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Evaluation Report

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Evaluation Report

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Colophon

Title	NOFIRNO sealing system Conformity to ATEX Directive 2014/34/EU
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1 NOFIRNO sealing system

1.1. Description of the NOFIRNO sealing system

The sealing system consists of a combination of rubber filler sleeves, rubber cable insert sleeves and a sealant. The aperture between penetrating pipe and penetration wall is filled with filler sleeves and on both sides the conduit opening is sealed with a sealant. The thickness of the sealant is 15 or 20 mm, depending on the specific application. For special applications the sealant layer may only be present at one side.

1.2. Intended use

The sealing system is intended to be used for the sealing of the transit of a single pipe or of multi pipes, or of the transit of a single cable or of multi cables through a penetration in rigid walls, floors, bulkheads and decks. The sealing system is applied in an opening in a concrete wall or floor, or a metal or glass-reinforced plastic conduit frame. The conduit frame is pre-installed in the wall, floor, bulkhead or deck by means of a proper method (e.g. installed during casting a concrete wall or welded in a metal bulkhead).

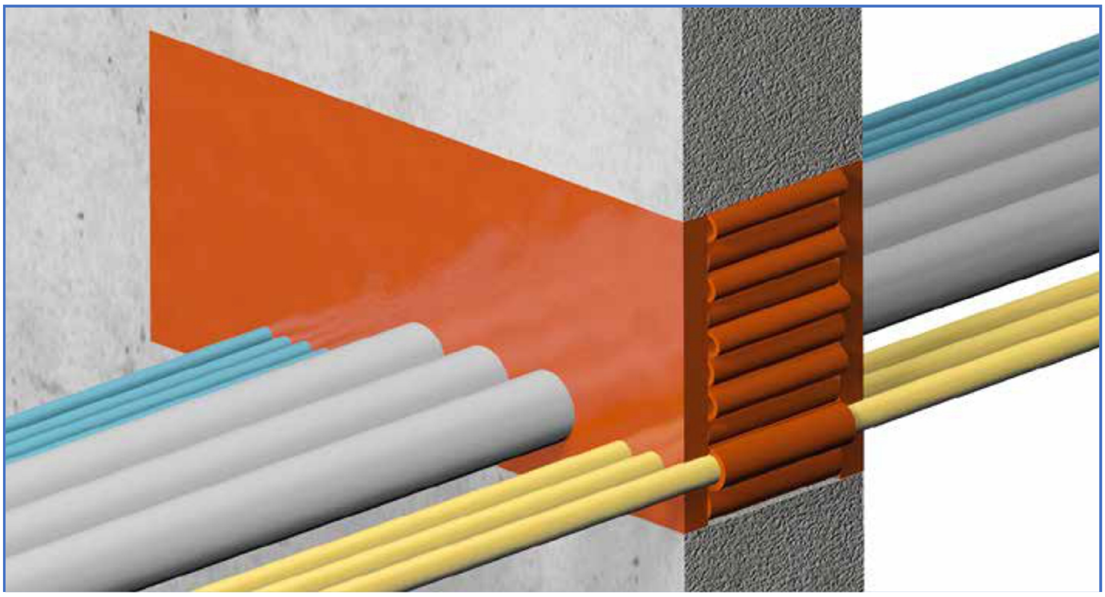


Figure 1. Principle of the NOFIRNO sealing system with cables in a concrete wall

2 ATEX conformity evaluation

2.1 Introduction

ATEX Directive 2014/34/EU describes the harmonization of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmosphere. Essential health and safety requirements are listed with respect to

- potential ignition sources of equipment intended for use in potentially explosive atmospheres;
- autonomous protective systems and safety devices;
- components with no autonomous function essential to the safe functioning of such equipment or autonomous protective system(s).

Products within the scope of the ATEX Directive are equipment, protective equipment, safety devices and components.

A defining element of equipment in the sense of the Directive is that it has to have its own potential source of ignition.
Potential sources of ignition could be: electric sparks, arcs and flashes, electrostatic discharges, electromagnetic waves, ionizing radiation, hot surfaces, flames and hot gases, mechanically generated sparks, optical radiation, chemical flame initiation and compression.

NOFIRNO sealant, NOFIRNO rubber sleeves as well as an installed NOFIRNO sealing system have no autonomous function and are no parts of equipment in the sense of the ATEX Directive.

Following the ATEX Directive Guidelines the manufacturer should carry out a risk assessment according to the European harmonized standard EN 1127-1 “Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology”.

This report contains a risk assessment of the design of installed NOFIRNO sealing systems in pipe and cable transits.

2.2 Risk assessment according to EN 1127-1

2.2.1 Possible ignition sources

2.2.1.1 Hot surfaces

If an explosive atmosphere comes into contact with a heated surface ignition can occur. Not only can a hot surface itself act as an ignition source, but a dust layer or a combustible solid in contact with a hot surface and ignited by the hot surface can also act as an ignition source for an explosive atmosphere.
The capability of a heated surface to cause ignition depends on the type and concentration of the particular substance in the mixture with air. This capability becomes greater with increasing temperature and increasing surface area. Moreover, the temperature that triggers ignition depends on the size and shape of the heated body, on the concentration gradient in the vicinity of the surface and, to a certain extent, also on the surface material. Thus, for example, an explosive gas or vapour atmosphere inside fairly large heated spaces (approximately 1 l or more) can be ignited by surface temperatures lower than those measured in accordance with EN 14522 or by other equivalent methods. On the other hand, in the case of heated bodies with convex rather than concave surfaces, a higher surface temperature is necessary for ignition; the minimum ignition temperature increases, for example, with spheres or pipes as the diameter decreases. When an explosive atmosphere flows past heated surfaces, a higher surface temperature could be necessary for ignition owing to the brief contact time.

If the explosive atmosphere remains in contact with the hot surface for a relatively long time, preliminary reactions can occur, e.g. cool flames, so that more easily ignitable decomposition products are formed, which promote the ignition of the original atmospheres.
In addition to easily recognizable hot surfaces such as radiators, drying cabinets, heating coils and others, mechanical and machining processes can also lead to hazardous temperatures. These processes also include equipment, protective systems and components which convert mechanical energy into heat, i.e. all kinds of friction clutches and mechanically operating brakes (e.g. on vehicles and centrifuges). Furthermore, all moving parts in bearings, shaft passages, glands etc. can become sources of ignition if they are not sufficiently lubricated. In tight housings of moving parts, the ingress of foreign bodies or shifting of the axis can also lead to friction which, in turn, can lead to high surface temperatures, in some cases quite rapidly. Consideration shall also be given to temperature increases due to chemical reactions (e.g. with lubricants and cleaning solvents).

Evaluation: the NOFIRNO sealing system is no heating source. Neither is the system part of a mechanical or machining process that could generate hot surfaces. All parts of the NOFIRNO sealing system are non-moving, there is no heat generation by friction.
Ducted cables potentially could get warm by the generated heat of the electric current. The outer surfaces of ducted pipes could get warm when the conveyed medium is hot. In transits with NOFIRNO sealing system the NOFIRNO sealant and NOFIRNO rubber sleeves are in contact with the outer surface of cables and pipes and could warm up in the contact area. Both sealant and rubber are both stable at high temperatures up to + 180 °C. Heat does not lead to chemical reactions inside the materials that may be a hazard.

Conclusion: No possible ignition source.

2.2.1.2 *Flames and hot gases (including hot particles)*

Flames are associated with combustion reactions at temperatures of more than 1000 °C. Hot gases are produced as reaction products and, in the case of dusty and/or sooty flames, glowing solid particles are also produced. Flames, their hot reaction products or otherwise highly heated gases can ignite an explosive atmosphere. Flames, even very small ones, are among the most effective sources of ignition. If an explosive atmosphere is present inside as well as outside an equipment, protective system, or component or in adjacent parts of the installation and if ignition occurs in one of these places, the flame can spread to the other places through openings such as ventilation ducts. The prevention of flame propagation calls for specially designed protective measures.
Welding beads that occur when welding or cutting is carried out are sparks with a very large surface and therefore they are among the most effective sources of ignition.

Evaluation: the NOFIRNO sealing system is not intended to be in contact with open flames under normal conditions. In case of hot gases, sparks, glowing solid particles and open flames, the NOFIRNO sealing system acts as a fire barrier that prevents propagation of these hazards to adjacent places at the other side of the wall or floor.

Conclusion: No possible ignition source.

2.2.1.3 *Mechanically generated sparks*

As a result of friction, impact or abrasion processes such as grinding, particles can become separated from solid materials and become hot owing to the energy used in the separation process. If these particles consist of oxidizable substances, for example iron or steel, they can undergo an oxidation process, thus reaching even higher temperatures. These particles (sparks) can ignite combustible gases and vapours and certain dust/air-mixtures (especially metal dust/air mixtures). In deposited dust, smouldering can be caused by the sparks and this can be a source of ignition for an explosive atmosphere.
The ingress of foreign materials to equipment, protective systems and components, e.g. stones or tramp metals, as a cause of sparking shall be considered.
Rubbing friction, even between similar ferrous metals and between certain ceramics, can generate hot spots and sparks similar to grinding sparks. These can cause ignition of explosive atmospheres.
Impacts involving rust and light metals (e.g. aluminium and magnesium) and their alloys can initiate a thermite reaction which can cause ignition of explosive atmospheres.
The light metals titanium and zirconium can also form incendive sparks under impact or friction against any sufficiently hard material, even in the absence of rust.

Evaluation: the NOFIRNO sealing system does not take part in friction, impact or abrasion processes that could generate particles become separated from solid materials and become hot owing to the energy used in the separation process.
In the unlikely case that the outer surface of the NOFIRNO sealant would be hit by ingress of foreign materials from a process in the vicinity of the sealing system the elastic sealant would absorb the energy of these particles; no sparks would be generated.

Conclusion: No possible ignition source.

2.2.1.4 *Electrical apparatus*

In the case of electrical apparatus, electric sparks and hot surfaces can occur as sources of ignition. Electric sparks can be generated, e.g.:
a) when electric circuits are opened and closed;
b) by loose connections;
c) by stray currents.
It is pointed out explicitly that an extra low voltage (ELV, e.g. less than 50 V) is designed for personal protection against electric shock and is not a measure aimed at explosion protection. However, voltages lower than this can still produce sufficient energy to ignite an explosive atmosphere.

Not applicable to NOFIRNO sealing system.

2.2.1.5 *Stray electric currents, cathodic corrosion protection*

Stray currents can flow in electrically conductive systems or parts of systems as:
a) return currents in power generating systems - especially in the vicinity of electric railways and large welding systems - when, for example, conductive electrical system components such as rails and cable sheathing laid underground lower the resistance of this return current path;
b) a result of a short-circuit or of a short-circuit to earth owing to faults in the electrical installations;
c) a result of magnetic induction (e.g. near electrical installations with high currents or radio frequencies; and
d) a result of lightning.
If parts of a system able to carry stray currents are disconnected, connected or bridged - even in the case of slight potential differences - an explosive atmosphere can be ignited as a result of electric sparks and/or arcs.
Moreover, ignition can also occur due to the heating up of these current paths.
When impressed current cathodic corrosion protection is used, the above-mentioned ignition risks are also possible. However, if sacrificial anodes are used, ignition risks due to electric sparks are unlikely, unless the anodes are aluminium or magnesium.

Not applicable to NOFIRNO sealing system.

2.2.1.6 *Static electricity*

Incendive discharges of static electricity can occur under certain conditions. The discharge of charged, insulated conductive parts can easily lead to incendive sparks. With charged parts made of non-conductive materials, and these include most plastics as well as some other materials, brush discharges and, in special cases, during fast separation processes (e.g. films moving over rollers, drive belts), or by combination of conductive and non-conductive materials) propagating brush discharges are also possible. Cone discharges from bulk material and cloud discharges can also occur. Sparks, propagating brush discharges, cone discharges and cloud discharges can ignite all types of explosive atmospheres, depending on their discharge energy. Brush discharges can ignite almost all explosive gas and vapour atmospheres. According to the present state of knowledge, the ignition of explosive dust/air atmospheres by brush discharges can be excluded.

Evaluation: The NOFIRNO materials and components are non-conductive. The NOFIRNO sealing system is however not applied in contact with electrical equipment. There are no moving parts that could lead to the generation of static electricity by friction.
No incendive discharges of static electricity possible.

Conclusion: No possible ignition source.

2.2.1.7 *Lightning*

If lightning strikes in an explosive atmosphere, ignition will always occur. Moreover, there is also a possibility of ignition due to the high temperature reached by lightning conductors. Large currents flow from where the lightning strikes and these currents can produce sparks in the vicinity of the point of impact. Even in the absence of lightning strikes, thunderstorms can cause high induced voltages in equipment, protective systems and components.

Not applicable to NOFIRNO sealing system.

2.2.1.8 *Radio frequency (RF) electromagnetic waves from 10^4 Hz to 3×10^{11} Hz*

Electromagnetic waves are emitted by all systems that generate and use radio-frequency electrical energy (radio-frequency systems), e.g. radio transmitters or industrial or medical RF generators for heating, drying, hardening, welding, cutting. All conductive parts located in the radiation field function as receiving aerials. If the field is powerful enough and if the receiving aerial is sufficiently large, these conductive parts can cause ignition in explosive atmospheres. The received radio-frequency power can, for example, make thin wires glow or generate sparks during the contact or interruption of conductive parts. The energy picked up by the receiving aerial, which can lead to ignition, depends mainly on the distance between the transmitter and the receiving aerial as well as on the dimensions of the receiving aerial at any particular wavelength and RF power.

Evaluation: the NOFIRNO sealing system has no conductive parts.
Not applicable to the NOFIRNO sealing system.

2.2.1.9 *Electromagnetic waves from 3×10^{11} Hz to $3. \times 10^{15}$ Hz*

Radiation in this spectral range can – especially when focused – become a source of ignition through absorption by explosive atmospheres or solid surfaces.
Sunlight, for example, can trigger an ignition if objects cause convergence of the radiation (e.g. bottles acting as lenses, concentrating reflectors).
Under certain conditions, the radiation of intense light sources (continuous or flashing) is so intensively absorbed by dust particles that these particles become sources of ignition for explosive atmospheres or for dust deposits.
With laser radiation (e.g. in communications, distance measuring devices, surveying work, visual-range meters), even at great distances, the energy or power density of even an unfocussed beam can be so great that ignition is possible. Here, too, the process of heating up occurs mainly when the laser beam strikes a solid body surface or when it is absorbed by dust particles in the atmosphere or on dirty transparent parts.

The NOFIRNO sealing system does not cause radiation nor is it sensitive for these kinds of radiation.

Conclusion: No possible ignition source.

2.2.1.10 *Ionizing radiation*

Ionizing radiation generated, for example, by X-ray tubes and radioactive substances can ignite explosive atmospheres (especially explosive atmospheres with dust particles) as a result of energy absorption. Moreover, the radioactive source itself can heat up owing to internal absorption of radiation energy to such an extent that the minimum ignition temperature of the surrounding explosive atmosphere is exceeded. Ionizing radiation can cause chemical decomposition or other reactions which can lead to the generation of highly reactive radicals or unstable chemical compounds. This can cause ignition.

NOFIRNO parts are resistant to radiation (Kiwa certified). No chemical decomposition of the materials in contact with radiation.

Conclusion: No possible ignition source.

2.2.1.11 Ultrasonics

In the use of ultrasonic sound waves, a large proportion of the energy emitted by the electroacoustic transducer is absorbed by solid or liquid substances. As a result, the substance exposed to ultrasonics warms up so that, in extreme cases, ignition may be induced.

Evaluation: the NOFIRNO sealant and rubber parts are non-polar and therefore hardly sensitive for ultrasonic sound waves and will not heat up.

Conclusion: No possible ignition source.

2.2.1.12 Adiabatic compression and shock waves

In the case of adiabatic or nearly adiabatic compression and in shock waves, such high temperatures can occur that explosive atmospheres (and deposited dust) can be ignited. The temperature increase depends mainly on the pressure ratio, not on the pressure difference.

Not applicable to the NOFIRNO sealing system.

2.2.1.13 Exothermic reactions, including self-ignition of dusts

Exothermic reactions can act as an ignition source when the rate of heat generation exceeds the rate of heat loss to the surroundings. Many chemical reactions are exothermic. Whether a reaction can reach a high temperature is dependent, among other parameters, on the volume/surface ratio of the reacting system, the ambient temperature and the residence time. These high temperatures can lead to ignition of explosive atmospheres and also the initiation of smouldering and/or burning.

Evaluation: the NOFIRNO materials are chemically stable.

Conclusion: No possible ignition source.

3 Conclusions

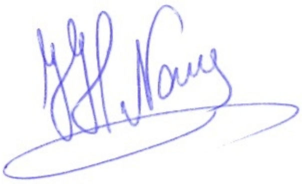
NOFIRNO sealant, NOFIRNO rubber sleeves as well as an installed NOFIRNO sealing system have no autonomous function and are no parts of equipment in the sense of the ATEX Directive.

Following the ATEX Directive Guidelines a risk assessment of the NOFIRNO sealant, NOFIRNO rubber sleeves and installed NOFIRNO sealing system is carried out according to EN 1127-1.
It is concluded that for all described possible unsafe situations in explosive atmospheres NOFIRNO sealant, NOFIRNO rubber sleeves and installed NOFIRNO sealing system have no possible source of ignition.

The NOFIRNO sealing system shows conformity to the requirements of ATEX Directive 2014/34/EU.

4 Signature

Rijswijk, May 2017



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