



Industrial instrumentation for Pressure and Temperature

User Manual

OM BOURDON TUBE PRESSURE GAUGES ATEX VERSION 2D0 ZONES 1, 2, 21, 22

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1. Safety

- The instrument works in safe conditions when correctly selected and installed in the system and when rules concerning the product, as well as the maintenance procedures established by the manufacturer, are respected. The user is fully responsible for the product installation and maintenance.
- This instruction manual forms an integral part of the supply. Therefore, it has to be read carefully before installation and use of the instrument and stored in a safe place.
- In order to choose an instrument model which matches your needs perfectly, please read the most updated product catalogue sheets available on our official website www.nuovafima.com
- If the instrument is used improperly, it may be affected by failure and be harmful to the personnel and to the plant.
- The instrument selection, installation and maintenance must be carried out by operators able to recognize what conditions might affect negatively the instrument's ability to operate and possibly lead it to premature failure. Therefore, they must be trained as qualified technicians capable of observing the plant's regulations.

2. Directive

The OM pressure gauges conform to the Essential Health and Safety Requirements laid down in European Directive 2014/34/EU Group II, Category 2G or 2GD equipment in the T6...T1 temperature class

VERSION	MARKING
2D0 (gases and dusts)	II 2G Ex h IIC T6...T1 Gb CE Ex II 2D Ex h IIC T85°C...T450°C Db 0°C ≤ Ta ≤ 60°C

This instrument is NOT suitable for ZONES 0 and 20.

EMC Directive 2014/30/EU on electromagnetic compatibility does not apply to this product.
Under the terms of directive PED 2014/68/EU, NUOVA FIMA pressure gauges are classified into 2 categories: PS ≤ 1000 bar: these instruments must be designed and manufactured according to the SEP practice - Sound Engineering Practice.
PS > 1000 bar: these instruments must satisfy the essential safety requirements required by the PED directive. They are classified as category I and certified according to Form A.

3. Standards

NUOVA FIMA's instruments are designed and manufactured to comply with the safety requirements required by the international regulations in force some of which are reported in this manual. In order to perform installation and commissioning of the instruments, it is necessary to know and to comply fully with the following standards: EN837-1, EN837-2, ASME B40.1, UNI EN 1127-1, UNI CEI EN ISO 80079-36, UNI CEI EN ISO 80079-37.
All instruments are subjected to calibration regarding national and/or international samples according to regulations established by the UNI EN ISO 9001:2015 quality management system.

4. Operating principle

The diaphragm seal is elastic and deforms according to the pressure level it receives. Pressure is transmitted to the tube sensing element employing a separating fluid.
The tube-sensing element moves linearly according to the pressure applied. A tie rod connects the bourdon tube to a mechanism capable of transforming the linear movement into a rotating one and then transmitting it to a pinion. The pointer is aligned on the pinion and shows the pressure value on a graduated scale engraved on a 270° amplitude dial. The filling liquid of the case dampens the vibrations produced by the components in movement.

5. Materials

Wetted materials are manufactured in stainless steel AISI 316L while the case is in stainless steel AISI 304 or AISI 316 L. Gaskets and blow-out vents are in EPDM; the window is in safety glass; the dial and the pointer are in aluminium. The liquid filling the case is glycerine; the separating fluid is food oil.

6. Data sheets

Detailed information about the construction and the operating features as well as the dimensional drawings, can be found in the OM model pressure gauges for homogenizers, 2D0 execution for Gases and Dusts catalogue sheet.

7. Function

The very function of this instrument is to show the local indication of the relative values of the pressure developed by homogenized fluids.
The instrument is triggered neither during its normal working nor when a malfunction takes place. It has to be used properly within the limits of use as described below.

8. Intended use limit

Max surface temperature – The fluid temperature is the only cause of the high surface temperature. The temperature resulting from the ambient temperature and the process fluid temperature combined must be lower than that established by the ATEX temperature class and should not be harmful to the instrument functioning.
Therefore, the fluid temperature (Pt) must be kept within the values shown in the table below:

Class (Tmax)	Pt (°C)
T6 (85°C)	70
T5 (100°C)	85
T4 (135°C)	120
T3 (200°C)	120 (*)
T2 (300°C)	
T1 (450°C)	
(*) 150 °C max for 1 hour during the cleaning phase (CIP) and sterilization (SIP)	

Ambient Temperature – the instrument is designed to work safely at an ambient temperature between 0...60 °C.

Model – OM model instruments are considered as type S1 (according to standard EN837-1) when they are provided with a safety blow-out vent which opens when pressure inside the case is beyond the safety level.

Working pressure – The instrument is designed to work at a dynamic or pulsating pressure of 75% of the Full-Scale Range.

Chemical compatibility – verify the compatibility level between the process fluid and the wetted parts materials and between the atmosphere and the exposed parts material. An IP65/67 protection level for a better degree is recommended for better protection. This mechanical construction can be employed with process fluids which are compatible with AISI316L stainless steel.

Overpressure – Not applicable.

Ambient pressure – this instrument is designed to work with atmospheric pressures between 0,8 and 1,1 bar A.

Maximum Allowable Operating Pressure of an Assembly – The maximum allowable pressure (AP) of an Assembly is determined by the AP of every component. To calculate the AP of an assembly, simply select the lowest value of each component. For safe operation, the AP of the assembly should not be exceeded.
To determine the maximum allowable pressure of a standard product, please consult the datasheet available on the website www.nuovafima.com. For products not included in the NUOVA FIMA catalogue, please refer to the contractual documents.

Protection level – The protection degree is shown as recommended by the EN 60529 standard concerning the condition where the ring is airtight, the plugs are intact and positioned properly in their seat: IP65/67.

Liquid-filled Cases – Liquid filling is generally used to dampen the vibrations of moving parts due to vibrations and/or to pulsations.
To prevent leakage of fluid from the case, instruments are manufactured and delivered properly sealed. Particular care must be taken in selecting the filling liquid used as well as the relevant use limitations in terms of ambient temperature.

Filling liquid	Ambient temperature
Glycerine 98 %	0°C...60°C

9. Improper use

The following applications can be potentially harmful and must be carefully considered:

- Systems working with corrosive fluids – (1)
- Systems working with oxidant fluids – (2)
- Systems where instruments are interchangeable are at risk of dangerous contaminations – (2)
- Systems producing vibrations – (3)

Failure for corrosion (1) – This condition may develop when the sensing element materials are subjected to a chemical attack coming from the substances composing the fluid to be measured or from the atmosphere surrounding the pressure system.

When this kind of failure occurs, fluid starts leaking locally in spots or a fatigue crack starts developing because of the material weakening. The sensing element is subjected to strong mechanical stress because it is usually quite thin. Therefore, it should be chemically compatible with the media to measure. None of the most common materials is immune from a chemical attack whose power can be influenced by concentration, temperature and the type of mix of chemical substances.

Failure for explosion (2) – If powerful thermal energy is released due to the chemical reactions between the separating oil and the process oxidant agents causing a crack of the separating membrane, a failure for explosion may take place. It is generally accepted that this kind of failure is impossible to foresee. If the chemical reaction involves the sensing element, located in a proper case, it may splinter and fragments are projected all around.

If oxidant agents are involved in the process, DO NOT install this instrument.

Failure for vibrations (3) – Most commonly, the instrument's parts in motion are completely worn out by vibrations which cause a progressive accuracy loss and, subsequently, the total stop of the pointer.

10. Transport

Although properly packaged, instruments' features might be affected during transport, a check before use is strongly recommended.

It is possible to check if the calibration is correct by isolating the instrument from the process through an interception valve and verifying that, after having the pipe drained, the pointer stops within the zero sign (unless the temperature is very different from 20°C)

If the pointer misses the zero it means that the instrument is severely damaged and has to be inspected.

11. Storage

Instruments must remain in their original packages until installation and should be stored indoors, in damp-proof places. When instruments are packaged in special containers such as tar paper-wrapped wooden boxes or moisture barrier bags, it is preferable to store them indoors, protected from the atmospheric agents. Containers' conditions must be checked every 3-4 months especially if they are stored outdoors. The storage area temperature should be between -20 and 65 °C unless otherwise specified in the relevant catalogue sheets.

12. Installation

OM model pressure gauges, 2D0 execution must be installed following the directions of the European standard EN837-2, preventing the electrical connections are slack. The instrument should be positioned where magnetic and electromagnetic induction, ionizing radiations, ultrasounds and sun exposure do not increase the surface temperature of the instrument. All instruments should be installed so that the dial is in a vertical position unless otherwise shown on the tag. A 20 mm minimum distance from any other object should be guaranteed to allow the safety blow-out vent to operate. The pressure connection must be airtight and this has to be verified when pressure is let in for the first time. The installation and fixing of the accessories must be checked as well.

Equipotentiality – The instrument has to be made equipotential to the system where it is installed through an ohmic contact between the threaded process connection and the system connection which has to be a metal one and connected to the ground.

13. Use

The user must be aware of the risks due to the chemical and physical characteristics of the gas, vapours and dust which are present in the plant and proceed to an initial close check before commissioning.

Commissioning – The commissioning procedure should always be carried out with extreme care to prevent pressure spikes or sudden temperature variations. Therefore, the maximum homogenizer process operating pressure should be reached gradually.

The use of instruments useful to measure values close to zero is not recommended as in that area the accuracy tolerance may be a large percentage of the pressure applied. That is why these instruments are not recommended to show the pressure remaining in big containers such as tanks, autoclaves or similar because the pressure remaining inside of them may be

harmful to the operator even though the instrument shows pressure zero. It is strongly advisable to add a ventilation device on tanks to reach pressure zero before removing tops, and connections or before acting similarly.

Vents – The filling and blow-out vents should not be removed during operation.

14. Possible Malfunctions

- **No indication (pointer on zero)**: absence of filling oil.
- **Pointer blocked on a value or beyond the graduated scale**: overpressure, temporary or permanent reading error.
- **Higher Error of indication than the one declared on the instrument**: altered calibration
- **Safety plug ejection**: overtemperature; possible breaking/cracking of the sensing element.

15. Maintenance

A specific and accurate maintenance program should be developed and carried out by qualified technicians to preserve the original features of the instruments throughout time. Mechanical constructions should be maintained to protect the instrument from high temperatures as well as from fire and explosion risks due to misfunctions which may occur during adaption.

prevent risks coming from high temperatures. due to high temperatures as well as to prevent fire and explosion danger due to possible misfunctions during operation.

General check – The window should not be cracked. The filling plug and the blow-out vent should be properly and correctly positioned.

Routine check – Instruments used on plants operating in severe working conditions (vibrations, pulsating pressures, corrosive or combustible and flammable fluids) should be replaced according to the maintenance programme. The state of the sensing element should be checked every 3/6 months, as well as the indication accuracy, the level of corrosion of the sensing element (for fluid diaphragm) the seal on the gaskets, and the presence of condensation inside the case. If the instrument does not operate properly, an extra check is advisable.

Dust deposits on the instrument should not be thicker than 5mm otherwise they must be removed and the instrument cleaned using a cloth soaked in a water and soap solution.

Removal – Before proceeding to the disassembling of the instrument, the homogenizer must be completely off and the system blow-out vents must be open.

Do not separate the instrument from the diaphragm seal. If the filling liquid leaks, the assembling can no longer work and must be returned to proceed to a new filling of the separation circuit.

Detailed check – The testing fluid should be compatible with the fluid to be measured in the pressurised system. To ensure that the sensing element is undamaged, fit the instrument on a pressure generator, provided with a shut-off valve between the two devices. Submit the instrument to the maximum pressure allowed and disconnect it from the pressure source by closing the shut-off valve. If leaks occur on the sensing element, the pointer will slowly return to zero. To check the accuracy in indication, a stable pressure should be generated in the laboratory and applied to the instrument and to a laboratory pressure gauge or primary pressure gauge. The accuracy of the latter must be 4 times higher than the nominal accuracy for the instrument being checked. The values shown by the two instruments during the pressure rise and fall allow to establish the non-linearity, the hysteresis, and the repeatability for the instrument under test.

Check the gaskets' condition and the IP protection level.

Recalibration – If after the calibration check measured values are different from the nominal values shown in the catalogue, the instrument should be recalibrated. The instrument has to be returned to NUOVA FIMA for recalibration through the **Product Return service**.



In case of unauthorized modification and use of an instrument, NUOVA FIMA won't be responsible for it and the relevant CE Declaration of Conformity as well as the instrument warranty will not be valid anymore.

16. Disposal

It is recommended to remove windows and plugs and dispose of the instrument as aluminium and stainless steel. The fluid remaining inside the instrument process connection may be harmful and toxic.