4.2 Failure for explosion

The silicon oil must not be used as a filling liquid with highly oxidants agents such as oxygen, chlorine, nitric acid and hydrogen peroxide because chemical flammability or explosion reactions could occur. In this case the use of fluororube is recommended.

## 4.3 Failure for high temperature

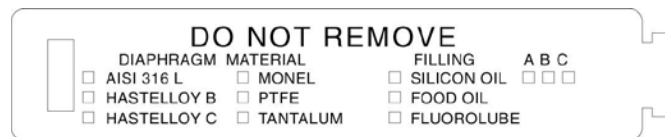
The filling liquid expansion due to temperature higher than the allowed one causes a diaphragm seal bulge which causes permanent damage to the diaphragm and/or may produce gas due to the decomposition of the filling liquid making the assembling permanently unusable.

## 4.4 Mechanical stress and vibrations

Instrument must not be affected by mechanical stress and vibrations. If the installation points are mechanically stressed, instruments must be remote mounted and connected through a capillary.

## 5. Maintenance

Mechanical instruments should be maintained following a proper maintenance program carried out and managed by skilled personnel. Diaphragm seals must be kept in good conditions in order to prevent damages for corrosion. All diaphragm seals are assembled and fastened to the instrument (except for the DN63 model) through a sealing tag. If the tag or the assembling are tampered with, the whole system operation and the relevant warranty are negatively affected.



**WARNING: Do not remove or slack the filling valve and do not separate the instrument from the diaphragm seal. In case of leakage the assembling is not working anymore and must be returned in order to proceed to a separating circuit refilling.**

### 5.1 Regular check

The seal tag must be fastened to the instrument connection pivot. The connection between the instrument and the diaphragm seal must not leak as well as the upper and lower body and the filling valve.

### 5.2 Periodical check

The corrosion level and the gaskets' tightness condition must be checked every 3 to 6 months by disassembling the diaphragm seal from the system even if this procedure is not included in the maintenance program.

Instruments must be isolated from the system by closing the root valve. No pressure should remain inside the instruments must be let out through the drain devices and the temperature must be as much as similar to the ambient temperature values.

The process fluid remaining inside the instrument's process connection must not be dispersed in the environment because it could be dangerous for people and the environment. If toxic fluids are involved extreme care must be taken.

### 5.3 Recalibration

If after recalibration results are different from the nominal values declared on the catalogue sheet, the recalibration procedure should be repeated. We recommend returning the instrument to NUOVA FIMA for recalibration through the service **Product Return**.

**NUOVA FIMA isn't responsible for non authorized intervention on the instrument. In this case the contract warranty and the CE Conformity Declaration will be no longer valid.**



### 6. Dismounting and disposal

In case of sediment, viscous or crystallizing or polymerizing process media, it is recommended cleaning the diaphragm using a solvent compatible with the sediment nature. Just remove deposits from the diaphragm with a soft brush and a suitable solvent. Do not use aggressive cleaning agents. Do not damage the diaphragm with sharp edged tools. Do not use powerful water jets for the diaphragm cleaning.

Some models are prearranged for cleaning operations because they are flushed diaphragm seals or have an intermediate ring provided with a plug for cleaning. Models with diaphragm welded to the upper body can be disassembled for cleaning. The gasket between upper and lower body must be replaced during the remounting operation. Models with a mechanical tightness cannot be dismounted and must be either disposed of or returned to Nuova Fima for cleaning or maintenance.

For disposal we recommend separating the diaphragm seal from the instrument, emptying the filling circuit, removing the window and the plugs then disposing of it as aluminium and stainless steel. The fluid remaining inside the instrument could be toxic and harmful.