NUOVA FIMA

Industrial instrumentation for Pressure and Temperature

User guide

BOURDON TUBE PRESSURE GAUGE

MGS – MS

MI-MAN-ENG_2
07/2016

1. General information

The instrument described in this manual has been designed and produced in compliance with the following standards:
EN 837-1-2 and ASME B40.1. 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 installation of the gauge in safe conditions. Therefore, reading the following instructions carefully before use is highly recommended.

This instrument operates safely when carefully selected, correctly installed in the system, and used in compliance with the related instructions and the maintenance procedures established by the manufacturer.
The personnel responsible for selecting, installing, and maintaining the instrument must be able to identify conditions that could negatively impact its performance or lead to premature failure. Therefore, they must be technically qualified and properly trained to follow the procedures established by plant regulations.

Standards
Directive P.E.D. **2014/68/EU**
Nuova Fima instruments are designed and manufactured according to the safety rules included in the international safety standards in force. According to the **2014/68/EU** standard, the NUOVA FIMA pressure gauges are classified into 2 categories:
PS ≤200 bar These instruments may not satisfy completely the essential safety standards but must be designed and manufactured according to a SEP-Sound Engineering Practice. No CE marking is required on them.
PS >200 bar These instruments must satisfy the essential safety standards established by the PED, they are classified as category I and they are certified according to Form A. They must bring the CE marking as the one shown below.

CE

1.1 Intended use
These instruments are designed to be used in food, processing, pharmaceutical, and petrochemical industries and for conventional and nuclear power plants. They are built to resist the most severe conditions created by the process medium and by the environment. They are designed to work with non-crystalizing, highly viscous fluids.

2. Installation

Attention	**Before installation, ensure that the instrument has been selected correctly according to the working conditions, the range, the working temperature and the compatibility between the material and the process fluid.**
Attention	**This manual does not concern the instruments as per standard 2014/34/EU (ATEX).**
Attention	**The product warranty is no longer valid in case of unauthorised modifications and improper use of the product.**
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.**
Warning	**Follow the specific safety rules carefully when oxygen pressure, acetylene, inflammable or toxic gas or liquids are involved.**
Attention	**The user is responsible for the instrument installation and maintenance.**
Warning	**Disconnect the instruments only after the depressurization of the system.**
Warning	**The process fluids remaining in the disassembled gauges may affect people, the environment and the system. Proper precautions are highly recommended.**

To verify the working and manufacturing features of Nuova Fima instruments, read the catalogue sheets in their most updated edition available online on
www.nuovafima.com

The instrument installation should be carried out according to standard EN 837-2 (Recommendations for pressure gauge installation and selection)

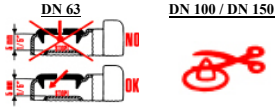
The gauge should be connected to the process system by tightening it with a special wrench at the process connection point, ensuring that no force is applied to the case by hand. For process connections with cylindrical threads, a head gasket compatible with the fluid being measured should be used. If the connection has conical threading, additional sealing materials, such as PTFE tape, should be applied to the threads.
This procedure is not suitable for cylindrical threading.

- Installation must follow **EN 837- 1**, Chapter 8. The user is responsible for any other combination which is not described in the above-mentioned regulation.
- The torching procedure, which is necessary to ensure a suitable tightness, depends on the measuring range, the threading type and the gasket type.

Instrument with marking ⚠3
Instruments with the DIN 11851 connection must be installed using special gaskets type SKS.
Instruments with process connection conformed to ISO 2853 (IDS/ISS) must be installed using gaskets with supporting rings as described in the above-mentioned directive.

- When a low-scale range pressure gauge is installed, it is necessary to ventilate the case according to the instructions shown on the tags applied to the gauge. This procedure allows the internal pressure of the case to be brought back to the atmospheric pressure value.

DN 63 **DN 100 / DN 150**



- In case of fluid leakage during mounting, careful cleaning is highly recommended.
- For gauges with security devices, a free space on the back side measuring at least 20mm should be maintained during installation.
- For gauges with full painting to protect them from corrosive atmospheres, it is essential that the safety device operates properly.
- For gauges with surface mounting and back connection, be sure that the pipe containing the fluid under pressure is connected to the instrument connection without tension.
- To ensure an accurate measuring procedure, the working limits described in the catalogue sheets must be respected.
- These instruments should be installed where vibrations are taking place. If the mounting point is unstable because of vibrations, the instrument should be supported using a clamp, a flange or a flexible capillary when possible.
- If vibrations cannot be prevented during installation, we suggest choosing liquid-filled instruments.
- According to standard EN 837-1 /9.6.7, the instrument mounting must be vertical. Different calibrations and mounting (when requested) are shown on the dial.
- Instruments must be protected from significant ambient temperature variations.
- Instruments must be protected from sun radiations during operation to prevent overheating.
- Liquid-filled instruments working within temperatures under 20 °C may have higher response times because of the filling liquid's increased viscosity.
- During installation, ensure that the fluid and the ambient temperatures are not affected by heating radiation, which may affect the real values. The temperature influence on the accuracy value has to be taken into account.
- During the first operating procedure, pressure spikes should be prevented. The interception valves should be opened slowly.
- The use of instruments measuring zero values is not recommended, especially with gauges in which the first section of the scale has been removed.
-These instruments should not be reused on plants operating with different process fluids to prevent chemical reactions during which explosions might occur because of the contaminated instrument's wetted parts.
-If the pressure indication remains steady for a long time, the pipe conveying pressure to the sensing element might be clogged. When the pressure level is zero, the gauge must be insulated through an interception valve before disassembly.

3. Use limits

3.1 Process and ambient temperature
This standard-type instrument is designed to be used in safety conditions, i.e. in an ambient temperature between –40C° and +65°C. As for the filled model, please see the paragraph "DAMPING LIQUID FILLING"
As for instruments equipped with stainless steel measuring systems, it is necessary to cool the process fluid when the process temperature exceeds 150 °C. In addition, the use of siphons, temperature dissipators or capillaries is recommended. In case of temperatures below 0°C, the use of liquid-filled gauges is recommended to prevent the freezing of some components. The fluid inside the sensing element must not freeze or crystallize.

3.2 Working pressure
The choice of an instrument supporting a working pressure ranging between 25% and 75% of the full-scale range is recommended. The full-scale range should be approximately twice the working pressure value. If the instrument is provided with a small black triangle printed on the dial scale, it means that the working pressure can reach 90% when operating with pulsating pressures and 100% when operating with static pressures.

3.3 Dynamic and Cyclic Pressures
When dynamic or cyclic pressures take place, the pointer starts to oscillate, and the durability of the sensing element and the amplifying movement might be reduced. Therefore, it is necessary to reduce the pulsating pressures by placing a dampener or a reducing valve between the pressure source and the instrument. The harmful effect of pulsations could also be reduced by filling the case with a dampening liquid. An incorrect choice of the instrument may cause a stress breakage.

3.4 Overpressure
Overpressure stresses the sensing element, reducing its durability and accuracy. Therefore, it is always better to use an instrument whose scale range is bigger than the maximum working pressure and which can absorb overpressures and pressure shocks. Pressure shocks can be treated in the same way as pulsating pressures. Overpressure could break the elastic element instantly.

3.5 Vibration
Vibrations can be detected by the continuous and often irregular oscillations of the case and the pointer. When the instrument is exposed to vibrations, the use of liquid-filled pressure gauges is recommended.

3.6 Safety device
In systems working with compressed gas, the use of an instrument with a proper safety device complying with standard EN 837-2 is recommended. In case of unexpected breaking of the sensing element, the compressed gas can expand outside the case through the safety device.

3.7 Damping liquid filling
The damping liquid is generally used to protect the moving parts of the instrument from vibrations. It significantly reduces wear on rotating components and enhances both the instrument's resistance to stress and its readability, preventing sudden pressure drops.
When working with oxidizing fluids such as oxygen, chlorine, nitric acid, and hydrogen peroxide, the selection of the damping liquid must be extremely careful. Oxidizing agents may trigger a dangerous chemical reaction, potentially leading to an instrument explosion. In such cases, a suitable filling liquid must be used to ensure safety.
The choice of damping liquid should also consider the working temperature, the liquid's viscosity, and the desired level of damping.
For specific information on the working temperature range of liquid-filled instruments, please refer to the instrument catalogue sheet.

3.8 Protection within an explosive environment
If pressure gauges are used in a potentially explosive atmosphere, specific procedures must be followed. The directive regarding ATEX products 94/9/CE concerns pressure gauges with electrical devices and mechanical pressure gauges.
To choose the right product, please see the relevant catalogue sheet and manual.

4. Wrong application

4.1 Failure due to Fatigue
If pressure varies frequently, the elastic element's durability may be reduced because of the pointer's oscillating movement. Failures, which could be more dangerous when measuring compressed gas instead of liquids, engage a pressure increase inside the case. At this point, the safety device opens. In case of an operation engaging high pressure, an explosion may develop. The use of a dampening, liquid-filled instrument is recommended. Moreover, to shrink the pressure entrance conduit, a restrictor screw or an adjustable dampener is recommended as well.

4.2 Failure for Overpressure
When compressed gas is involved, overpressure can unexpectedly and severely damage the product. It may lead to an explosion of the instrument, causing debris to be projected in all directions. Although the safety device opening can reduce the impact, it does not always prevent fragments from spreading.
If there is a real risk of breakage due to overpressure, we recommend using a solid front blow-out-back instrument. This model protects the operator from being struck by instrument fragments. Relying on glass alone is insufficient for proper protection; in fact, it often poses the greatest hazard.
Short overpressure pulsations can occur in pneumatic or hydraulic systems, particularly when valves open or close. These pulsations may have an amplitude exceeding the working pressure, and their high velocity can distort instrument readings, making them difficult for the operator to detect. Such pulsations can lead to complete instrument failure or a permanent zero error.
In this scenario, using a choking element can help reduce the amplitude of overpressure spikes transmitted to the sensing element. Additionally, a limiting pressure valve can safeguard the instrument by preventing exposure to pressures exceeding its calibrated threshold.
Bourdon tube pressure gauges can also be designed to withstand overpressure. A clamp inside the gauge prevents the tube from extending beyond safe limits, enhancing durability and safety

4.3 Failure for Corrosion
Compatibility with the process medium is essential in preventing failure due to corrosion. If the sensing element thickness is reduced by corrosion, it works in conditions of stress. None of the most common materials can resist a chemical attack, the intensity of which depends on many factors such as the medium concentration, temperature, and the type of chemical mix. In this case, a suitable diaphragm seal is recommended.
The customer is entirely responsible for the choice of the instrument material, which must be as compatible as possible with the process medium.

4.4 Failure for Explosion
After a violent release of thermal energy due to chemical reaction, such as the adiabatic compression of oxygen in the presence of hydrocarbons, an explosion may occur. Even the use of a solid front gauge cannot prevent the front window of the gauge itself from spreading around.

Pressure gauges suitable for use with oxygen are marked with:

OXYGEN **"Oxygen - No lubrication" and/or they are marked with a crossed-out oil can symbol on the dial**

Instruments are properly cleaned and degreased with special products and packed in polyethene bags. The user must take the necessary precautions to ensure that the connection and the elastic element are clean after unpacking.

4.5 Failure due to Vibration and Shocks
Vibrations generally produce an abnormal deterioration of the parts in movement up to a progressive loss of accuracy and then to a complete stop of the pointer.
Vibrations could also produce stress cracks in the sensing element's structure, producing a liquid leakage and even an explosion.

5. Maintenance

Instruments' original characteristics should be maintained over time according to a special maintenance program which must be developed and managed by qualified technicians.
The maintenance program consists of cleaning the external parts of the instrument using a humid cloth, checking the pressure indication accuracy, checking the gasket's tightness state, checking inside the case to prevent the condensation from developing, checking the glass, the case and the general safety conditions of the instrument.
Heavy work instruments operating in severe conditions (vibrations, pulsating pressures, corrosive or sediment fluids, fuel or flammable fluids) should be replaced according to the maintenance program. In case the instrument does not work properly, it is necessary to proceed to an extra-checking procedure.
Instruments should remain in their original packaging and stocked indoors to protect them from damp. The temperature in the storage area should be between –25 and +65°C unless otherwise indicated.
Even when properly packed, improper handling of instruments may compromise their metrological features. Instruments should always be checked before use. For zero-free instruments, the null-pressure pointer may remain within the zero span, potentially affecting accuracy.

5.1 Routine check
To verify the sensing element conditions, the instrument should be installed on the pressure generator, adding an interception valve between them. The maximum pressure value should be applied to the gauge while the valve isolates it from the pressure source. A slow return of the pointer to zero may indicate a potential leakage of the sensing element.

5.2 Recalibration
If results differ from the nominal values declared on the catalogue sheet after recalibration, the recalibration procedure should be repeated. For this procedure, instruments must be returned to **NUOVA FIMA.**

NUOVA FIMA will not be responsible for all non-authorized interventions on the instrument. In case of non-authorized modification of the instrument, the contract warranty and the CE Conformity Declaration are no longer valid.

6. Disposal

An inappropriate disposal procedure can be dangerous for the environment. The instrument components and packing materials disposal process must follow an eco-compatible procedure and must comply with the national standards. The fluid remaining inside the instrument could be dangerous or toxic to the environment and people.

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