

A public-law institution jointly sponsored
by the Federal Government and the federal
states

General technical approval / General type approval

**Approval and licensing body for
construction products and construction
types**

Date:

27.07.2021

Reference:

II 23-1.65.30-30/21

Number:

Z-65.30-562

Period of validity

from: **17 August 2021**

until: **17 August 2026**

Applicant:

Fenotec GmbH
Bahnhofsweg 2
14547 Beelitz
Germany

Subject of this notice:

Leak protection lining type "Fenosafe fuel" for the storage of fuels, oils, hydrocarbons, alcohols, esters and ketones

The above-mentioned subject of regulation is hereby generally approved/authorised by the building authorities.

This notice comprises twelve pages and one annex.

The object was first approved by the general building authorities on 16 August 2016.

Translation of the original German version, not verified by Deutsches Institut für Bautechnik.

I GENERAL REGULATIONS

- 1 This notice proves the usability or applicability of the subject matter of the regulation in the sense of the building regulations of the federal states.
- 2 This notice does not replace the permits, approvals and certificates required by law for the implementation of building projects.
- 3 This notice is issued without prejudice to the rights of third parties, in particular private property rights, are granted.
- 4 Copies of this notification must be made available to the user of the subject matter of the regulation, without prejudice to further provisions in the "Special Provisions". In addition, the user of the subject matter must be informed that this notification must be available at the place of use or application. Copies must also be made available to the authorities involved upon request.
- 5 This notification may only be reproduced in full. Publication of extracts requires the consent of Deutsches Institut für Bautechnik. Texts and drawings of promotional literature must not contradict this notice, translations must contain the note "Translation of the original German version not verified by Deutsches Institut für Bautechnik".
- 6 This notification is revocable. The provisions may be subsequently supplemented and amended, in particular if new technical expertise makes this necessary.
- 7 This notice refers to the information provided and documents submitted by the applicant. A change in these basic principles is not covered by this notification and must be disclosed to Deutsches Institut für Bautechnik without delay.

I SPECIAL PROVISIONS

1 Subject matter of regulation and area of use respectively scope of application

(1) The subject of this notice is a leak protection lining of the type "Fenosafe fuel" which is part of a leak detection device and is used to create a surveillance space together with a tank wall. The leak protection lining may be used for the storage of the following Liquids with a minimum ignition energy MIE ≥ 0.2 mJ:

1. petrol according to DIN EN 228¹ with an ethanol content of max. 20 %,
2. diesel fuel according to DIN EN 590², or mixtures of diesel fuel and a total of max. 20 % fatty acid methyl ester (FAME) according to DIN EN 14214³, for use as a fuel for vehicles,
3. unused internal combustion engine oils, unused motor vehicle transmission oils, aliphatic and aromatic hydrocarbons with a mass fraction of aromatics of max. 20 % and a flash point > 55 °C (media group 3 according to DIN EN 14879-4⁴, Annex C, Table C.1),
4. used internal combustion engine oils and used motor vehicle transmission oils having a flash point > 55 °C (media group 5b according to DIN EN 14879-4, Annex C, Table C.1),
5. all hydrocarbons including benzene and mixtures containing benzene (media group 5^d according to DIN EN 14879-4, Annex C, Table C.1),
6. all alcohols and glycol ethers (media group 7 according to DIN EN 14879-4, Annex C, Table C.1),
7. all organic esters and ketones, (media group 8 including 8a and 8b (biodiesel) according to DIN EN 14879-4, Annex C, Table C.1),
8. aviation gasoline 100 LL and jet fuel Jet-A1 with additives (NATO code F-34).

(2) Each leak protection liner consists of a tailored liner (inner cover), a bottom protection plate welded to the liner, an intermediate layer and the accessories, e.g. fastening devices, connecting lines, grommets and angled hose nozzles.

(3) The surveillance space is monitored by a vacuum leak detector with an alarm switching pressure of at least 30 mbar negative pressure (≤ -30 mbar) and a pump-off pressure, depending on the intermediate layer, of at most 100 mbar ± 15 mbar negative pressure (≥ -100 mbar) respectively at most 450 mbar ± 15 mbar negative pressure (≥ -450 mbar). A leak in the walls of the surveillance space is detected by an increase in pressure and indicated visually and acoustically (for an example of the arrangement of the leak protection lining, see Appendix 1).

(4) The leak protection lining may be installed in cylindrical tanks made of steel. The tanks must not be higher than 3 m.

¹ DIN EN 228:2017-08

Automotive fuels - Unleaded petrol - Requirements and test methods

² DIN EN 590:2017-10

Automotive fuels - Diesel - Requirements and test methods

³ DIN EN 14214:2019-05

Liquid petroleum products - Fatty acid methyl esters (FAME) for use in diesel engines and heating applications - Requirements and test methods

⁴ DIN EN 14879-4:2008-01

Organic coating systems and linings for protection of industrial apparatus and plants against corrosion caused by aggressive media - Part 4: Linings on metallic components

(5) The tanks must be demonstrably suitable for the storage of the liquids referred to in paragraph (1) and must be operated under atmospheric pressure at a temperature of max. 30 °C.

(6) This notice provides proof of the functional safety of the subject of regulation within the meaning of paragraph (1).

(7) The notice shall be issued without prejudice to the provisions and reservations of review or of approval of other areas of law.

(8) This notice considers the water law requirements for the subject matter of the regulation. Pursuant to § 63 para. 4 nos. 2 and 3 WHG⁵, the subject matter is thus deemed suitable from the point of view of water law.

(9) The period of validity of this notice (see page 1) refers to the use in the sense of installation of the subject matter of the regulation and not to the use in the sense of subsequent use.

2 Provisions for the construction product

2.1 General

The leak protection lining and its parts shall comply with the Special Provisions and the Annex to this notice as well as the information deposited with Deutsches Institut für Bautechnik.

2.2 Composition and properties

(1) The inlay consists of the foil type "Fenosafe silver 800ext" with a total thickness of 0.9 mm. It meets the following requirements:

- it withstands the mechanical and thermal stresses that occur,
- it is chemically resistant to the liquids mentioned in section 1 (1),
- it has a permeability that ensures the functionality of the intermediate layers in accordance with section 2.2 (3) and the leak detector,
- it is conductive and may be used in accordance with test reports "PTB Ex 14-54194" of 05.12.2014 and "PTB Ex 16-56154-best-korr" of 13.01.2017 for the storage of liquids with a flash point ≤ 55 °C.

(2) The bottom protection plate is made of the material of the foil type "Fenosafe silver 800" and has a thickness of 0.8 mm. It is welded to the inlay at the applicant's factory.

(3) Synthetic fleece sheets may be used as an intermediate layer for tanks that are more than 30 cm below ground level or are installed above ground in buildings at a temperature not exceeding 40 °C, as follows:

- Type "LSV 6", weight per unit area: approx. 1000 g/m², thickness approx. 9 mm, conductive,
for the liquids 1. to 6. and 8. according to section 1 (1),
Pump-off pressure of the leak detector max. 100 mbar \pm 15 mbar negative pressure.
- Type "Fenotex", weight per unit area: 340 to 450 g/m², thickness: 4 to 5 mm,
for the liquids 1. and 2. according to section 1 (1),

⁵ Water Resources Act of 31 July 2009 (BGBl. I p. 2585), as last amended by Article 1 of the Act of 19 June 2020 (BGBl. I p. 1408)

- Pump-off pressure of the leak detector max. 450 mbar \pm 15 mbar negative pressure,
double-layer installation at the bottom and from there on the tank wall minus 2 m.
- Type "Fenotex plus", weight per unit area: 590 to 610 g/m², thickness: 6 to 7 mm, for the liquids 1. and 2. according to section 1 (1),
Pump-off pressure of the leak detector max. 100 mbar \pm 15 mbar negative pressure.
- (4) The inner diameter of the connecting pipes between the leak detector and the surveillance space must be at least 4 mm for tanks that are at least 30 cm below ground level and for tanks in rooms, and at least 6 mm for other tanks. For connecting pipes longer than 50 m, a correspondingly larger inner diameter must be selected.

2.3 Production and labelling

2.3.1 Production

- (1) The film "Fenosafe silver 800" and the fleece for the intermediate layer may only be manufactured in the factories that have been named to the DIBt.
- (2) The foil may only be manufactured and the discharge capacity produced in the factory of the applicant, Fenotec GmbH in 14547 Beelitz. The joining seams of the inlay must be made in accordance with DVS guideline 2225-1⁶. The person performing the weld or the person responsible for the execution of the weld seam must have a valid certificate according to DVS guideline 2212 part 3⁷. After processing, the foil has the designation "Fenosafe silver 800^{ext}".

2.3.2 Packaging, transport, storage

Packaging, transport and storage of the construction products or components according to section 1 (2) must be carried out in such a way that the usability is not impaired. Building products or components damaged during transport and storage must be removed from further use.

2.3.3 Labelling

- (1) The tailored inlay as well as the intermediate layer, its packaging or its delivery note shall be marked by the applicant with the mark of conformity (Ü mark) according to the conformity mark ordinances of the federal states. The labelling may only be made if the requirements according to section 2.4 are fulfilled. In addition, the tailored inlay must be marked with the following information.
- Name or code of the product type,
 - year of manufacture,
 - serial number.
- (2) With regard to the labelling by the operator of the tanks fitted with a leak protection lining, see section 4.1 (1).

⁶ DVS- guideline 2225-1:2019-10 Welding of lining membranes of polymer materials in geotechnical and hydraulic engineering

⁷ DVS- guideline 2212-3:1994-10 Testing of Plastics Welders - Test Group III - Lining membranes in geotechnical and hydraulic engineering

2.4 Conformity attestation

2.4.1 General

(1) The attestation of compliance of the non-tailored foil with the provisions of the general technical approval covered by the notification shall be provided for the manufacturing plant by means of a declaration of compliance of the manufacturer on the basis of a factory production control and a certificate of compliance of a certification body recognised for this purpose as well as regular external surveillance by a recognised surveillance body according to the following provisions:

- For the issuing of the certificate of conformity and the external surveillance, including the product tests to be carried out, the manufacturer of the foil shall engage a certification body recognised for this purpose as well as a surveillance body recognised for this purpose.
- The certification body shall provide the Deutsches Institut für Bautechnik with a copy of the certificate of conformity issued by it.

(2) The attestation of compliance of the tailored inlay as well as the intermediate layer with the provisions of the general technical approval covered by the notice shall be made for the manufacturer's works with a declaration of compliance on the basis of a factory production control and an initial test of the products by a testing body recognised for this purpose. The manufacturer must submit the declaration of compliance by marking the products with the mark of conformity (Ü mark) with a note of the intended use.

2.4.2 Factory production control

(1) A factory production control system shall be established and maintained at the manufacturing plant. In-house production control means the continuous surveillance of production to be carried out by the manufacturer to ensure that the products manufactured by him conform to the provisions of the general technical approval covered by the notice. The factory production control must include at least the measures listed below.

(2) The results of the factory production control shall be recorded and evaluated. The records shall contain at least the following information:

- designations of the foil and the intermediate layer,
- type of inspection or test,
- date of manufacture and testing of the un-tailored foil, the tailored inlay and the interlayer,
- results of the inspections or tests,
- signature of the person responsible for factory production control.

(3) The records shall be kept for at least five years. They must be submitted to the Institut für Bautechnik and the competent supreme building supervisory authority on request.

(4) If the test result is unsatisfactory, the applicant shall immediately take the necessary measures to remedy the defect. Foils, inlays and layer pads which do not meet the requirements shall be handled in such a way that confusion with matching ones is excluded. After the fault has been remedied, the test in question must be repeated

without delay, insofar as this is technically possible and necessary to prove that the fault has been remedied.

2.4.2.1 Factory production control of the un-tailored foil

(1) The applicant shall verify that with the acceptance test certificate 3.1 according to DIN EN 10204⁸ for the foil it is attested by the manufacturer of the foil according to a factory production control that the tests according to the following table have been carried out and that the requirements have been met:

	Test basis	Requirements	Frequency
General texture and appearance	visual	Closed surface, free of cracks, bubbles and pores, no damage	min. 1 x per batch
Thickness	DIN EN 1849-2 ⁹	Nominal thickness: 0.8 mm average deviation $\pm 10\%$ Deviation of individual values $\leq 12\%$	min. 1 x per batch
Density	DIN EN ISO 1183-1 ¹⁰	1,26 g/cm ³ $\pm 2\%$	1 x per batch
Tensile strength	DIN EN ISO 527-3 ¹¹ Test speed: 200 mm/min $\pm 10\%$ specimens: Type 2	≥ 15 MPa	min. 1 x per batch
Elongation at break	DIN EN ISO 527-3 Test speed: 200 mm/min $\pm 10\%$ specimens: Type 2	$\geq 200\%$	min. 1 x per batch
Dimensional change after storage at 80 °C	DIN EN 1107-2 ¹²	$\leq 10\%$	min. 1 x per batch
Folding in the cold	DIN EN 495-5 ¹³	No cracks at -20 °C	annually

⁸ DIN EN 10204:2005-01

Metallic products - Types of inspection documents

⁹ DIN EN 1849-2:2010-04

Flexible sheets for waterproofing - Determination of thickness and mass per unit area - Part 2: Plastics and rubber sheets for roof waterproofing

¹⁰ DIN EN ISO 1183-1:2013-04

Plastics - Methods for determining the density of non-cellular plastics - Part 1: Immersion method, liquid pycnometer method and titration method

¹¹ DIN EN ISO 527-3:2003-07

Plastics - Determination of tensile properties - Part 3: Test conditions for films and sheets

¹² DIN EN 1107-2:2001-04

Flexible sheets for waterproofing - Determination of dimensional stability - Part 2: Plastic and rubber sheets for roof waterproofing

¹³ DIN EN 495-5:2013-08

Flexible sheets for waterproofing - Determination of foldability at low temperature - Part 5: Plastic and rubber sheets for roof waterproofing

Marking	visual	Designation "Fenosafe silver 800" inside the roll sleeve	on each roll
---------	--------	--	--------------

(2) At the applicant's factory, the surface resistance of each tailored inlay shall be tested at 8 defined measuring points according to DIN IEC 62631-3-2¹⁴ with the corresponding measuring voltage. The resistance must be $<10^9 \Omega$.

2.4.2.2 Factory production control of the tailored inlay

(1) The routine testing of the tailored inlay must include at least the following measures:

- testing for dimensional accuracy,
- testing for leak tightness,
- Inspection of all joining seams in accordance with DVS Guideline 2225-2¹⁵

(2) For each welding procedure used, the behaviour of the joint seam during the shear test and the joining factor shall be tested four times a year on parallel samples according to the following conditions:

Test according to DIN EN ISO 527-3¹⁶, test speed: at least 100 mm/min,
 specimens: Type 2

The test specimens are taken from two web sections joined together parallel to the longitudinal direction in such a way that the joint seam is arranged in the middle of the measuring length and perpendicular to the tensile direction. The ratio of the tensile strength of the joined to the unjoined material gives the joining or welding factor. The test conditions must be the same for all samples to be compared.

The following requirements must be met:

- breakage outside the joining seam,
- joining factor ≥ 0.5 .

2.4.2.3 Factory production control of the intermediate layer

Within the scope of the incoming inspection of each intermediate layer, the result of the following tests in accordance with DIN EN 13160-7¹⁷ section 5.1.4, documented in the manufacturer's factory by inspection certificate "3.1" according to DIN EN 10204¹⁸, shall be checked for completeness and documented:

A nonwoven test sample of 100 cm², square or circular, from each batch is subjected to 1.3 x the highest possible pressure^x, but at least 0.5 bar, at room temperature until the residual thickness does not change by more than 1 % within 24 h from the initial thickness.

½ yearly this pressure load of the nonwoven test samples shall be carried out at 40 °C.

¹⁴ DIN IEC 62631-3-2:2016-10 Dielectric and resistive properties of solid insulating materials – Part 3-2: Determination of resistive properties (DC Methods) - Surface resistance and surface resistivity

¹⁵ DVS Guideline 2225-2:2019-02 Joining of Lining Membranes Made of Polymer Materials - Site Testing

¹⁶ DIN EN ISO 527-3:2003-07 Plastics - Determination of tensile properties – Part 3: Test conditions for films and sheets

¹⁷ DIN EN 13160-7:2016-12 Leak detection systems – Part 7: Requirements and test/assessment methods for interstitial spaces, leak detection linings and leak detection jackets

¹⁸ DIN EN 10204:2005-01 Metallic products - Types of inspection documents

Afterwards, these nonwoven test samples are further compressed until half the residual thickness ($\frac{1}{2} \times s_2$) is reached or they are loaded with 2.6 x highest possible pressure^x, but at least with 1.0 bar. In this condition, the air flow resistance is to be measured at a volume flow of 85 l/h.

Requirement: The measured air flow resistance must be ≤ 10 mbar.

^x The highest possible pressure is to be determined from the max. pump-off pressure, the max. density of the liquid and the max. tank height resulting from this notice for the corresponding intermediate layer.

For type "LSV 6", the discharge capacity $< 10^9 \Omega$ must be tested according to DIN IEC 62631-3-2.

2.4.3 External monitoring of the un-tailored foil

(1) For the un-tailored foil, the tests according to section 2.4.2.1 must be carried out regularly, at least once a year by a recognised inspection body. The samples shall be provided by the applicant.

(2) An initial test must be carried out as part of the external monitoring. The approval tests for this general technical approval can be evaluated as initial tests.

(3) The results of certification and external surveillance shall be kept for at least five years. They shall be submitted by the certification body or the inspection body to Deutsches Institut für Bautechnik and the competent supreme building supervisory authority upon request.

2.4.4 Initial testing of the tailored inlay as well as the intermediate layer by a recognised testing centre

Within the scope of the initial test of the tailored inlay as well as the intermediate layer, tests corresponding to the factory production control shall be carried out. If the evidence on which the general technical approval is based has been provided on samples from current production, these tests replace the initial test.

3 Provisions for planning and execution

3.1 Planning

(1) The leak protection lining may only be installed if the manhole of the tank has a diameter of at least 500 mm.

(2) After the installation of the leak protection lining, the setting dimension (dimension x) for the limit value transmitter / the overflow protection of the respective tank must be determined according to the reduced filling volume by the installing company or by an expert according to water law and the limit value transmitter / the overflow protection must be set accordingly. The changed setting dimension must be documented in the tank's marking respectively deposited in the tank's documents.

3.2 Execution

(1) The leak protection lining must be installed and put into operation in accordance with the tested installation instructions¹⁹. Only companies with knowledge of fire and explosion protection may be entrusted with the installation, maintenance, repair and

¹⁹ Installation instructions certified by TÜV NORD Systems GmbH & Co. KG as of June 2016 Rev. 1.0 for the leak protection lining type "Fenosafe fuel".

cleaning of the leak protection lining if these activities are carried out on tanks for liquids with a flash point ≤ 55 °C.

(2) The so-called unmanned installation of the leak protection lining (without entering the tank) may only be carried out by specialist companies that have been instructed accordingly by Fenotec GmbH. The camera inspection of the tank prior to unmanned installation may only be carried out by a test centre²⁰ confirmed by DIBt, see also installation instructions section 2.2.2.

(3) The conductive coating must be connected to earth in a suitable manner, e.g. at the manhole pit or the equipotential bonding rail of the installation.

(4) There must be an electrically conductive connection between the liquid and earth for equipotential bonding.

(5) The suction line must be gas- and liquid-tight and must be routed between the intermediate layer and the tank wall from the manhole to the tank bottom and there along the tank bottom to the end of the tank. A perforated tube (compensating line) is connected to the respective suction line by means of a plastic plug-in connection.

(6) Edges and reinforcements or reinforcement rings in the containers must be separately padded with plastic fleece, see section 2.2 (3).

(7) The intermediate layers are to be used according to section 2.2 (3).

(8) If an already operated tank is to be equipped with the leak protection lining, it must fulfil the following requirements:

- the condition of the inner tank wall must be sufficient at the time of refurbishment,
- corrosion damage must have been eliminated
- deviations from roundness must be permissible.

(9) The installing company shall submit a declaration of conformity of the design (installed leak protection lining) with this notice. This is based on the requirements according to section 4.2 of this notice.

4 Provisions for use, maintenance, servicing and testing

4.1 Provisions for use

(1) The operator shall attach a sign to the tank with the inscription:

"Attention! Storage tank is equipped with inner cover and vacuum leak detector. Filling may only take place when system is properly in operation."

(2) When storing liquids with a flash point ≤ 55 °C, the tanks equipped with the leak protection lining must not be repeatedly filled and emptied quickly. The tanks must not be operated with agitators.

(3) The following documents shall be handed over to the user of the leak protection lining:

- print of this certificate,
- declaration of conformity according to section 3.2 (9) (e.g. installation and test certificate),
- installation instructions,
- technical description of the leak detector.

²⁰ Information available from DIBt

4.2 Provisions for the commissioning tests

(1) The following checks and tests shall be carried out by the installing company in accordance with section 3.2 (1) and (2):

- checking the identity of the construction products intended for installation,
- checking the correct installation of the inserts and their marking in accordance with Section 2.3.3,
- checking the tightness of the installed leak protection lining:

The surveillance space is first evacuated to 600 mbar negative pressure and then ventilated to 300 mbar negative pressure. The holding of the negative pressure of 300 mbar is then tested in a long-term test with the connection of a suitable measuring device (up to a maximum of 7 days, depending on the volume of the surveillance space, but at least 30 minutes). The measuring device is considered suitable if pressure changes of ≤ 1 mbar can be read.

The examination is considered passed if the following condition is met:

$$0,1 \geq \frac{(p_B - p_E) \cdot V_1}{t} \quad [\text{mbar} \cdot \text{l} \cdot \text{s}^{-1}]$$

Here

p_B is the pressure at the beginning of the test, in mbar

p_E is the pressure at the end of the test, in mbar

V_1 is the volume of the surveillance space, in litres

t is the test time, in seconds

The temperature at the beginning and end of the test should not differ by more than 1 K, otherwise the temperature difference must be taken into account in the test result.

The temperature at the beginning and end of the test should not differ by more than 1 K, otherwise the temperature difference must be taken into account in the test result.

Tank volume [l]	Testing time [min]	$p_B - p_E$ [mbar]
≤ 1.000	≥ 30	≤ 10
≤ 5.000	≥ 30	≤ 3
≤ 10.000	≥ 60	≤ 4
≤ 16.000	≥ 60	≤ 3
≤ 30.000	≥ 90	≤ 3
≤ 60.000	≥ 150	≤ 3
≤ 80.000	≥ 180	≤ 3
≤ 100.000	≥ 240	≤ 3
≤ 200.000	≥ 300	≤ 3

- The electrically conductive connection of the leak protection lining and all installations for the required equipotential bonding between liquid and earth must be checked. The explosion protection measures are not the subject of this notice.

(2) The results of the inspections and tests shall be recorded. The records must contain at least the following information:

- designation of the leak protection lining,
- date and result of the inspection,
- signature of the person responsible for the execution control.

(3) The records shall be kept on the operator's file. They shall be submitted to Deutsches Institut für Bautechnik, the competent supreme building supervisory authority and the expert in accordance with water law upon request.

(4) If the test result is unsatisfactory, the installer must immediately take the necessary measures to remedy the fault. Inlays that do not meet the requirements are to be handled in such a way that any confusion with matching inlays is ruled out. After the fault has been remedied, the existing test must be repeated without delay - insofar as this is technically possible and necessary to prove that the fault has been remedied.

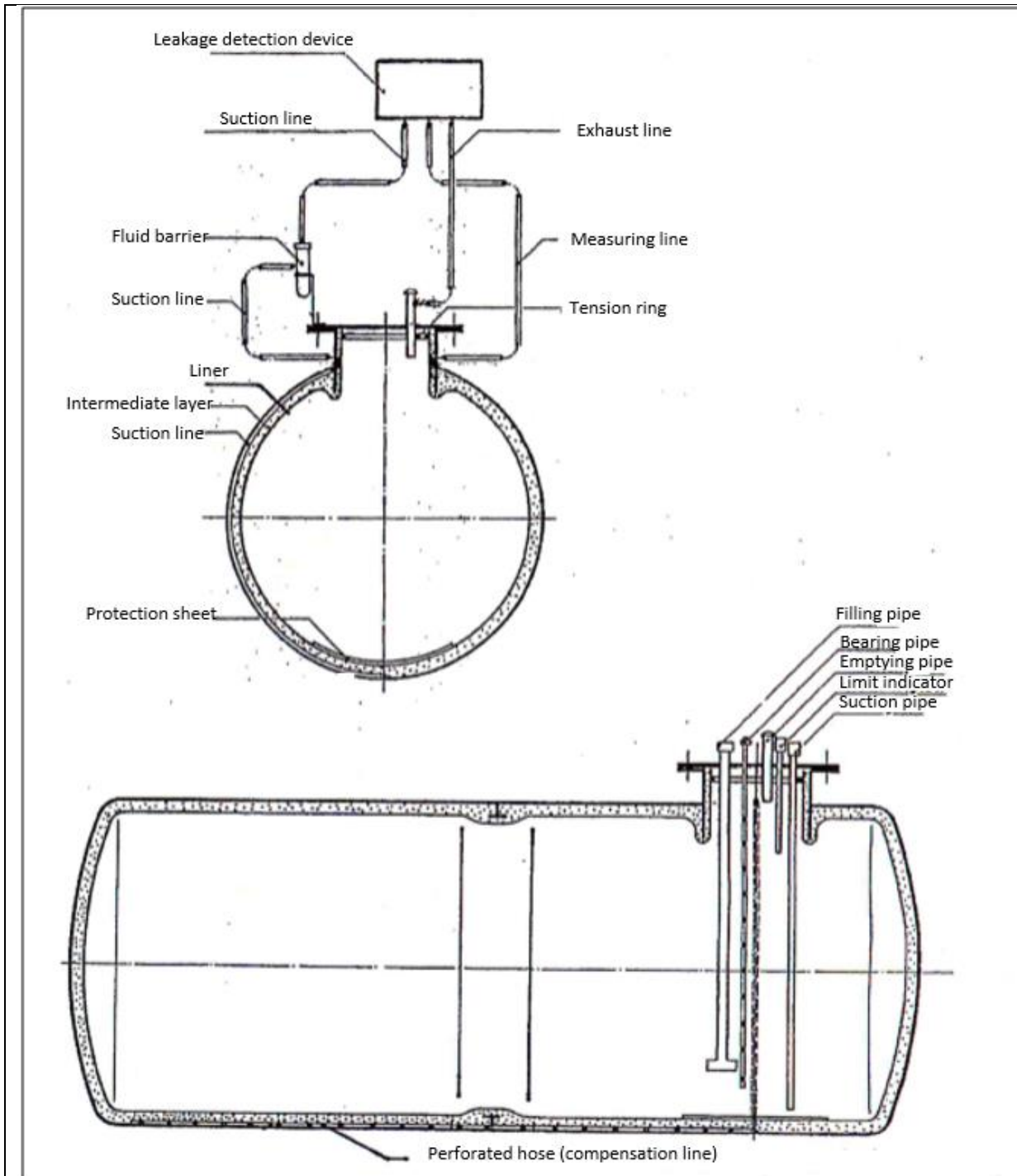
4.3 Provisions for periodic inspections

(1) The leak protection lining shall be included in the tests of the tank.

(2) Recurring inspections according to other areas of law, also with regard to explosion protection, remain unaffected.

Holger Eggert
Head of Unit

Certified
Schoenemann



Leak protection lining type "Fenosafe fuel" for the storage of fuels, oils, hydrocarbons, alcohols, esters and ketones	Annex 1
Schematic diagram	