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### 3. Standards

NF instruments are designed and constructed to comply with the safety requirements prescribed by the international regulations in force, some of which are given in this manual. A full knowledge of these and complete compliance of the same are necessary for installing and commissioning the instrumentation: EN837-1, EN837-2, ASME B40.1, UNI CEI EN ISO 80079-36, UNI CEI EN ISO 80079-37, UNI EN 1127-1, UNI EN ISO 15156-3/MR0175.

All instruments should be calibrated with reference to national and/or international samples according to regulations established by the UNI EN ISO 9001:2015 quality management system.

### 4. Operating principle

The elastic membrane element moves linearly as a function of the difference in pressures applied to its surfaces. A system of leverage links it to a movement, which transforms linear movement into a rotary movement, transmitting it to a pinion. The pointer, keyed on the pinion, indicates the pressure value on a graduated scale, engraved on the dial with a width of 180° or 270°

### 5. Materials

The wetted are made of AISI 316L stainless steel or Monel 400 or Hastelloy C. The housing is made of AISI 304 or AISI 316 L stainless steel. Gaskets and the blow-out vent are in EPDM, VITON or SILICONE RUBBER. Models MD15, 16 and 17 can be filled with silicon or fluorurate fluids. The transparent part is made of safety glass. The dial and indicator are made of aluminium.

### 6. Data-sheet

Detailed information about the construction and the operating characteristics, as well as drawings showing the overall dimensions, are available in the catalogue sheets regarding MD differential pressure gauges, 2G2, 2G0 model for gas and 2D2, 2D0, 2D5, 2D6 model for gas and dusts:

DATA-SHEET	
Mod.	DN
MD13	150
MD15 – MD16 – MD17	100-150

### 7. Functioning

The instrument is intended to operate for local differential pressure measuring.

This instrument cannot cause fires when operating in normal conditions or when not in use, Operation within the operating limits is recommended. Any misuse of the instrument should be prevented.

### 8. Intended use limit

**Maximum surface temperature** - It may be produced by the fluid temperature only. The temperature produced by the combination between the ambient temperature and the process fluid temperature must be below the one intended for the ATEX temperature class, and should not affect the instrument operating functioning.

The process fluid temperature (Pt) must, therefore, be kept within the limits shown in the table below:

Class (Tmax)	Tp (°C)	
	Instrument case: Dry	Instrument case: Vented / Filled
T6 (85°C)	70	65
T5 (100°C)	85	
T4 (135°C)	120	
T3 (200°C)	150	
T2 (300°C)		
T1 (450°C)		

**Ambient temperature** - This instrument is designed to be used in safe conditions at the following ambient temperatures:

- 0°C...60°C (2G0 and 2D0 version)
- 20°C...60°C (2G2 and 2D2 version)
- 53°C...60°C (2D5 version)
- 60°C...60°C (2D6 version)

**Model** - In order to maintain the best safety conditions for the instrument, the type of fluid to be measured and the maximum static pressure should be taken into account. In order to choose the most suitable instrument, see the table below:

Mod.	PN (1)	Operative principle	Tipo fluido
13	100	Single diaphragm	Liquids
15	200	Double diaphragm	Liquids / gas
16	100		
17	400		

(1) Max static pressure : expressed in BAR, whose value depends on the full scale range. See tables on data-sheets.

**Operating pressure** - This instrument is designed to operate at a static pressure up to 100% of the scale range. When dynamic or pulsating pressure is involved, the working pressure should not exceed 90% of the full scale range.

**Chemical compatibility** - The chemical compatibility between the process fluid and the materials used for the wetted parts, and between the atmosphere and the materials used for the exposed parts must be checked, as well as the chemical compatibility between the process fluids and the fluid used to fill the measuring system. It is advisable to select an IP65/67 protection level for a better protection. This instrument can be used with process fluids that are compatible with AISI 316L stainless steel, or with Monel400 and Hastelloy C upon request. In all other cases pressure gauges provided with fluid diaphragm and which wetted parts are made of a compatible material are recommended.

**Ambient pressure** - This instrument is designed to work at atmospheric pressures ranging 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 standard product, please consult the data sheet available on the web site [www.nuovafima.com](http://www.nuovafima.com). For product not included in the NUOVA FIMA catalogue, please refer to the contractual documents.

**Overpressure or Static Pressure** - These values are expressed as bilateral when the pressure is applied to both inlets simultaneously and as unilateral when the pressure is applied to just one inlet. The gauge is built to operate with overpressures for service fluctuations of short duration. If unilateral overpressure occurs, it may happen that the O-Rings adhere to the stops very strongly and not detach themselves properly even when the pressure differential is reduced.

**Protection level** - According to CEI EN 60529 standard. These refer to hermetically sealed ring conditions, with built-in caps located in the right place. Values are shown in the table below:

Version	IP rating (instrument case)
2G2-2G0	IP 55 (dry)
2D2-2D0	IP65/67 (dry) (filled)
2D6	IP65/67 (filled)
2D5	IP65/67 (vented)

**Liquid filled cases** - Liquid filling is generally used to dampen the vibrations of the parts in motion due to vibrations and/or pulsations. When oxidant fluids such as oxygen, chlorine, nitric acid, hydrogen peroxide are involved, the dampening liquid must be chosen very attentively because the risk of a chemical reaction, flammability or explosion of the instrument exists when dealing with oxidant agents. In this case the use of fluorine or chlorine-based filling liquids is recommended. In order to prevent any leakage of damping liquid from the case, these instruments are manufactured and delivered sealed. The filling liquid should be selected carefully taking the use limitations in terms of ambient temperature into account according to the table below:

Filling liquids	Ambient temperature
Glycerine 98%	0°C...60°C
Silicon oil	-20°C...60°C
Low temperature silicone oil	-60°C...60°C
Fluorurate fluid	-20°C...60°C

**Instruments with double diaphragm** - The main feature of instruments provided with double diaphragm (MD15-MD16-MD17) is the filling of the internal circuit with specific oils.

If the instrument is intended to be used with oxidant fluids such as oxygen, chlorine, nitric acid, hydrogen peroxide, it is advisable to fill the internal circuit of the instrument with neutral fluorurate fluid.

### 9. Wrong uses

The following applications must be considered potentially dangerous and require a detailed description:

- Systems containing corrosive, liquid or gaseous fluids (1)
- Systems containing oxygen (2)
- Systems in which interchangeable pressure gauges may give rise to dangerous contamination (2)
- Systems containing toxic or radioactive fluids in a liquid or gaseous state (2)
- Systems producing vibrations (3)
- Systems containing combustible / flammable fluids (4)
- Systems containing vapour under pressure (5)
- Systems containing compressed gas (1) (5)

**Corrosion failure (1)** - When the material of the measuring element is weakened by the corrosive chemicals present either in the media inside or the environment around it, a corrosion failure may occur producing a pinhole leakage or early fatigue failure due to stress cracking brought about by the chemical deterioration of the material.

The sensing element is generally thinner, therefore works under significant mechanical stress. Chemical compatibility with the fluid to be measured should be considered. None of the commonly used materials can be immune to chemical attack, and various factors may affect the extent of this phenomenon such as: concentration, temperature and the type of mixture of the various chemical substances.

**Explosion Failure (2)** - When a violent release of thermal energy due to a chemical reaction, such as adiabatic compression of oxygen in the presence of hydrocarbons occurs, the instrument may explode. It is generally accepted that the effects of this type of failure cannot be prevented. Even the use of solid-front instruments cannot prevent the fragments from propelling in all directions. - Pressure gauges suitable for use with oxygen are marked "Oxygen - Use no Oil" and/or with a crossed out oil can symbol on the dial. The instruments are supplied already washed and degreased and packed in polyethylene bags.



The user must take the necessary precautions to ensure that the connection and the elastic element are kept clean after the pressure gauge has been unpacked.

**Vibration Failure (3)** - The most common vibrations may wear the movement components out because of high cyclic loading resulting in a gradual loss of accuracy and, eventually, in a failure of the pointer in indicating a pressure change.

**Crack failure (4)** - When the instrument is used improperly or the sensing element is cracked or broken, when the process fluid is combustible or inflammable and the instrument shouldn't operate because an explosive atmosphere may be generated inside and around the instrument case. In cases like these, it is extremely important that the worn-out parts of the instrument are replaced preventing the fluid from leaking.

**Temperature (5)** - The temperature inside and outside the instrument may increase significantly due to rapid compression of a gas measured, or an impact wave in a liquid measured. Internal overheating caused by adiabatic compression or by an impact wave can lead to spontaneous combustion of fluids measured, or ignition of explosive atmospheric conditions outside the casing. The surface temperature should not exceed the limit set for the temperature class required in the area in which the instrument is installed.

### 10. Transportation

The instruments may be affected during transport, despite adequate packing. An accurate check is required before use. Calibration can be checked by isolating the instrument from the process by means of the shut-off valve and checking that the pointer returns to the zero mark (unless the temperature is far from 20°C). If the pointer doesn't return to zero it means that the instrument is seriously damaged and must be repaired.



### 1. Safety

The safest ambient conditions for the instrument to operate properly depend on the correct selection and installation of the it in the system, as well as on the compliance with the maintenance procedures set out by the manufacturer. The user is entirely responsible for a correct installation and maintenance.

This manual is supplied with the instrument and should be properly kept. It is advisable to read it carefully before using this product.

In order to specify the functional and constructive characteristics of the instruments, it is advisable to consult the most up-to-date version of the catalogue and data sheets which are available on the website [www.nuovafima.com](http://www.nuovafima.com)

Improper use may damage the instrument and the operator as well as the whole plant.

The managers responsible for the selection, installation and maintenance of the instrument should be aware of the environmental conditions that may negatively affect the instrument operational activity and which may lead to its premature failure. Therefore, only technically qualified and trained staff should carry out the procedures called for in the plant regulations.

### 2. Directives

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

VERSION	MARKING
2G2 (gas)	CE Ex II 2G Ex h IIC T6...T1 Gb -20°C ≤ Ta ≤ 60°C
2G0 (gas)	CE Ex II 2G Ex h IIC T6...T1 Gb 0°C ≤ Ta ≤ 60°C
2D2 (gas and dust)	CE Ex II 2G Ex h IIC T6...T1 Gb II 2D Ex h IIC T85°C...T450°C Db -20°C ≤ Ta ≤ 60°C
2D0 (gas and dust)	CE Ex II 2G Ex h IIC T6...T1 Gb II 2D Ex h IIC T85°C...T450°C Db 0°C ≤ Ta ≤ 60°C
2D5 (gas and dust)	CE Ex II 2G Ex h IIC T6...T1 Gb II 2D Ex h IIC T85°C...T450°C Db -53°C ≤ Ta ≤ 60°C
2D6 (gas and dust)	CE Ex II 2G Ex h IIC T6...T1 Gb II 2D Ex h IIC T85°C...T450°C Db -60°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. According to directive PED 2014/68/EU NUOVA FIMA differential pressure gauges are classified into 2 categories:

- PS ≤ 200 bar these instruments do not meet the essential safety requirements. They are designed and constructed in accordance with "Sound Engineering Practice" and are not required to bear the CE mark;
- PS > 200 bar these instruments should comply with the essential safety requirements prescribed by the PED, are classified as Category 1 and certified according to Form A. They must bear the CE mark.

### 11. Storage

Instruments should stay packed in their original standard box until installation and stored in dry, indoor spaces. If instruments are supplied with special packaging (in wooden boxes lined with tar paper or in barrier bags), it is always best to keep them indoor, and always protected from the atmospheric agents. The condition of the packaging materials must be checked every 3-4 months, especially if the boxes are exposed to the weather. The storage area temperature should range between 20°C and 65 °C, except if otherwise specified in the catalogue data sheets.

### 12. Installation

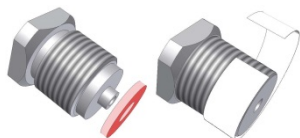
2G2, 2G0, 2D2, 2D0, 2D5, and 2D6 version MD differential pressure gauges must be installed in compliance with European Standard EN 837-2.

The instrument should be installed far from magnetic and electromagnetic induction, ionising radiation, ultrasound and sunlight in order to prevent the instrument surface temperature increase.

Fluids to measure should not contain solids in suspension, air bubbles, or undissolved gas.

To facilitate removal for maintenance purposes, a shut-off valve should be mounted between the instrument and the plant (root valve) as well as a 3-way manifold for setting up the instrument. We recommend fixing the instrument to the wall or a pole using brackets. All instruments must be mounted in such a way that the dial is vertical.

The pressure connection must be watertight. If the pressure connection has a cylindrical thread, the seal is achieved using an O-ring clamped between the two flat sealing surfaces, one on the pressure connection and the other on the instrument's process connection. If the pressure connection has a tapered thread, the seal is achieved by simply screwing the connection onto the coupling, through the mating of the threads, for at least 5 threads.



Wrapping a PTFE tape around the male thread before coupling is suggested (see Fig above). In both cases the torque must be applied using two hexagonal spanners, one on the flat faces of the instrument/process coupling and the other on the pressure connection. When pressurising the system for the first time, check the tightness of the connection seal.

**Effect of liquid columns** - The installer must be aware that, if the instrument is loaded with a liquid column, it needs to be calibrated to compensate this weight. This is the case of an instrument fitted above or below the pressure connection to which it is connected. Gas and steam do not overload the instrument.

In this case the instrument should be mounted above the pressure socket to prevent condensate which may affect the readings. In order to measure liquid levels using differential pressure switches the instrument should be installed at least 50 cm below the tank's minimum level, and the difference in height between the tank's minimum level and the level of the condensate tank must be equal to or slightly less than the instruments differential scale range.

**Temperature** - The fluid should not freeze or crystallize inside the sensing element. However, if the instrument is intended to measure high temperature peaks, the use of a capillary is recommended. A 1,5-2 Meter-long tube decreases the actual working temperature approximately

to the ambient one. If the fluid nature does not allow the use of a reduced section tube, it is often necessary to add a capillary to connect the process fluid to the instrument provided that the transmission fluid is suitable for the process fluid temperature.

**Adiabatic compression** - For gaseous fluids which may be compressed rapidly, the range of pressure variation must be decreased until the maximum surface temperature drops to the permitted range. When working with gaseous fluids pressure should be increased as slowly as possible. Suitably sized bottlenecks or shock-absorbers should be installed until the 1 sec. raise time is reached through pressure steps 80% of the full range value.

**Mechanical stress** - Pressure gauges should not be subjected to mechanical stress. If the installation points receive mechanical stress, the instrument should be installed remotely and connected through flexible hoses. - The instruments selected should be surface, wall or panel mounting type.

**Vibrations** - When the pressure gauge support is subject to vibrations, various solutions may be considered, such as:

a) the use of liquid-filled gauges; b) if the vibrations are strong or irregular, the instruments must be mounted at a distance and connected using a flexible hose or tubing. Vibrations are indicated by continuous and irregular fluctuations of the pointer.

**Dynamic and cyclical pressures** - Not admitted.

**Equipotentiality** - The instrument is equipotent with the plant when it is mounted on by means of an Ohmic contact between the threaded process connection and the pressure connection.

### 13. Accessories

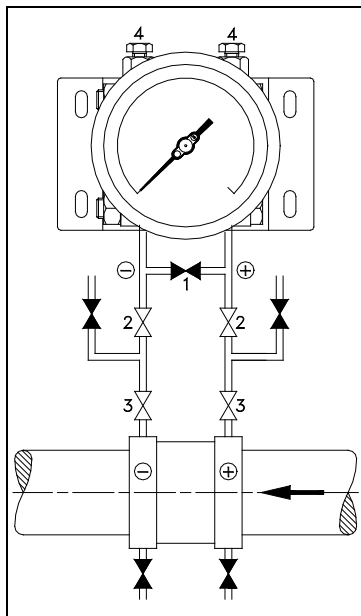
**Diaphragm seals:** They are required for transmitting the pressure exerted by corrosive, hot, high viscosity or crystallisable process fluids. See the relevant instruction manual: MGS9.

Valves, loops, blow-out vents, and pipe fittings and connection piping, and pressure stabilisers: See the relevant instruction manual: MP.

### 14. Use

The user must be aware of the risks related to the chemical and physical characteristics of the gases, vapours, and/or powders in the system, and carry out a thorough preliminary check before putting into service.

**Setting up** - The unit is to be set up carefully to avoid pressure surges or sudden changes in temperature. Despite the high resistance to overloading on both sides of the instrument, the valves must be manoeuvred to prevent unilateral overloading as much as possible. **Shut-off valves must therefore be opened slowly.** Before proceeding with the complete set up of the instrument, make sure that the connection line is carried out as per diagrams shown in the figure on page 3. Make sure that Verify that reading is not affected by narrowing, sediments, air bubbles, or condensate.



Follow these instructions:

1. Open by-pass valve "1";
2. Open root valve "3";
3. Open shut-off valve "2" on the positive side (+) and the instrument will read a pressure of zero;
4. Close by-pass valve "1";
5. Open shut-off valve "2" on the negative side (-).

### Setting the zero:

1. Close the shut-off valves "2" on the positive (+) and negative (-) sides;
2. Open by-pass valve "1";
3. If zeroing is not achieved, open the bleeding caps on the top or side of the block that contains the sensing element. Fill the pressure chambers up with fluid and recharge if necessary;
4. If after bleeding the pointer has moved away from zero less than 10% of the scale range, reach the zero by turning the micrometric adjustment. If zero cannot be achieved please return the product to the manufacturer.

### 15. Possible malfunctions

- **No indication (pointer on zero):** Root valve closed. Indication is still.
- **Pressure pipes blocked. Root valve closed. Indication stuck off the graduated scale:** Exceeding pressure; temporary or permanent reading error.
- **Error with indication exceeding the one declared for the instrument:** Calibration altered.
- **Rapid oscillation of the pointer:** Damaging pulsation in the process fluid. Destructive mechanical vibrations.

### 16. Maintenance

A specific maintenance programme should be drawn up in order to perform a proper maintenance of the instrument and of its original features condition. Mechanical components must be maintained and protected from high temperatures and the risk of fire and explosion due to any malfunction should be prevented.

**Detailed check** - The window should be intact, without cracks. Filling plug and blow out vent should be placed in the right position. The pointer should be within the graduated scale.

**Routine check** - Instruments used on plants operating in severe working conditions (vibrations, pulsating pressures, corrosive or combustible / inflammable 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 degree of corrosion on the sensing element (for fluid diaphragm) the seal on the gaskets, and the presence of condensate 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 by means of a cloth soaked in a water and soap solution.**

**Removal** - Do not loosen the bolts of the containment plates of the sensitive element.

Instruments should be isolated from the system by closing the root valve, and the pressure inside the instrument must be reduced to zero by opening the vent in the system. The process fluid left in the instrument process connection must not be disposed in the environment, not to cause pollution or harm people. Dangerous and toxic fluids must be handled with care.

**Detailed check** - The testing fluid should be compatible with the fluid to be measured in the pressurised system. Fluids containing hydrocarbons must not be used when the process contains oxygen or any other oxidising substance. To check the integrity of the sensing element, fit the instrument on a pressure generator, 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 there are any leaks on the sensing element, the pointer will slowly return to zero. In order to check the accuracy in indication, a stable pressure should be generated in laboratory and applied to the instrument which is being checked 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 indicated 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 condition of the gaskets and the IP protection level.**

**Recalibration** - If the calibration check produces measured values that are different from the nominal values shown in the catalogue, the instrument should be recalibrated. It is advisable to return the instrument to NUOVA FIMA for recalibration following the **Product Return** service.



NUOVA FIMA does not accept any responsibility for misuse of the instruments or for instruments operating in non-authorised working conditions. In this case the CE Declaration of Conformity and Contractual Guarantee is null and void.

### 17. Disposal

Windows and caps should be removed and disposed of as aluminium and stainless steel. The fluid remaining in the instrument may be dangerous or toxic.



## DICHIARAZIONE UE DI CONFORMITÀ EU DECLARATION OF CONFORMITY Direttiva 2014/34/UE - Directive 2014/34/EU

Apparecchi e sistemi di protezione destinati ad essere utilizzati in  
atmosfera potenzialmente esplosiva

**Equipment and protective systems intended for use in potentially explosive  
atmospheres.**

NUOVA FIMA s.r.l. dichiara sotto la propria responsabilità che i manometri differenziali in esecuzione 2G2, 2G0, 2D0, 2D2, 2D5 e 2D6 di seguito elencati sono in accordo con la direttiva

NUOVA FIMA s.r.l. declares on its sole responsibility that the following differential pressure gauges 2G2, 2G0, 2D0, 2D2, 2D5 and 2D6 version comply with the above-mentioned directive

Modello Model	DN DS	Campo Range	Tipo custodia Case type	Versione Version	Marcatura Marking
MD13	150	Tutti All	Secco IP55 Dry IP55	2G2	CE Ex II 2G Ex h IIC T6...T1 Gb -20°C ≤ Ta ≤ 60°C
MD15 MD16 MD17	100 150	Tutti All	Secco IP55 Dry IP55	2G0	CE Ex II 2G Ex h IIC T6...T1 Gb 0°C ≤ Ta ≤ 60°C
MD13	150	Tutti All	Secco IP65/67 Dry IP65/67	2D2	CE Ex II 2G Ex h IIC T6...T1 Gb II 2D Ex h IIIC T85°C...T450°C Db -20°C ≤ Ta ≤ 60°C
			Riempita Filled		
MD13	150	Tutti All	Riempita Filled		
MD15 MD16 MD17	100 150	Tutti All	Secco IP65/67 Dry IP65/67	2D0	CE Ex II 2G Ex h IIC T6...T1 Gb II 2D Ex h IIIC T85°C...T450°C Db 0°C ≤ Ta ≤ 60°C
			Riempita Filled		
MD 13	150	Tutti All	Ventilata Vented	2D5	CE Ex II 2G Ex h IIC T6...T1 Gb II 2D Ex h IIIC T85°C...T450°C Db -53°C ≤ Ta ≤ 60°C
			Riempita Filled	2D6	CE Ex II 2G Ex h IIC T6...T1 Gb II 2D Ex h IIIC T85°C...T450°C Db -60°C ≤ Ta ≤ 60°C

### Norme di riferimento - Reference standards

- UNI EN 1127-1:2019
- UNI CEI EN ISO 80079-36:2016
- UNI CEI EN ISO 80079-37:2016

Il fascicolo tecnico è depositato presso l'Organismo Notificato:  
The technical file is recorded at the following Notified Body:

**ICIM - 0425**

Il fascicolo tecnico è denominato:  
The technical file is named:

**TF9 (2008 ATEX 1808)**

La revisione e la data di revisione sono:  
The revision number and the revision date are:

**Rev.1 - 11/01/2021**

Il controllo della fabbricazione interna degli strumenti è assicurato dal Sistema Qualità secondo ISO 9001:2015 operante in azienda e certificato da ICIM SpA.

The internal manufacturing process of the instruments is controlled and guaranteed by the current company Quality System according to ISO 9001:2015 and certified by ICIM SpA.

Invorio, 29/01/2021

NUOVA FIMA  
Responsabile ATEX-ATEX Responsible  
F. Zaveri

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Data di emissione 29/01/2021

Edizione 7

Rilasciato da resp. ATEX F. Zaveri