Industrial instrumentation for Pressure and Temperature

User guide

BOURDON TUBE PRESSURE GAUGE

MGS – MS

MI-MAN-ENG_1
01/2014

1. General information

The instrument described in this manual has been designed and produced in conformity to 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 the installation of the gauge in safe conditions. Therefore it is highly recommended to read carefully the following instructions 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..

Standards
Directive P.E.D. **97/23/CE**
Nuova Fima instruments are designed and manufactured according to the safety rules included in the safety international standards in force. According to the **97/23/CE** standard the NUOVA FIMA pressure gauges are classified in 2 categories
PS ≤200 bar these instruments should not satisfy the essential safety standards but they have only to be designed and manufactured according to a SEP-Sound Engineering Practice and they do not have to bring any CE marking.
PS >200 bar these instruments should satisfy the essential safety standards established by the PED, they are classified as category I and they are certified according to Form A. They should bring the CE marking as reproduced below.

CE

1.1 Intended use
These instruments are designed for food, processing, pharmaceutical, petrochemical industries and for conventional and nuclear power plants. They are built to resist to the most severe conditions created by the process medium and by the environment and for those fluids, which have high viscosity and do not crystallize.

2. Installation

Attention	**Before installation be sure that the right instrument has been selected following the working conditions and in particular the range, the working temperature and the compatibility between the material used and the process fluid.**
Attention	**This manual does not concern the instruments conforming to standard 94/9/CE (ATEX).**
Attention	**The product warranty is no longer valid in case of non-authorized modifications and of wrong 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 carefully the specific safety rules in case of measuring oxygen pressure, acetylene, inflammable or toxic gas or liquids.**
Attention	**The user is totally responsible for the instrument installation and maintenance.**
Warning	**Disconnect the instruments only after depressurization of the system.**
Warning	**The process fluids residuals in the disassembled gauges could affect people, the environment and the system. It is highly recommended to take proper precautions.**

In order to verify the working and manufacturing features of the instruments read the catalogue sheets in the most up-dated edition available on.line on
www.nuovafima.com

The instrument installation should be carried out according to stadard EN 837-2 (Recommendation for pressure gauges installation and selection)

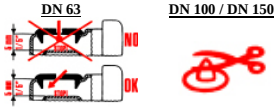
- The gauge should be connected to the process sytem forcing throuhg a special wrench on the process connection point without forcing on the case by the hands. As for the process connections with cylindric threading, a head gasket compatible with the fluid to be measured should be used. In case the connection threading is conic additional sealing materials are applied on the thread (PTFE tape).
This procedure is not suitable for cylindric threading.

- Installation must be done according to **EN 837- 1**, Chapter 8. The user is solely responsible for any combinations that differ from the ones shown in the mentioned rule.
- The requested torcing procedure to guarantee an adequate tightness depends in the measuring range, on the threading type and on 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 those gaskets with supporting ring as described in the above mentioned directive.

- During installation of pressure gauges with a low scale range it is necessary to ventilate the case following the instructions shown on labels applied on the gauge. This procedure allows to bring the internal pressure of the case back to the atmospheric pressure value.

DN 63 **DN 100 / DN 150**



- In case of fluids leakage during mounting, clean carefully.
- As for gauges with security device installation should guarantee a free space on the back side of 20mm at least.
- As for gauges with full painting which is necessary to protect it from corrosive atmospheres the safety device must be able to fully operate.
- As for gauges with surface mounting and back connection be sure that the pipe conducting the fluid in pressure is connected to the instrument connection without tensions.
- In order to guarantee the accuracy in measuring it is necessary to respect the working limits described in the catalogue sheets.
- Instruments should be installed in vibrations proof positions. If the mounting point is not stable because of vibraions a support for the instrument fixing should be used such as a clamp or a flange , possibly use a flexible capillary.
- If vibrations cannot be prevented during installation, use liquid filled instruments.
- The instrument mounting according to standard
EN 837-1 /9.6.7 established the vertical position as standard mounting. Calibration and therefore mounting positions different from standard (when requested) are shown on the dial.
- Instruments must be protected from wide ambient temperature variations.
- Instruments must be protected from sun radiations during working in order to prevent overheating.
- Liquid filled instruments used in temperatures lower than 20°C, could have higher response times because of the increase of viscosity of the filling liquid.
- During installation be sure that no deviation above or below the fluid allowed and the ambient temperatures takes place considering the heating radiations. It is necessary to consider the temperature influence on the accuracy value.
- During the first operating procedure all pressure rush should be prevented. Slowly open the interception valves.
- The use of instruments measuring the zero values is not recommended especially in gauges where the first part of the scale is suppressed.
- It is not recommended to reinstall the instruments on plants working with different process fluids in order to prevent any chemical reaction which could cause explosions owing to contamination of the wetted parts.
- If the pressure indication stays fixed for a long time be sure that this is not due to a closing up of the pipe bringing the pressure to the sensing element. Before disassembling especially in case of pressure with zero value be sure that there is no pressure inside the gauge isolating it through the interception valve.

3. Use limits

3.1 Process and ambient temperature
This standard type instrument is designed to be used in safety conditions that is in an ambient temperature between –40 and +65°C. As for the filled model please see the paragraph "DAMPENING LIQUID FILLING"
As for instruments with measuring systems in stainless steal in case of process temperatures from 150 °C, it is necessary to cool the process fluid. In these cases it is necessary to use siphons, temperature dissipators or capillaries. In case of temperatures below 0°C, it is recommended to use liquid filled gauges preventing that the components such as the measuring system toothing can freeze. The fluid must not freeze or cristalize inside the sensing element.

3.2 Working pressure
The instrument shall be chosen considering the working pressure between 25% and 75% of the full scale range. The full scale range should be approximately double than the working pressure value. In case the instrument is identified through a small black triangle placed on the scale range of the dial, the working pressure could reach 90% with pulsating pressures and 100% with static pressures.

3.3 Dynamic and cyclic pressures
The dynamic and cyclic pressures are normally indicated by the measuring index oscillations. They reduce the sensing element's and the amplifying mouvement's life. It is necessary to reduce the pulsating pressures placing a dampener or a reducing valve between the pressure source and the instrument. The harmful effect of the pulsations could also be reduced filling the case with a dampening liquid.. An improper choice of the instrument can bring to a breakage by stress.

3.4 Overpressure
Overpressure stresses the sensing element reducing its life and accuracy. Therefore it is always better to use an instrument whose scale range is bigger than the maximum working pressure and which is able to absorbe overpressures and pressure shocks. Pressure shocks can be treated in the same way as the pulsating pressures. The elastic element could break even if overpressure hits it just one time.

3.5 Vibration
Vibrations can be detected through continuous and often irregular oscillations of the index or of the case..
When the instrument is under vibrations it is recommended to use liquid filled pressure gauges.

3.6 Safety device
In systems working with compressed gas it is recommended to choose an instrument with a proper safety device in accordance to standard EN 837-2. In case of unexpected breaking of the sensing element the compressed gas expands outside the case through the safety device.

3.7 Dampening liquid filling
The dampening liquid is generally used to reduce vibrations of the moving parts due to vibrations and/or pulsations. It reduces considerably the use of the rotating parts increasing the instrument resistance to stress, increasing the instrument readability and it reduces the sudden loss of pressure. The dampening liquid must be chosen very carefully in case the instrument is used with oxidant fluids such as oxygen, chlorine, nitric acid, hydrogen peroxide, etc. In presence of oxidant agents there is a potential risk of chemical reaction, inflammability and explosion of the instrument. In this case proper filling liquids must be used.
The dampening liquid type should also be choosen considering the working temperature, the liquid viscosity degree and the expected damping level.
As for working temperatures of the liquid filled instruments please see the instrument's catalogue sheet.

3.8 Protection in explosive ambient
In case pressure gauges are used in potentially explosive atmospheres special procedures are requested. The directive regarding the ATEX products 94/9/CE is applied to pressure gauges with electrical devices as well as to mechaninical pressure gauges.
In order to chose the products requiring these features please see the catalogue sheet and the manual.

4. Wrong application

4.1 Fatigue rupture
A continuous pressure variation highlighted by oscillations of indication can reduce the elastic element's life.
These breakage, which could be more dangerous if occur in measuring compressed gas instead of liquids, cause a pressure increase inside the case and therefore the safety device opening. In case of operation with high pressure the breakage could degenerate in an explosion. It is recommended to use dampening liquid filled instruments and to narrow the pressure entrance conduit through a restrictor screw or am adjustable dampner.

4.2 Overpressure rupture
The effects of this kind of breakage are unexpected. Most commonly they are more serious during compressed gas measuring procedure and they can cause the explosion of the instrument whose debris could be deflected everywhere. The safety device opening does not always hold the fragments. In case of breakage risk for overpressure we recommend to use a solid front blow out back. instrument. In case of breakage this model prevents that the operator is hit by the instruments fragments. The glass alone does not guarantee a proper protection and in this case it represents the most dangerous component. Short overpressure pulsations could occur in pneumatic or hydraulic systems especially after valves opening or closing. The amplitude of these pulsations can often be higher than the working pressure and their high velocity does not allow to read the instrument so they are invisible for the operator. These pulsations can bring to the final breakage of the instrument or to a permanent zero error. Also in this case the application of a choking element can reduce the overpressure peak amplitude transmitted to the sensing element. The use of a limiting pressure valve protects the instrument from pressures which could be higher than those on which the valve itself is calibrated protecting in this way the instrument form overpressures.
The bourdon tube pressure gauges as well can be designed in order to resist to overcharges.
A clamp is mounted inside the gauge preventing any further extension of the tube.

4.3 Corrosion rupture
The compatibility with the process medium is fundamental in preventing breakage for corrosion. The sensing element is generally less thick so it works in conditions of stress corrosion. None of the most common materials is immune from a chemical attack whose entity is influenced by concentration, temperature and the type of a mix of different chemical substances.
In this case we recommend to use a diaphragm seal produced in the proper material.
The customer is entirely responsible for the choice of the insturment material which should be the most proper one for the process medium.

4.4 Explosion rupture
It occurs after a violent release of thermal energy due to some chemical reactions such as the adiabatic compression of oxygen in presence of hydrocarbons. The use of a solid front gauge does not even prevent the deflection of the debris away from the front of the gauge.

Pressure gauges suitable for use with oxygen are marked

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

Instruments are supplied properly cleaned and degreased with special products 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.

4.5 Vibration and shoks rupture
Vibrations most commonly cause an abnormal deterioration of the parts in mouvement bringing to a gradual loss of accuracy and then to a total block of the pointer.
Vibrations could also cause stress cracks in the sensing element structure causing a liquid leakage and even an explosion.

5. Maintenance

The instrument's characteristics should be maintained during time through a special maintenance program which should be carried out and managed by qualified technicians.
The maintenace program includes: the cleaning of the external parts of the instrument by a humid cloth, the pressure indication check, the gaskets tightness check, condensate presence inside the case, the glass, case and safety device soundness.
As for heavy work instruments operating in severe conditions plants (vibrations, pulsating pressures, corrosive or sedimentous fluids, fuel or inflammable fluids) we recommend to schedule their replacement according to the maintenance program schedule. In case the instrument does not work properly it is necessary to proceed to an unschedule checking procedure.
Instruments should be kept in their original packaging and placed indoor and protected from humidity. The stocking area temperature should be between –25…and +65°C except different instructions.
A careless moving of the instrument could affect the metrological features although it is properly packed.
Instruments should be checked before use. In particular in the zero free instruments it could occur that the null-pressure pointer position is inside the zero span.

5.1 Routine check
In order to verify the sensing element condition install the instrument on the pressure generator introducing an interception valve between them. Apply the maximum pressure value to the gauge and exclude it form the pressure source through the valve. Any possible leakage of the sensing element can be noticed from the slow return of the pointer to zero.

5.2 Ricalibration
If after recalibration results are different from the nominal values declared on the catalogue sheet the recalibration procedure should be repeated. It is recommended to return the instrument to **NUOVA FIMA** for this procedure.

NUOVA FIMA will not be responsible for any non authorized intervention on the instrument. Moreover the contract warranty and the CE Conformity Declaration will be no longer valid.

6. Disposal

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

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