

II 2G Ex db IIC T6 Gb
II 2D Ex tb IIIC T85°C Db
-20≤Ta≤+65°C -20≤Tp≤+60°C

Models

3.40 3.42 3.43 3.45

3.48 3.49

(differential pressure)

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The pressure switches in series 3.4x/xx conform with the Essential Requirements for Health and Safety as outlined by European Directive 2014/34/EU for equipment of Group II, category 2GD. Conformity is ensured by adhering to the provisions of standards CEI EN 60079-0 and CEI EN 60079-1, as stated in the EC Declaration of Conformity issued by the Manufacturer and enclosed with these instructions. Pressure switches fall into the category of safety electrical constructions. No modifications that could compromise the structure or the electrical and mechanical functionality of this safe electrical construction should be made unless expressly authorised by NUOVA FIMA.

1. Safety

Instruments operate in safe conditions only if selected carefully and installed correctly on the system, and if the manufacturer's established maintenance procedures are observed. The user is fully responsible for the instrument installation and maintenance.

To choose the construction and functional features of the instruments correctly, we recommend reading the

international regulations in force, extracts of which appear in this manual and which should be fully known and observed to allow a correct installation and commissioning of the instruments. In the absence of Regulations and/or national Laws, within the European Union, the requirements of CEI EN 60079-14, CEI EN 60079-17, standards, must be observed.

People in charge of instrument selection, installation and maintenance should be able to recognize the conditions that may affect negatively the instrument's operational ability and that may lead to an early failure. Therefore, only qualified technicians should be trained to carry out the procedures established by the plant engineering regulations.

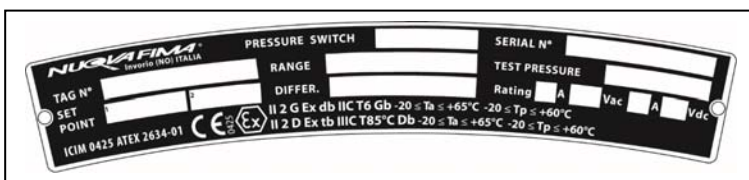
NF20 - The safety electrical construction should be selected according to the hazardous zones classification. The safety electrical construction group and equipment/components group installed thereon, must be suitable for gases, vapours and powders in the system.

(NOTE: This safety electrical construction IS USUITABLE for ZONE 0 and 20, and CANNOT be used to measure inflammable fluid pressures).

2. Directives

According to Regulation 2014/68/EU (P.E.D.), pressure switches series 3.4x/xx are designed and manufactured according to a "Sound Construction Practice" (SEP-Sound Engineering Practice). Directive EMC 2014/30/UE regarding electromagnetic compatibility cannot be applied to this product (EMC).

The accessories used for cable or pipe entries must comply with Directive 2014/34/EU and with standards EN IEC 60079-0, EN 60079-1, EN 60079-31 for the Ex db IIC T6 Gb and Ex tb IIIC T85°C Db protection



mode.

3. Materials

In models 3.40/42/43/45 the elastic element is made from an AISI 316 diaphragm, while in models 3.48/49 it is made from an AISI 316 diaphragm complete of an AISI321 double bellows. In both cases, the elastic element acts directly on the microswitch through an auto-centred articulated pivot which guarantees an excellent performance. The tag is in stainless steel, irremovable and with indelible writing.

operating pressure. For ranges < 1 bar the application of an accidental vacuum higher in absolute value than the operating range of the instrument, should be avoided.

Microswitch – The maximum resistive load values indicated on the tag should not be exceeded otherwise the surface temperatures of the case and the cable control sheaths could increase, making the installation unsafe. The value of the differential should be considered according to the microswitch type. See regulation NF32.

Case – The case is in aluminium with blue polyurethane paint. The cover is in aluminium with beige polyurethane paint. Designed for open-air use. The degree of resistance of the polyurethane paint to corrosion due to the installation site environment and the weather conditions should be considered to guarantee a fully safe operating condition for the instrument.

Degree of protection – It is indicated as per provisions of legislation CIE EN 60529. It refers to the condition of the cover being completely screwed. An appropriate safety dowl on the case body must be screwed against the cover rabbit to prevent its removal under normal operating conditions.

Electric safety – The supply requirements must be satisfied with extreme care preventing any damage to the instrument and the operators. The same care must be taken to the ground connection procedures of the instrument conductor parts to prevent that power losses, due to damages and accidents may be hazardous for the operators and for the equipment. The safe electrical construction should be assigned to the service for which it has been manufactured (voltage, frequency, mechanical and thermal stresses within the project values).

Mechanical stress

Instruments should not receive mechanical stress. If the

installation points receive mechanical stress, instruments should be mounted remotely and connected employing flexible pipes. Instruments must be selected among those provided with mounting brackets for walls, panels or stakes.

5. Improper uses

The following applications may be potentially hazardous and must be taken seriously into consideration:

- compressed gas system: par. NF25;
- oxygen systems: par. A4274;

A4271;

- systems where over ranges could be applied accidentally or where low-pressure instruments could be installed on high-pressure sockets: par. E724, A4272;
- systems where the interchangeability of the pressure gauges could give rise to hazardous contaminations: par. A4274;
- systems containing toxic or radioactive fluids, liquids or gaseous: par. A4274;
- systems that generate mechanical vibrations: par. A4275, A4276, E722;
- systems with functioning temperatures different from that of the environment: par. NF27

NF25 – In systems with compressed gas, it is advisable to choose an instrument with the most adequate safety level. In case of an unexpected failure of the sensitive element, the compressed gas must be able to escape outside through the safety device.

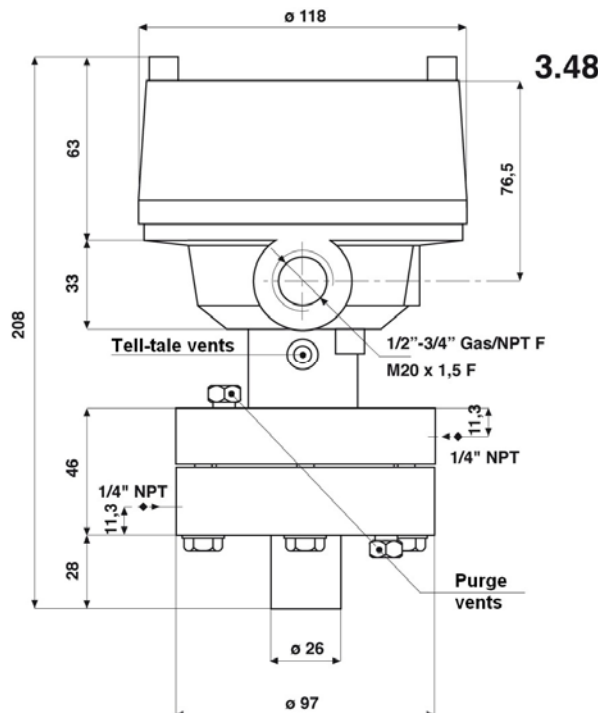
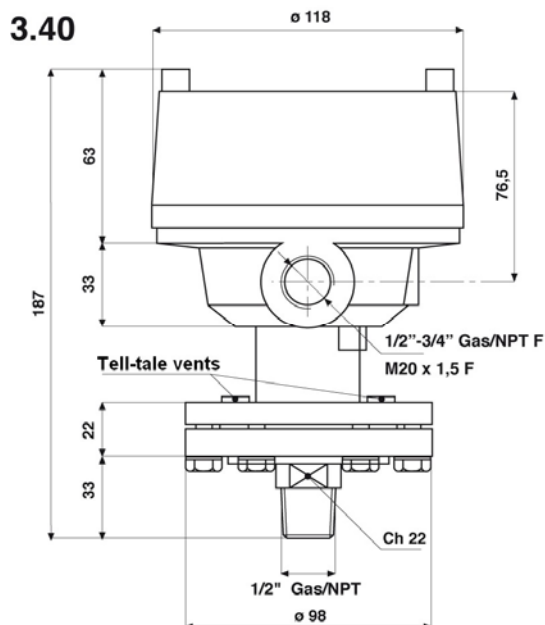
The NUOVA FIMA instruments are provided with a safety tell-tale vent that opens as soon as pressure inside the case exceeds the safety value, connecting it to the environment. Inflammable fluids cannot be measured.

E723 - Dynamic and cyclic pressures – When instruments are mounted on pumps dynamic and cyclic pressure may occur and the working life of the elastic element and the microswitch may be reduced. Continuous false alarms indicate that they are affecting the instrument. Therefore, it is necessary to reduce pulsating pressures by interposing a damper between the source of pressure and the instrument. The wrong choice of the instrument may lead to failure due to fatigue.

A4271 - Failure due to Fatigue – Mechanical stress induced by pressure may produce a failure for fatigue and a small crack may appear on the instrument. This kind of failure is even more serious if it occurs during the measurement of compressed gasses rather than liquids. Failures due to fatigue release the fluid slowly so that the increase of pressure inside the case is noticed by the opening of the safety tell-tale vent.

E724 - Overpressure – Overpressure stresses in the elastic element and, consequently, reduces its working life and accuracy. It is therefore preferable to use an instrument the full scale value of which is greater than the maximum operating pressure and that consequently, absorbs overranges and pressure blows more easily. Pressure blows may be treated in the same way as pulsating pressures. Overpressures of long duration may be overcome by installing a calibrated restrictor on the instrument. However, it must be considered that rise of even one event may lead to failure due to over range.

A4272 - Failure due to Overpressure – When a pressure higher than the declared maximum limit suitable



catalogue sheets in their most recent updated version available online on www.nuovafima.com.

The NF instruments are designed and constructed according to the safety standards included in the

4. Intended use limits

Operating pressure – The operating pressure of the instrument should be included between 25% and 75%, which must be approximately double the value of the

- corrosive fluids, liquids or gaseous systems: par. A4331, A4273;
- vapour under pressure systems: par. NF25;
- dynamic and cyclic pressure systems: par. E723,

for the elastic element affects the instrument a failure may occur (for instance, it may happen, when a low-pressure instrument is installed on a high-pressure system). The effects of this type of damage, commonly

more significant in the case of compressed gasses measurement, are unforeseeable and the case may burst, notwithstanding the presence of a safety tell-tale vent. Overrange impulses of short duration (spikes) may occur in pneumatic or hydraulic systems, especially further to valves opening or closing. The amplitude of these impulses can be many times bigger than the operating pressure, and the great speed with which they happen prevents the instrument from detecting them thus resulting in the operator not being aware of them and the instrument may be damaged permanently. A constriction may reduce the amplitude of the overpressure peak (spike) transmitted to the elastic element. A restrictor protects the instrument from all pressures higher than that to which the valve itself is calibrated, thus protecting the instrument from overpressures.

A4331 - The elastic element is generally characterized by a reduced thickness, therefore it works under significant mechanical stress conditions. The chemical compatibility with the fluid to measure must therefore be taken into consideration. None of the common materials may be considered immune to chemical attack which can be more or less aggressive depending on the following factors: concentration, temperature and type of mixture among various chemical substances. Chemical attacks may lead to failure due to rapid corrosion rapidly.

A4273 - Failure due to Corrosion – When the material of the elastic element is subjected to chemical attack by substances contained in the fluid to measure or in the environment surrounding the system under pressure, damage due to corrosion may occur. The damage appears as a punctiform loss or the beginning of a fatigue crack further to the weakening of the material. In this case, the use of a diaphragm chemically compatible with the process fluid must be considered.

A4274 - Failure due to Explosion – When a violent release of thermal energy due to chemical reactions, such as that of adiabatic compression of oxygen in the presence of hydrocarbons happens, the instrument may explode. The impossibility of foreseeing the effects of this damage is generally accepted. To avoid hazardous chemical reactions, washing and removing grease on wet parts with suitable products is recommended especially if the instrument has to be replaced. The same procedure is carried out by the manufacturer when highly oxidized agents are involved. It is necessary to inform the manufacturer at the moment of ordering about the issue.

A4275 - Failure due to Vibrations – The most common failure due to vibrations is an abnormal wear and tear of the parts in movement.

A4276 - Failure due to Fatigue induced by Vibrations – Wide amplitude vibrations may produce cracks due to fatigue on the elastic element structure. In this case, the leakage of fluid may be either slow or fast.

E722 - Vibrations – When the effective support of the instrument receives vibrations, instruments should be mounted remotely and connected employing flexible pipes (for strong or irregular vibrations). Shouldn't this procedure be possible, the instrument has to be mounted in an orthogonal position according to the plane of vibrations. Vibrations may be detected by continuous false actions of the microswitch.

6. Temperature

NF26 – The temperature class of the safe electrical construction and the devices installed on it must be adequate to the gas, vapour or dust present in the system.

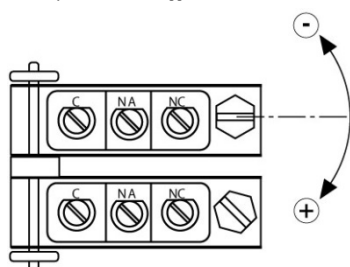
E7251 – Ambient temperature: -20...+65°C. isolating an instrument from ambient temperatures which are too high or too low is extremely unlikely. A solution to that could be taking it away from a heat or cold source when possible.

NF27 – Process fluid temperature: +60°C max, measured at the inlet of the pressure threaded connection The use of a siphon is advised when the instrument is employed with high-temperature vapour or liquids. A siphon or a similar device should always be placed close to the instrument, and filled with condensed fluid, before pressurizing the installation to prevent the hot fluid from reaching the instrument during the early pressure rise. Fluid should not freeze or crystallize inside the elastic element. However, if the instrument is employed to measure high-temperature points, the use of a tube with an internal diameter of at least 6 mm is recommended to connect it to the pressure entrance. One tube 1.5-2.0 m. long resets the operating temperature approximately to that of the environment.

7. Calibration

NF30 - Point of calibration – The NUOVA FIMA pressure switches are supplied with 1 or 2 micro switches, the point of action of which is separated by a micrometric adjustment screw, according to the drawing. The point of calibration is indicated on the tag by the

manufacturer indelibly. Calibration is also supplied by the manufacturer or instruments may be supplied already calibrated at the lowest possible point. In the second case, the user will have to proceed to calibration, considering the differential value. For safety reasons, calibration has to be performed in a laboratory before installation. Once calibrated, the tag with the calibration point printed indelibly on it has to be applied to the instrument.



A4332 - The calibration fluid should be compatible with the fluid to measure on the pressure system. **Fluids containing hydrocarbons must not be used when oxygen or other oxidizers are involved.**

NF31 - Calibration – A calibration circuit composed by one pressure switch, one pressure generator and one pressure indicator (pressure gauge or sensor) should be available for calibration. The set-point accuracy which can be gained is a function of the indicator accuracy used. After having unscrewed the cover, the following operations should be performed:

- connect the microswitch in series to a signalling light or sound source as indicated in the figure, to indicate the set point thereof;
- apply a pressure/vacuum to the pressure switch equal to the set-point value, by reading it on the instrument of reference;
- for a set-point adjustment on the incline rise, rotate the adjustment screw of the microswitch clockwise to raise the set-point value (this is also valid for instruments that usually operate under vacuum. Operation is considered under absolute pressure), anticlockwise to lower it, until the light or sound signal is on;
- lower the pressure until the reinstatement of the set point;
- repeat the above operations until an enough accurate set-point is obtained;
- for an adjustment of the set point on the incline drop of the pressure value, repeat the above-described procedure, taking into consideration that accuracy should be established according to the value of refitting;
- repeat the above operations until an enough accurate value is obtained.

In the case of 2 microswitches, keep in mind that these operations have to be repeated alternatively on each microswitch at a time, until obtaining the desired set-point accuracy. This procedure is necessary because the two microswitches interact on the same measuring element. Once the above-described operations are completed, retighten the cover-up to the rabbit.

NF32 - Differential – The differential or dead band is indicated on the tag and indicates the difference between the point of action and the point of refitting of the microswitch. The point of action and the value of the differential have to be taken into account to allow the microswitch to refit. This is particularly significant in the case of a micro switch with an adjustable differential ranging from 10% to 50% of the range operating value. The latter is adjusted by acting on the graduated roller located under the microswitch itself. The adjustment roller is graduated from the letter "A" to the letter "F" corresponding to the minimum differential (about 10% of the full range value) and maximum (about 40-50% of the full range value), respectively. During the adjustment of the differential the device acts on the triggering force of the microswitch and the value of the adjusted set-point increases leaving the refitting steady. This is important particularly when the instrument, equipped with such a microswitch, is first calibrated at the factory and next adjusted on the installation. It is likewise important to consider this when the instrument operates in a vacuum (empty).

NF40 - Pressure switches, series 3.4x/xx, must be installed according to the European Standards EN 60079-14 requirements.

8. Trasporto

Gli strumenti possono perdere le loro caratteristiche durante il trasporto nonostante un adeguato imballaggio e dovrebbero essere controllati prima dell'uso. In questo caso attenersi alle procedure previste di verifica/calibrazione. Un mancato riarmo del

microinterruttore significa un importante danno allo strumento.

9. Conservazione

Gli strumenti conservati nell'imballo originale standard (in scatole di cartone) devono essere sistemati in locali chiusi ed al riparo dall'umidità: in questo caso non occorrono particolari attenzioni. Se gli strumenti sono imballati in modo speciale, (in casse di legno rivestite di carta catramata o in sacchi barriera) è sempre opportuno riportarli in locali possibilmente chiusi e in ogni caso al riparo dagli agenti atmosferici; le condizioni dei materiali imballati devono essere verificate ogni 3-4 mesi, specie se le casse sono sottoposte all'azione degli agenti atmosferici. La temperatura dell'area di stoccaggio dovrà essere compresa tra -20 e +65°C salvo diversamente specificato sui fogli di catalogo relativi.

10. Installation

E71 - Installation – To turn on or off the instrument and remove it for maintenance purposes, an on-off valve should be added between the pressure switch and the installation (root valve). If the pressure switch is a differential one (3:48/49) a 3-way manifold or 3 distinct valves, should also be added, as per drawings on page 3. The pressure connection should be sealed tightly. If the threading of the pressure connection is cylindrical, the sealing is performed using a ring gasket tightened between the two plane sealing faces: one belongs to the pressure entrance while the other is to the instrument process connection. If the threading of the pressure connection is conical, the sealing is performed by tightening the connection on the pressure entrance, for at least 5 complete threads. However, it is common practice to add a PTFE tape on the male thread, before coupling (see fig. below).



In both cases, the twisting moment must be applied employing two spanners, one applied on the plane faces of the connection to the instrument process, and the other one on those of the pressure entrance. **Tightening should not be performed by forcing the case not to damage the instrument.** During the first pressure operation, the connection should be sealed tightly. The pressure entrance should be in a vertical position for all instruments $\pm 5^\circ$, except if otherwise indicated on the tag. A minimum distance of 20 mm must be guaranteed from any adjacent object to allow the safety tell-tale vent device to operate properly

NF41 - Electrical connection – Use Exd adaptors and cable clamps that do not reduce the case protection degree and comply with national regulations. At least 5 complete threads have to be completed.

Cod.	Process connection threading
3	1/2" NPT F
4	3/4" NPT F
A	M20 x 1,5 F

NF42 - Electrical Cable – For connection, it is advisable to use cables with sections suitable to the required electrical output (1.2 ... 2.5 mm² – 14 ... 16 AWG) and which comply with the technical provisions for the connection to switching equipment. The external diameter should be compatible with that required by cable clamps. The cable terminals should be provided with a spade terminal type.

NF43 – Electrical connection – Loosen the safety screw and remove the cover. The electrical cable should be tension-free. Connect the cable to the micro switch with a perfect tight and check that:



- Does not undergo torsion or be excessively tense;
- The cable should not have frays or the insulation sheath be cut or damaged;
- Ensure there are no false contacts and that terminal screws are properly tightened;
- Do not alter the calibration (if it was conducted at the factory). Ensure that no impurities remain inside the casing, secure the cable gland, and reassemble the cover, finally securing it with the safety screw.

NF44 – Ground connection – Points for ground connection, protection or equipotentiality are located inside and outside the case. Once the integrity and the continuity of these conductors have been checked, connect one or both of them following the installation

specifications and make a perfect tight.

NF50 – The user should be aware of the risks due to the electrical current and the chemical and physical features of gases, vapours and/or powders involved in the system.

E8 – Commissioning – Commissioning should always be carried out carefully to prevent pressure blows or sudden temperature variations. Therefore, the on-off valves should be opened slowly. As for differential pressure switches, follow the instructions below according to the drawings on page 3:

- open by-pass valve "1";
 - open root valve "3";
 - open on-off positive side valve "2" (+).
- The instrument indicates pressure zero;
- close by-pass valve "1";
 - open on-off negative side valve "2" (-).

NF51 – Ensure that the failure to reset the microswitch for an extended period is not due to blockage of the pressure supply conduit to the sensitive element. Especially in case of non-operation, ensure that there is no pressure inside the instrument before any disassembly, by isolating it through the intercept valve.

11. Maintenance

NF60- The use of an electrical construction subject to interventions not explicitly authorized by NUOVA FIMA excludes any liability of the company and will result in the invalidation of the corresponding EU Declaration of Conformity and contractual warranty. Repairing the lamination joints of the flame-proof housing is prohibited.

NF61- All the operations intended to maintain or restore a safe electrical construction to ensure its full operational condition to satisfy the specifications required are called maintenance. An accurate maintenance program should be guaranteed to safeguard the original safety of electrical construction features and should be carried out by qualified technicians whose task is to ensure the good conditions of the electrical construction, their functions and the environmental conditions in which the instrument operates. Since safety is a legal obligation such is also the preservation of all conditions on which safety depends. Safe electrical constructions, in all their parts, must be installed and maintained very attentively to prevent accidental contact with the elements under voltage, and high temperatures, and to prevent the risk of fire and explosion originating from abnormalities that may occur during operation. The maintenance operations must be assigned to personnel specifically qualified and instructed about the specific features of the equipment. For all actions lying outside regular maintenance, please rely only on authorized and qualified personnel of NUOVA FIMA. All maintenance operations must be carried out only after the safe electrical construction has been isolated from all power sources. If vibrations affect the safe electrical construction, all junctions and the pipe and cable entry must be securely tightened, and the required anti-loosening and anti-vibration devices must be installed.

NF62 – Dust accumulation on the pressure switch case should not be more than 5 mm thick. The instrument must be cleaned properly.

NF63 – Every 3 to 6 months the instrument accuracy, the condition of the movement parts, the corrosion level of the elastic element and the condensation inside the case should be checked carefully even if the maintenance program does not include these actions. As for instruments employed on systems working under heavy conditions (vibrations, pulsating pressures, corrosive fluids, or sediments, etc.), they should be replaced according to the maintenance program.

NF64 – The safe electrical construction should be opened only after insulation from electricity.

NF65 - Recalibration – Instruments should be insulated from electricity before inspection and disassembling. They are inspected or calibrated according to the procedure described in paragraph NF 31. Process fluid residuals remaining inside the instrument process connection should not be dispersed in the environment to prevent pollution and from being a danger to people.

NF70 - Possible malfunctioning – Absence of action or missing refitting: Electric line interrupted, Microswitch damaged, Root valve closed. Fluctuation of the set-point (false set-point): Excessive mechanical vibrations due to incorrect installation. Displacement of the point of action: Deformation of the elastic element due to fatigue, high over pressure or high process fluid temperature. Slow response: Pressure conduits are partially obstructed or fluid is too viscous.

NF80 – L'unica operazione eseguibile dall'utilizzatore che sia possibile ai fini della sicurezza, è la sostituzione del microinterruttore. L'autorizzazione del costruttore è

però indispensabile, del quale vige seguirne le procedure di intervento da parte del personale certificato.

NF80 – Safety can be restored exclusively by replacing the microswitch. The manufacturer's authorization is nevertheless required and the specific procedure established by it must be performed by qualified personnel.

12. Disposal

NF90 - Disposal – it is recommended that the electrical part is separated from the instrument's body and then disposed of as aluminium and stainless steel.

E727 – Liquid columns' effect – the user must be aware of the fact that if the instrument is affected by the load of a liquid column, the calibration must be

performed by compensating this effect. This happens when the instrument is measuring liquids and it is mounted above or under the pressure entrance to which it is connected (fig. 1,2). If gas or vapour are involved this condition is impossible and it is advisable to mount the instrument above the pressure entrance to prevent condensation alters the readings. For liquid level measurements with differential pressure switches, it is necessary for the

instrument installation point to be at least 50 cm below the minimum level of the tank (fig.3) and for the height difference between the minimum level of the tank and the level of the condensate barrel to be equal to or slightly less than the differential scale range of the instrument."

