Department of Environmental Protection

2600 Blair Stone Road ♦ Tallahassee, Florida 32399-2400

DEP Form: 62-761.900(9)
Form Title: Storage Tank Equipment Registration Form
Effective Date: July 2019
Incorporated in Rule 62-761.850, F.A.C.

Storage Tank System Equipment Registration Form

Fill out completely

General Information

Company Name: Don Wood, Inc.
Contact Name: Luis A. Diaz
Company Address: 6501 Old Winter Garden Rd.
City, State: Orlando, Florida Zip: 32835
E-mail: ldiaz@donwoodinc.com
Contact Number: 407-293-0891
Product Name: Rafibra
Model Number(s): Rafibra
Product Type: Internal Field-Fabricated Sec. Containment
Rule(s) citation that registration is being requested within Chapter 62-761 (UST), and/or 62-762 (AST), 62-761.900 and 62-762.501, F.A.C.

F.A.C.: Write a brief description of equipment registration request including product limitations:

Rafibra is an internal field-fabricated secondary containment system that is co-structural that can be used as an upgrade for a single-wall UST or AST or a repair for an existing double-wall UST or AST. It will be installed and managed in the United States by Don Wood, Inc.

Information Checklist (Choose Yes, No, or N/A - Not Applicable):

		Yes	No	N/A
1.	Third-party Certification by a Nationally Recognized Testing Laboratory? (Required)	✓		
2.	Documentation of third-party evaluation that the equipment meets DEP Rules?	✓		
3.	Documents included about the qualifications of the Nationally Recognized Testing Laboratory?	✓		
4.	Technical information and drawings included?	✓		
5.	Installation instructions included?	✓		
6.	Annual Operability Testing Requirements (Rules 62-761.500, 62-762.501, & 62-762.502 F.A.C.)?	✓		
7.	Integrity Testing Requirements (Rules 62-761.700, 62-762.701, & 62-762.702, F.A.C.)?	✓		
8.	Compatible with fuel blends containing >10% ethanol or >20% biodiesel?	✓		
9.	Has the product been approved or registered in other countries or states? (If so provide list)	✓		
10.	Any requirements for company-certified installers or trainers?	✓		
11.	Was this product(s) previously approved or registered by the Department? If yes, EQ- 979		✓	
12.	Any changes or modifications to the equipment since the last submittal to DEP?			✓

Document Information: Provide supporting documents indicated as "Yes" above including this form via email to Tanknotify@floridadep.gov, or documents can be sent to FDEP, Division of Waste Management, 2600 Blair Stone Road, MS 4560, Tallahassee, FL 32399.

Write a brief description of equipment installation and performance in the U.S.:

The Rafibra System is similar to other FDEP approved internal field-fabricated secondary containment systems but meets stringent European standards. The system is widely used in Europe.

Equipment Registration Certification:

To the best of my knowledge and belief, all information submitted on this form is true, accurate and complete.

Luis A. Diaz
Printed Name and Title

Signature (right click to sign)

4-15-24
Date

For Department Use Only:

Date Application Received: 05/09/2024 Application complete: Yes: [X] No: [ ]

EQ- 979 Date of complete or incomplete letter sent: 06/10/2024 Date Equipment Requires Renewal: 06/10/2029

Storage tank system equipment requires renewal every 5 years in accordance with subsection 62-761.850(2), F.A.C.

Department of Environmental Protection

2600 Blair Stone Road ♦ Tallahassee, Florida 32399-2400

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Storage Tank System Equipment Registration Form

Fill out completely

General Information

Company Name: Don Wood, Inc.
Contact Name: Luis A. Diaz
Company Address: 6501 Old Winter Garden Rd.
City, State: Orlando, Florida Zip: 32835
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Contact Number: 407-293-0891
Product Name: Rafibra
Model Number(s): Rafibra
Product Type: Internal Field-Fabricated Sec. Containment
Rule(s) citation that registration is being requested within Chapter 62-761 (UST), and/or 62-762 (AST), 62-761.900 and 62-761.500(2)(f), F.A.C.

F.A.C.: Write a brief description of equipment registration request including product limitations:

Rafibra is an internal field-fabricated secondary containment system that is co-structural that can be used as an upgrade for a single-wall UST or a repair for an existing double-wall UST. It will be installed and managed in the United States by Don Wood, Inc.

Information Checklist (Choose Yes, No, or N/A - Not Applicable):

		Yes	No	N/A
1.	Third-party Certification by a Nationally Recognized Testing Laboratory? (Required)	✓		
2.	Documentation of third-party evaluation that the equipment meets DEP Rules?	✓		
3.	Documents included about the qualifications of the Nationally Recognized Testing Laboratory?	✓		
4.	Technical information and drawings included?	✓		
5.	Installation instructions included?	✓		
6.	Annual Operability Testing Requirements (Rules 62-761.500, 62-762.501, & 62-762.502 F.A.C.)?	✓		
7.	Integrity Testing Requirements (Rules 62-761.700, 62-762.701, & 62-762.702, F.A.C.)?	✓		
8.	Compatible with fuel blends containing >10% ethanol or >20% biodiesel?	✓		
9.	Has the product been approved or registered in other countries or states? (If so provide list)	✓		
10.	Any requirements for company-certified installers or trainers?	✓		
11.	Was this product(s) previously approved or registered by the Department? If yes, EQ- _____		✓	
12.	Any changes or modifications to the equipment since the last submittal to DEP?			✓

Document Information: Provide supporting documents indicated as "Yes" above including this form via email to Tanknotify@floridadep.gov, or documents can be sent to FDEP, Division of Waste Management, 2600 Blair Stone Road, MS 4560, Tallahassee, FL 32399.

Write a brief description of equipment installation and performance in the U.S.:

The Rafibra System is similar to other FDEP approved internal field-fabricated secondary containment systems but meets stringent European standards. The system is widely used in Europe.

Equipment Registration Certification:

To the best of my knowledge and belief, all information submitted on this form is true, accurate and complete.

Luis A. Diaz
Printed Name and Title

Signature (right click to sign)

07/07/2022
Date

For Department Use Only:

Date Application Received: 07/18/2022 Application complete: Yes: [X] No: [ ]

EQ- 979 Date of complete or incomplete letter sent: 07/18/2022 Date Equipment Requires Renewal: 07/18/2027

Storage tank system equipment requires renewal every 5 years in accordance with subsection 62-761.850(2), F.A.C.

Equipment Registration Submittal

to the

Florida Department of Environmental Protection's
Division of Waste Management
Compliance Assistance Program

By

Don Wood, Inc.

for the

Rafibra Internal Field-Fabricated Secondary Containment System

Submitted on July 07, 2022 by

Marshall T. Mott-Smith, President
Mott-Smith Consulting Group, LLC
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Mott-Smith
Consulting Group LLC

Mott-Smith
Consulting Group LLC

July 7, 2022

Amanda Dorsett,
Environmental Administrator
Florida Department of Environmental Protection
Division of Waste Management
Compliance Assistance Program
2600 Blair Stone Road
Tallahassee, Fl 32399-2400

Re: Equipment Registration Renewal Request for the Rafibra Internal Field-Fabricated Secondary Containment System

Dear Amanda,

We are submitting a new Equipment Registration from Don Wood, Inc. for their Rafibra Internal Field-Fabricated Secondary Containment System. They would appreciate the expedient processing of this request. Don Wood, Inc. appreciates your consideration in this matter, and please feel free to contact me if you have any questions or if we need to provide additional information.

Best Regards,

Marshall Mott-Smith, President

Mott-Smith Consulting Group, LLC

111 North Calhoun Street

Tallahassee, FL 32301

850.391.9835

www.mott-smithconsulting.com

Table of Contents

1. Background

This Equipment Registration Submittal is sought in accordance with Florida Administrative Code Rule 62-761.850(2) by Don Wood, Inc. With the exception of the cover letter of this Equipment Registration Request, Don Wood, Inc. is requesting that every document within the Equipment Approval Request be considered CONFIDENTIAL. The reason Don Wood, Inc.is requesting confidentiality is because the proprietary nature of the information. Don Wood, Inc. does not want to share this information with competitors and adversely affect the marketability of the Rafibra Internal Field-Fabricated Secondary Containment System

The Rafibra Internal Field-Fabricated Secondary Containment System is a system that repairs existing double-wall steel or fiberglass USTs or converts an existing single-wall steel or fiberglass system with a new double-wall secondary containment tank within an existing UST. The Rafibra Internal Field-Fabricated Secondary Containment System has several European third-party approvals by internationally recognized third-party laboratories.

The Rafibra Internal Field-Fabricated Secondary Containment System is for new construction or the upgrade of single-wall USTs to double-wall USTs with secondary containment and interstitial monitoring. All materials in the Rafibra Internal Field-Fabricated Secondary Containment System are non-metallic and will not corrode. The resins have physical properties and compatibility with the products stored within petroleum storage tank systems. In accordance with the requirements of Rule 62-761, F.A.C., the system is impervious, able to withstand deterioration and the secondary containment and interstitial space has sufficient strength and thickness to contain regulated substances for 30 days.

Rafibra, S.L., with its facilities in Alberic, Valencia, Spain, has equipment and infrastructure necessary for the repair and coating of underground atmospheric storage tanks and for the verification of the tightness of these systems. Rafibra has a worldwide presence, knowledge of systems, materials, and advanced procedures, and the proven experience in the procedure of in situ conversions of single-wall USTs to double-wall USTs. They have the capacity to manage and coordinate each one of the job phases and have the required inventory of the material, equipment, and instruments to effect and guarantee the proper installation of their system. They have a system for residue extraction, ventilation, and the measurement of the thicknesses of the metallic structures of tanks and tank coatings using ultrasonic methods, and other testing equipment and instruments.

Rafibra and Don Wood, Inc. have an experienced group of technical personnel, installers, and engineers, for the installation, testing, and monitoring of their Internal Field-Fabricated Secondary Containment System.

Third Party Approvals

The Rafibra Internal Field-Fabricated Secondary Containment System has third-party approvals from LNE (The National Metrology and Testing Laboratory) in Paris, AIMPLAS, (the Technological Institute of Plastics) in Spain, and The Bureau Veritas in Spain. These Laboratories and Technological Institutes meet the definition of a Nationally Recognized Laboratory as defined in Rule 62-762.201(47), F.A.C., and as required in Rule 62-762.851(2), F.A.C. The system meets the demonstration of equivalent protection and certification that is required in DEP Rule 62-761.850(2)(f), F.A.C. Copies of the third-party approvals are provided in Appendix A of this submittal.

2. The Rafibra Internal Field-Fabricated Secondary Containment System

The Rafibra Internal Field-Fabricated Secondary Containment System is a field-constructed double-walled fiberglass tank system that is designed and constructed to be installed within an existing steel or fiberglass single-wall or double-wall underground storage tank. The design employs the fiberglass laminate matrix in conjunction with a Parabeam interstice.

The installation protocols are specified in Attachment C of this submittal and in Section 3 below. The fabric and resins are compatible with petroleum products, and the Rafibra Internal Field-Fabricated Secondary Containment System can be used inside of a steel or fiberglass double-wall tanks. The materials compatibility information is provided in Appendix F of this submittal.

The Rafibra Internal Field-Fabricated Secondary Containment System can only be installed by people that are trained, certified, and qualified by Don Wood, Inc. in accordance with the manufacturers and installation instructions. This includes the installation, cleaning, inspecting, repairing and preparing of the existing tank interior surface.

The recommended release detection system is the SGB system previously approved by the FDEP. The SGB Release Detection System is being resubmitted for FDEP Equipment Registration concurrent with this submittal. However, the installation of a leak detection system in the interstitial space of the tank will be the choice of the tank owner. Once the double-wall system is constructed, a permanent leak detection system shall be installed for the detection of leaks in the interstitial space in accordance with Florida Department of Environmental Protection requirements.

The integrity test protocol for the Rafibra Internal Field-Fabricated Secondary Containment System is specified in Attachment D, and is performed at the time of installation, and if necessary, after the completion of repairs. No further integrity tests are required unless the tank has an incident that requires another repair and integrity test before the tank is put back into service.

The system meets the demonstration of equivalent protection and certification that is required in DEP Rule 62-761.850(2)(b), F.A.C. The fuel restrictions are specified to petroleum products, alcohol fuels, and alcohol fuel mixtures.

The average time of installation is between seven and ten days. The Installation Process is provided in Appendix C of this request. Only Rafibra-and Don Wood Inc. trained and certified personnel are authorized to install the Rafibra Internal Field-Fabricated Secondary Containment System. They will use equipment with attention to quality control and will perform all required testing. The Quality Control provisions and the Installation safety measures are addressed in the installation requirements.

The System incorporates the field-proven Parabeam internal secondary containment technology, and owners can choose whatever method of interstitial monitoring they prefer (visual inspection, sensors, hydrostatic, vacuum, or pressure). The sensors will have to have an annual operability test in accordance with DEP rules and manufacturer's specifications for the specific leak detection system approved by the Department in accordance with Rule 62-761.850(2)(b), F.A.C. More information about release detection is available in Appendix G.

3. ***Installation Process***

The documents in Appendix C specify the Installation Process and Procedures for the Rafibra System. The installation process includes the testing protocols, the interstitial communication test, the testing of the interstitial integrity, safety, tank entry, and inspection, and installation checklists.

The materials used in the construction of the Rafibra System include Parabeam that creates an interlocking annular space, base resins for saturating the fiberglass materials, fiberglass mats, resins, catalysts, primer coats, putty and caulking materials, and fiberglass chopped strand mat. All of these materials are compatible with petroleum products.

The type of host tank will determine the type of surface preparation needed during installation. Steel tanks should be sand-blasted, while fiberglass tanks may be sand-blasted or grinded. Steel tanks should be inspected in accordance with API 1631, and measurements taken for tank deflections and thickness. Any repairs must be made in accordance with manufacturer's specifications. Fiberglass tanks need to be inspected with measurements and repairs similar to steel tanks.

The installation requirements specify the usual actions needed for UST tank entry such as safety, removal of sludges, and tank inspection. This is followed by surface preparation, final cleaning and inspection, photographs, and ultrasonic testing. New manways and fittings are installed as necessary, and existing gauge striker plates are removed.

A decision must be made on the location of the interstitial monitoring system in accordance with the tank-specific conditions and with the installation requirements.

Integrity Testing

The integrity of the interstitial space and leak detection system will be verified for each tank. Rafibra has a method to test the continuity of the interstitial space. This is accomplished by using a powerful light which verifies that the tridimensional fiber is not collapsed. The installation of a permanent and automatic leak detection system in the interstitial space of the tank will be the choice of the tank owner. Once the double-wall system is constructed, a permanent and automatic leak detection system shall be installed for the detection of leaks in the interstitial space as described in Class I or Class II under standard UNE-EN 13160-1:2003, or in accordance with Florida Department of Environmental Protection requirements.

Leak detection system In Class I (SGB or THOMAS), are approved according to standard UNE-EN 13160-1:2003, and are recommended, but the Rafibra System can use other pressure, vacuum, electronic sensors, and visual methods of release detection manufactured by companies with release detection systems registered with the Department under Rule 62-761.850, F.A.C. For systems classified in the category of Class I by pressure, the manufacturer of the resin should confirm that the material used in the interstitial space is impermeable. It is not recommended to pressurize the interstitial space of the tank with air. It is recommended that an inert gas like nitrogen is used.

On Class I vacuum systems, the system of automatic regeneration by vacuum should conform to standard RD 400/1996, of March 1, as described under standard 94/9/CE, related to the leak protection system to be used in a potentially explosive atmosphere (ATEX) regardless of the fuel in storage at that moment.

Only qualified (trained and company certified) field personnel may perform these tests.

5. Release Detection

The Rafibra System is a secondary containment internal upgrade system that has the ability to use a number of different interstitial monitoring methods and systems, including vacuum, pressure, visual, or DEP-approved sensors. However, the SGB Vacuum or Pressure System is recommended for optimal performance. The interstitial spaces have sufficient strength and thickness to contain regulated substances for 30 days.

Vacuum and Pressure release detection systems must meet European Class I requirements. The Rafibra System can also have electronic liquid float sensors within a low-point monitoring point, or use visual monitoring of the same monitoring point. Regardless of the type of release detection system selected and installed, the procedures for the annual operability tests must be performed in accordance with the procedure prescribed by the manufacturer and approved by the FDEP.

Appendix A

Third Party Approval Certification and Spanish Standard

Organisme désigné par
l'arrêté du 18 avril 2008

LABORATOIRE NATIONAL DE MÉTROLOGIE ET D'ESSAIS

CERTIFICAT QUALIFICATION ET SUIVI

suivant l'arrêté du 18 avril 2008 relatif à la transformation des réservoirs enterrés de liquide inflammable soumis à autorisation ou à déclaration, au titre de la rubrique 1432 de la nomenclature des installations classées pour la protection de l'environnement.

Délivré à

RAFIBRA CENTRAL ESPANA

Avda. Ribera Alta, 30

SPAIN 46260 ALBERIC - VALENCIA

pour la transformation des réservoirs, conformes aux exigences de l'article 10 de l'arrêté susvisé, à partir de la (des) matière(s) identifiée(s) ci-après

Résina Vinilester Rafibra Ecologica 2014

et selon la (les) procédure(s) mise(s) en oeuvre référencée(s) par le transformateur :

Cahier des charges P3 R/304 rev.12/Dec/2014 incluant la check-list P5 R/502 rev. 30 Ene/2020

Ce certificat est délivré suivant la méthode de qualification et de suivi définie dans l'article 16 et l'annexe III de l'arrêté du 18 avril 2008.

Etabli à Paris, le 04 décembre 2020

Pour le Directeur Général

Laboratoire national de métrologie et d'essais

Signature numérique de PASCAL PRUDHON ID
Date : 2020.12.04 14:27:57 +01'00'

Pascal PRUDHON

Responsable du Pôle Certification Environnement, Sécurité et Performance

date de début de validité : 04 décembre 2020

date de fin de validité : 04 décembre 2021

Certificat n° 28508 - 6

Renouvelle le certificat 28508-5

TRANSPO_RESERVOIRS-315-2016

AIMPLAS
INSTITUTO TECNOLÓGICO
DEL PLÁSTICO

REPORT AT-0048/10

NV-09-2615

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FINISHING DATE: 03/12/09

AIMPLAS
N.º S-10-00717
FECHA 25/01/10
REGISTRO DE SALIDA

COMPANY

RAFIBRA, S.L.
LLAURADOR; PARCELA 106
POLÍGONO INDUSTRIAL ALBERIQUE
46260-ALBERIQUE (Valencia)

PETITIONER

Mr. Juan Vicente Pascual

Electronic signature of the authorized signatories

Firmado digitalmente por NOMBRE GIL ROJO MARIA LUISA - NIF 33413320R
Motivo: Responsable Laboratorio Fisico-Mecánico
Fecha: 2010.01.27 16:30:42 +01'00'

LABORATORIO DE ENSAYOS AIMPLAS

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email: info@aimplas.es

The current report cancels and replaces report nº AT-0903/09-NV-09-2615 and that is how is reflected in our files.

Please destroy the report which is in your possession in order to avoid any kind of mistake.

Reason of the cancellation

1.- The client requests the change of the following text about the nature of the material:

Where it states:

- Nature and form of the material: metallic plate with resin

It must state:

- Nature and form of the material: metallic plate with resin Resina Ecologica Rafibra 2014 (client specifications)

2.- Mistake of transcription:

Where it states:

Test	Height (*) (mm)	Width (*) (mm)	Tensile strength (N/mm^2)
1	8.19	30.22	20.3
2	8.36	30.49	17.3
3	7.78	31.11	19.7
4	7.90	32.47	16.8
5	8.12	31.83	17.8
Average Standard deviation			18.4 1.5

And:

Sample	Adherence test	Standard	Units	Requirements	Results	Conclusion
Adherence specimens STEEL WITHOUT TREATING (SMOOTHLY)	Tensile strength (N/mm^2)	Appendix A UNE 53991 IN	N/mm^2	≥6	18.4 1.5	OK

It must state:

Test	Height (*) (mm)	Width (*) (mm)	Tensile strength (N/mm^2)
1	15.17	30.22	10.9
2	15.29	30.49	9.47
3	15.14	31.11	10.1
4	15.24	32.47	8.71
5	15.20	31.83	9.49
Average Standard deviation			9.75 0.8

And:

Sample	Adherence test	Standard	Units	Requirements	Results	Conclusion
Adherence specimens STEEL WITHOUT TREATING (SMOOTHLY)	Tensile strength (N/mm^2)	Appendix A UNE 53991 IN	N/mm^2	≥6	9.75 0.8	OK

TESTS

Determination of adherence strength according to Appendix A of the standard UNE 53991 IN (March 2004).

SAMPLES

Adherence specimens STEEL WITHOUT TREATING (SMOOTHLY)

- *Description: Adherence specimens*
- *Code: 09/23724*

TEST PROCEDURES

(1) Test/s:

- Speed of test: 5 mm/min
- Distance between grips: 230 mm
- Distance between marks: 230 mm
- Load cell: 50 kN
- Grips: mechanical
- Class machine (according to ISO 7500): Clase 0.5

(2) Specimen/s:

- Nature and form of the material: metallic plate with resin Resina Ecologica Rafibra 2014 (client specifications)
- Test specimen: according to Appendix A of the standard UNE 53-991 IN (March 2004)
- Preparation of the specimen: prepared by the client
- Dimensions: are indicated in the table of results
- Number of specimens: 5
- Conditioning: 88 hours at (23 ± 2) °C and (50 ± 10) % HR

(3) Environment conditions:

T = (23 ± 2) °C

HR = (50 ± 10) %

RESULTS

Test	Height (*) (mm)	Width (*) (mm)	Tensile strength (N/mm^2)
1	15.17	30.22	10.9
2	15.29	30.49	9.47
3	15.14	31.11	10.1
4	15.24	32.47	8.71
5	15.20	31.83	9.49
Average			9.75
Standard deviation			0.8

(*)Dimensions of the adhered zone.

Note 1: A summary table of the results and the requirements demanded by the standard are shown in the Appendix I

Note 2: The strength-strain graph of the adherence test is shown in the Appendix II.

APPENDIX I

SUMMARY TABLE

Sample	Adherence test	Standard	Units	Requirements	Results	Conclusion
Adherence specimens STEEL WITHOUT TREATING (SMOOTHLY)	Tensile strength (N/mm^2)	Appendix A UNE 53991 IN	N/mm^2	≥6	9.75 0.8	OK

APPENDIX II

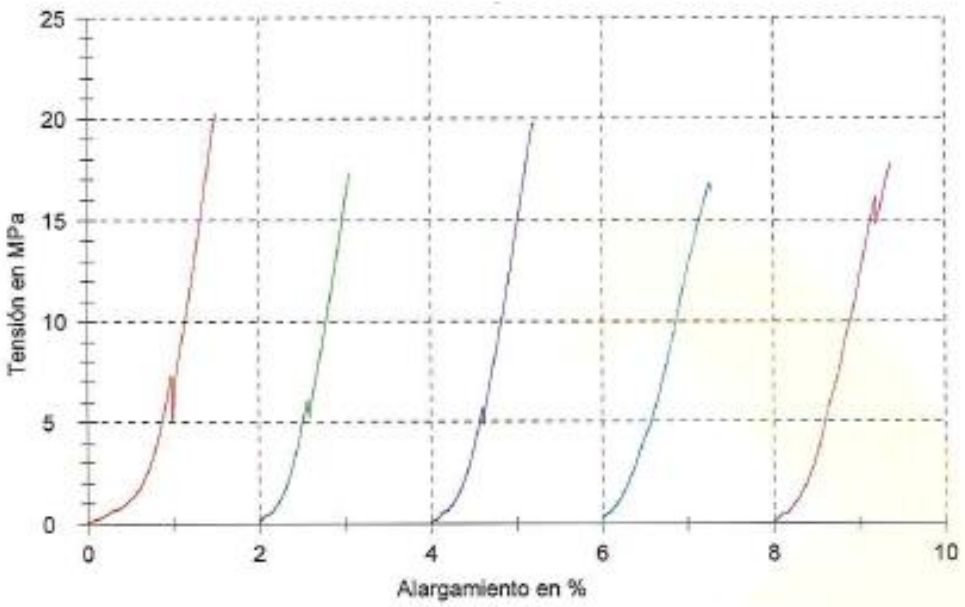

Figure 1. Strength-strain graph of the adherente test.

TERMS AND CONDITIONS

1.- AIMPLAS is responsible only for results obtained from the analytical methods cited in this report. Results exclusively refer to the materials and samples mentioned herein, the legal and professional responsibility of the Institute will be restricted to said materials and samples. Unless otherwise stated, the samples have been freely selected, indexed and provided by the client.

2.- The Institute assumes no responsibility for any misinterpretation or misuse of this document. Partial or total reproduction of this document without prior authorisation by AIMPLAS is strictly forbidden.

3.- The results are considered the property of the client. Without prior authorisation, AIMPLAS will not disclose them with any third party. However, one month after the results are delivered, they may be published by AIMPLAS for scientific or statistical purposes.

4.- No information contained in this report constitutes a guarantee for the trademarks cited, if any.

5.- In the event of any discrepances within reports, a final verification will be carried out at the Institute's head office. The client undertakes to inform the Institute of any complaint it may receive regarding this report. Failure to do so exempts the Institute from any responsibility. To this effect, the period stated below must be taken into account.

AIMPLAS
INSTITUTO TECNOLÓGICO DEL PLÁSTICO

LABORATORIO DE CONSTRUCCIÓN
CONSTRUCTION LABORATORY

ENAC
ENSAYOS
Nº 56/LE156

REPORT AT-0051/11

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AIMPLAS
Nº S-11-00653
FECHA 27/01/11
REGISTRO DE SALIDA

COMPANY

RAFIBRA, S.L.
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POLÍGONO INDUSTRIAL ALBERIQUE
46260-ALBERIQUE (VALENCIA)

PETITIONER

Mr. JOSÉ LUIS FOLGADO

Electronic signature of the authorized signatories:

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TESTS

Flexural properties according to UNE-EN ISO 178 (May 2003) and the requirements demanded by the standard UNE-EN 13160-7(December 2003).

SAMPLES

1.-Resina Ecologica Rafibra 2014 REFERENCE specimens flexural test
- *Description: REFERENCE specimens*
- *Code: 11/0135/1*

2.-Resina Ecologica Rafibra 2014 LIQUID PHASE specimens flexural test
- *Description: LIQUID PHASE specimens*
- *Code: 11/0135/2*

3.-ResinaEcologicaRafibra2014 AIR PHASE specimens flexural test
- *Description: AIR PHASE specimens*
- *Code: 11/0135/3*

Note 1: The specimens supplied by the client have been exposed to the Ethanol Absolute (CH_3CH_2OH) in conformity with them specified in the standard during 28 days at 40ºC.

TEST PROCEDURES

(1) Test/s:

- Speed of test: 2 mm/min
- Span:
  - Sample: Resina Ecologica Rafibra 2014 REFERENCE specimens flexural test: 63 mm
  - Sample: Resina Ecologica Rafibra 2014 LIQUID PHASE specimens flexural test: 68 mm
  - Sample: Resina Ecologica Rafibra 2014 AIR PHASE specimens flexural test: 68 mm
- Radius supports: 5 mm
- Radius of the striking edge: 5 mm
- Load cell: 2 kN
- Points load: single-point midspan load
- Class machine (according to ISO 7500):
  - Force: Class 0.5
  - Displacement indicator: Class 0.5
- Extensometer: crosshead
- Surface of application of the force: smooth surface (the submitted one to chemical resistance suffers the tensile strength)
- Points of deformation for the calculation of the elasticity modulus: 0.05% and 0.25%
- Equation used in the calculation of the modulus:

$$E_f = \frac{L^3}{4 \cdot b \cdot h^3} \cdot \left(\frac{\Delta F}{\Delta s} \right)$$

E_f: flexural elasticity modulus (MPa)
L: span (mm)
h: thickness (mm)
b: specimen width (mm)
Δs: difference of deflection at flexural stress between s'' and s' (where s'' and s' are the corresponding to the deformation in flexure of the single-point midspan, being the deformations indicated ones previously)
ΔF: difference between loads F'' and F' in s'' and s'

(2) Specimen/s:

- Dimensions: are indicated in tables 1 to 3 of results
- Conditioning: 88 hours at (23 ± 2) °C and (50 ± 10) % HR
- Number of specimens: 5

(3) Environment conditions:

T = (23 ± 2) °C
HR = (50 ± 10) %

RESULTS

Sample: Resina Ecologica Rafibra 2014 REFERENCE specimens flexural test

Table 1

Test	Thickness (mm)	Width (mm)	Flexural strength (MPa)
1	3,89	14,63	72,6
2	3,92	14,95	79,5
3	3,95	14,80	70,2
4	4,00	15,06	57,6
5	4,00	14,86	78,9
Average Uncertainty (k=2)			71,7 ±8,9

Sample: Resina Ecologica Rafibra 2014 LIQUID PHASE specimens flexural test

Table 2

Test	Thickness (mm)	Width (mm)	Flexural strength (MPa)
1	4,45	15,21	69,8
2	4,35	15,04	72,8
3	4,29	14,97	83,7
4	4,16	14,95	72,8
5	4,14	14,82	82,0
Average Uncertainty (k=2)			76,2 ±8,4

Sample: Resina Ecologica Rafibra 2014 AIR PHASE specimens flexural test

Table 3

Test	Thickness (mm)	Width (mm)	Flexural strength (MPa)
1	4.28	14.24	62,8
2	4.29	14.31	66,8
3	4.26	14.95	50,7
4	4.25	14.64	56,0
5	4.31	14.73	82,5
Average Uncertainty (k=2)			63,8 ±11,0

Note 2: Stress-strain graphs are shown in the Annexe.

CONCLUSIONS (*)

Table 4

Flexural strength (MPa)				% of lost Flexural strength
Resina Rafibra REFERENCE specimens flexural test	Resina Rafibra LIQUID PHASE specimens flexural test	Resina Rafibra AIR PHASE specimens flexural test	Average AIR – LIQUID	
71,7	76,2	63,8	70,0	-2,4

In view of this result, the average value of Flexural strength of the specimens submitted to chemical resistance doesn't overcome the maximal value demanded (-30 %) according to the standard UNE-EN 13160-7.

ANNEX

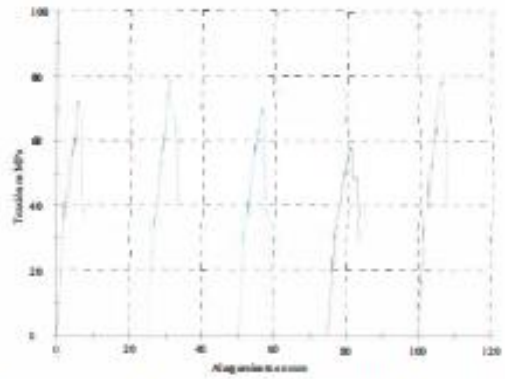

Figure 1. Stress-strain graph of flexural test of the sample: *Resina Ecologica Rafibra REFERENCE specimens flexural test*

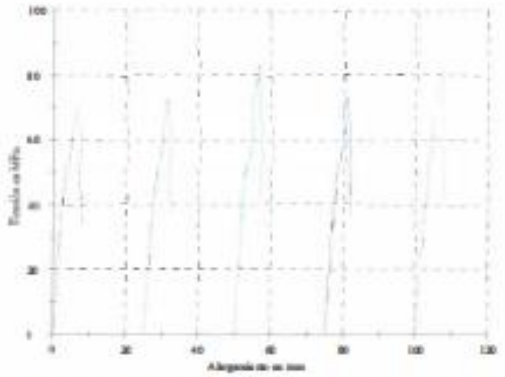

Figure 2. Stress-strain graph of flexural test of the sample: *Resina Ecologica Rafibra LIQUID PHASE specimens flexural test*

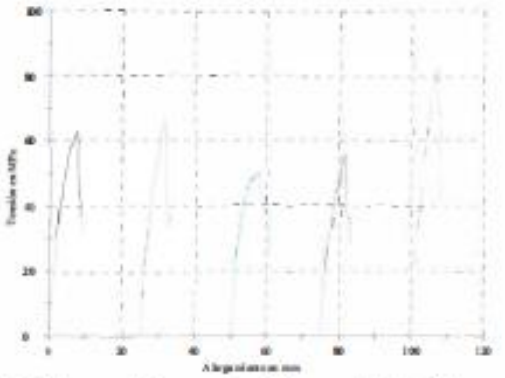

Figure 3. Stress-strain graph of flexural test of the sample: Resina Ecologica Rafibra AIR PHASE specimens flexural test

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TESTS

Flexural properties according to UNE-EN ISO 14125 (September 1999) and the requirements demanded by the standard UNE 53991 IN (March 2004).

SAMPLES

1.- REFERENCE flexural specimens
- *Description: REFERENCE flexure specimens*
- *Code: 10/0005/1*

2.- LIQUID phase flexural specimens
- *Description: LIQUID phase flexural specimens*
- *Code: 10/0005/2*

3.- AIR phase flexural specimens
- *Description: AIR phase flexural specimens*
- *Code: 10/0005/3*

TEST PROCEDURES

(1) Test/s:

- Speed of test: 3 mm/min
- Span:
  - Sample: REFERENCE flexural specimens: 103 mm
  - Sample: LIQUID phase flexural specimens: 96 mm
  - Sample: AIR phase flexural specimens: 95 mm
- Radius supports: 5 mm
- Radius of the striking edge: 5 mm
- Load cell: 2 kN
- Points load: single-point midspan load
- Class machine (according to ISO 7500):
  - Force: Class 0.5
  - Displacement indicator: Class 0.5
- Extensometer: crosshead
- Surface of application of the force: smooth surface (the submitted one to chemical resistance suffers the tensile strength)
- Points of deformation for the calculation of the elasticity modulus: 0.20% and 0.40%
- Equation used in the calculation of the modulus:

$$E_f = \frac{L^3}{4 \cdot b \cdot h^3} \cdot \left(\frac{\Delta F}{\Delta s} \right)$$

E_f: flexural elasticity modulus (MPa)
L: span (mm)
h: thickness (mm)
b: specimen width (mm)
Δs: difference of deflection at flexural stress between s'' and s' (where s'' and s' are the corresponding to the deformation in flexure of the single-point midspan, being the deformations indicated ones previously)
ΔF: difference between loads F'' and F' in s'' and s'

(2) Specimen/s:

- Dimensions: are indicated in tables 1-3 of results
- Conditioning: 88 hours at (23 ± 2) ºC and (50 ± 10) % HR
- Number of specimens: 5

(3) Environment conditions:

T = (23 ± 2) ºC
HR = (50 ± 10) %

DEVIATION OF THE STANDARD METHOD:
Spans are not the indicated in the standard UNE-EN ISO 14125. This requirement could not have fulfilled due to the dimensions of the specimens given by the own client.
Due to the initial behaviour of the specimens during the test, there are modified the points of deformation of 0.05 % and 0.25 % recommended by the standard UNE-EN ISO 14125 for the calculation of the elasticity modulus as they are indicated previously.

RESULTS

Sample: REFERENCE flexural specimens

Table 1

Test	Thikness (mm)	Width (mm)	Módulo de Elasticidad (MPa)
1	6.09	14.99	5600
2	6.30	15.02	5270
3	6.60	15.07	5260
4	6.47	14.97	5630
5	6.59	14.97	5530
Valor medio Incertidumbre (k=2)			5460 ±170

Sample: LIQUID phase flexural specimens

Table 2

Test	Thikness (mm)	Width (mm)	Elasticity Modulus (MPa)
1	6.03	15.16	5030
2	6.03	15.33	4950
3	6.05	15.22	4710
4	6.04	15.04	5090
5	5.99	15.08	5070
Average Uncertainty (k=2)			4970 ±150

Sample: AIR phase flexural specimens

Table 3

Test	Thikness (mm)	Width (mm)	Elasticity Modulus (MPa)
1	5.93	14.87	5200
2	5.91	15.01	5120
3	5.96	14.91	4930
4	5.98	15.15	4860
5	6.00	14.73	4940
Average Uncertainty (k=2)			5010 ±140

Note: Stress-strain graphs are shown in the Appendix.

CONCLUSIONS (**)

Table 4

Elasticity Modulus (MPa)				% of Elasticity Modulus recovered
REFERENCE flexural specimens	LIQUID phase flexural specimens	AIR phase flexural specimens	Average AIR – LIQUID	
5460	4970	5010	4990	91

In view of this result, the average value of the Elasticity Modulus in flexure of the specimens submitted to chemical resistance overcomes the minimal value demanded (80 %) according to the standard UNE 53991.

(**)Paragraph not included in the Scope of the Accreditation.

APPENDIX

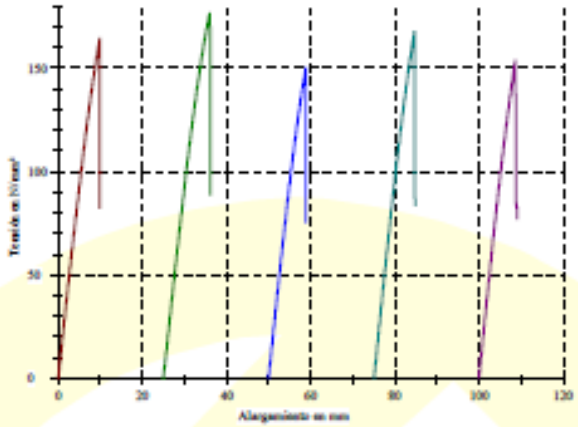

Figure 1. Stress-strain graph of flexural test of the sample:
REFERENCE flexural specimens

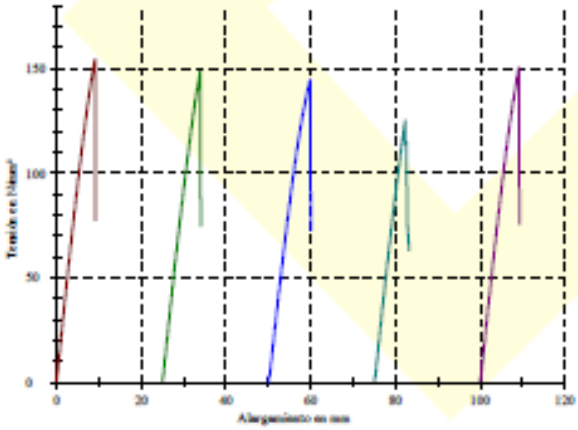

Figure 2. Stress-strain graph of flexural test of the sample:
LIQUID phase flexural specimens

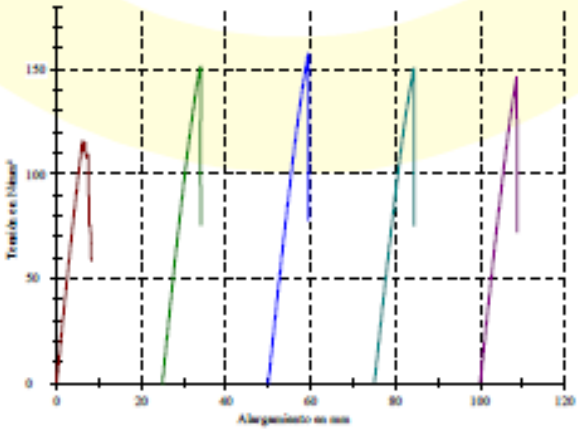

Figure 3. Stress-strain graph of flexural test of the sample:
AIR phase flexural specimens

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ENSAYOS
TESTS

Determinación de las propiedades en flexión según norma UNE-EN ISO 14125 (Septiembre 1999) + A1 (Mayo 2011) de acuerdo a especificaciones de la norma UNE 53991 IN (Marzo 2004).

Flexural properties according to UNE-EN ISO 14125 (September 1999) + A1 (May 2011) and the requirements demanded by the standard UNE 53991 IN (March 2004).

MUESTRAS
SAMPLE

RESINA ECOLOGICA RAFIBRA 100% ACETONA.

1.- R05. Probetas de referencia / *Reference specimens*

- *Código/Code: 16/2241/1*

2.- L05. Probetas fase líquida / *Liquid phase specimens*

- *Código/Code: 16/2241/2*

3.- A05. Probetas fase aérea / *Air phase specimens*

- *Código/Code: 16/2241/3*

MÉTODOS DE ENSAYO
TEST PROCEDURES

(1) Ensayo/s:

- Velocidad de ensayo: 4 mm/min
- Distancia entre apoyos:

Tabla 1

Código muestra	Referencia	Distancia entre apoyos (mm)
16/2241/1	Probetas de referencia	116
16/2241/2	Probetas fase líquida	115
16/2241/3	Probetas fase aérea	119

- Radio de apoyo: 5 mm
- Radio del útil de carga: 5 mm
- Célula de carga: 10 kN
- Puntos de carga: 3 puntos
- Exactitud de la máquina de ensayo (según ISO 7500):
  Fuerza: Clase 0,5
  Indicador de desplazamiento: Clase 0,5
- Tipo de indicador de desplazamiento: brazo flexión-compresión
- Superficie de aplicación de la fuerza: cara lisa color negro
- Puntos de deformación para el cálculo del módulo de elasticidad: 0.05% y 0.25 %
- Ecuación utilizada en el cálculo del módulo:

$$E_f = \frac{L^3}{4 \cdot b \cdot h^3} \cdot \left(\frac{\Delta F}{\Delta s} \right)$$

E_f: módulo de elasticidad de flexión (MPa)
L: distancia entre apoyos (mm)
h: espesor de la probeta (mm)
b: anchura de la probeta (mm)
Δs: diferencia de las flechas entre s'' y s' (donde s'' y s' son las flechas correspondientes a la deformación en flexión del punto central de la viga, siendo la deformación las indicadas anteriormente)
ΔF: diferencia entre la carga F'' y F' en s'' y s' respectivamente

(2) Probeta/s:

- Dimensiones: se indican en las tablas de resultados
- Acondicionamiento previo: 88 horas a (23 ± 2) ºC y (50±15) % HR
- Nº de probetas: 5

(3) Condiciones ambientales:

T = (23 ± 2) ºC
HR = (50 ± 10) %

DESVIACIÓN DE NORMA:

Según la norma se deben acondicionar las probetas con una humedad relativa de 50 ±10 % HR, pero debido a problemas en el almacenamiento se ha realizado a 50 ±15 % HR.

(1) Test/s:

- *Speed of test: 4mm/min*
- *Span:*

Table 1

Sample code	*Reference*	*Span (mm)*
16/2241/1	*Reference specimens*	*116*
16/2241/2	*Liquid phase specimens*	*115*
16/2241/3	*Air phase specimens*	*119*

- *Radius supports: 5 mm*
- *Radius of the striking edge: 5 mm*
- *Load cell: 10kN*
- *Points load: 3 single-point midspan load*
- *Class machine (according to ISO 7500):*
  Force: Class 0,5
  Displacement indicator: Class 0,5
- *Extensometer: flexural-compression arm*
- *Surface of application of the force: smooth black surface*
- *Points of deformation for the calculation of the elasticity modulus: 0.05% and 0.25%*
- *Equation used in the calculation of the modulus:*

$$E_f = \frac{L^3}{4 \cdot b \cdot h^3} \cdot \left(\frac{\Delta F}{\Delta s} \right)$$

Ef: flexural elasticity modulus (MPa)
L: span (mm)
h: thickness (mm)
b: specimen width (mm)
Δs: difference of deflection at flexural stress between s'' and s' (where s'' and s' are the corresponding to the deformation in flexure of the single-point midspan, being the deformations indicated ones previously)
ΔF: difference between loads F'' and F' in s'' and s'

(2) Specimen/s:

- *Dimensions: are indicated in tables of results*
- *Conditioning: 88 hours at (23 ± 2) ºC and (50 ± 15) % HR*
- *Number of specimens: 5*

(3) Environment conditions:

T = (23 ± 2) ºC
HR = (50 ± 10) %

DEVIATION OF THE STANDARD METHOD:

According to the standard the specimens should be conditioned at a relative humidity of 50 ± 10% RH, but due to problems in storage it was performed at 50 ± 15% RH.

RESULTADOS
RESULTS

- Muestra/*Sample*: R05. Probetas de referencia / *Reference specimens*

Tabla 2 /*Table 2*

Ensayo *Test*	Espesor *Thickness* (mm)	Ancho *Width* (mm)	Módulo de Elasticidad *Elasticity modulus* (MPa)	Resistencia a flexión *Flexural strength* (MPa)	Flecha a fuerza máxima *Deflection at flexural strength* (mm)
1	5,832	14,844	8510	118	8,7
2	5,776	14,669	8620	117	9,0
3	5,687	14,980	8640	118	8,4
4	5,789	14,877	8740	114	7,6
5	5,815	14,778	8570	116	7,8
Valor medio *Average* Incertidumbre (k=2) *Uncertainty (k=2)*			8620 ±115	117 ±4	8,3 ±0,6

- Muestra/*Sample*: L05. Probetas fase líquida / *Liquid phase specimens*

Tabla 3 /*Table 3*

Ensayo *Test*	Espesor *Thickness* (mm)	Ancho *Width* (mm)	Módulo de Elasticidad *Elasticity modulus* (MPa)	Resistencia a flexión *Flexural strength* (MPa)	Flecha a fuerza máxima *Deflection at flexural strength* (mm)
1	5,755	14,699	8880	106	8,7
2	5,676	14,718	8910	103	8,3
3	5,763	14,831	8680	106	8,8
4	5,776	14,852	8770	108	9,1
5	5,791	14,862	8830	107	9,5
Valor medio *Average* Incertidumbre (k=2) *Uncertainty (k=2)*			8820 ±91	106 ±3	8,9 ±0,5

- Muestra/*Sample*: A05. Probetas fase aérea / *Air phase specimens*

Tabla 4 /*Table 4*

Ensayo *Test*	Espesor *Thickness* (mm)	Ancho *Width* (mm)	Módulo de Elasticidad *Elasticity modulus* (MPa)	Resistencia a flexión *Flexural strength* (MPa)	Flecha a fuerza máxima *Deflection at flexural strength* (mm)
1	5,898	14,977	13800	149	4,4
2	6,089	14,751	14300	147	4,6
3	5,949	14,759	14800	154	5,0
4	6,010	14,891	14400	149	4,7
5	5,911	14,803	14800	151	4,9
Valor medio *Average* Incertidumbre (k=2) *Uncertainty (k=2)*			14400 ±375	150 ±3	4,7 ±0,3

Nota: En el Anexo se muestran las gráficas esfuerzo-deformación obtenidas en los ensayos de flexión.
Note: Stress-strain graphs are shown in the Annex.

CONCLUSIONES (*)
CONCLUSIONS

Tabla 5 / *Table 5*

RESINA ECOLOGICA RAFIBRA 100% ACETONA				
Módulo de Elasticidad *Elasticity Modulus* (MPa)				% de Módulo de Elasticidad recuperado *% of Elasticity Modulus recovered*
Probetas de referencia *Reference specimens*	Probetas fase líquida *Liquid phase specimens*	Probetas fase aérea *Air phase specimens*	Valor medio AÉREA–LIQUIDA *Average AIR–LIQUID*	
8620	8820	14400	11610	134,6

Atendiendo a los resultados obtenidos el valor medio del módulo de Elasticidad en flexión de las probetas sometidas a resistencia química supera el valor mínimo exigido (80%) por la norma UNE 53991.

Based on the results obtained, in all cases, the mean Elasticity Modulus in bending of the specimens subjected to chemical resistance exceeds the minimum required value (80%) by standard UNE 53991.

ANEXO
ANNEX

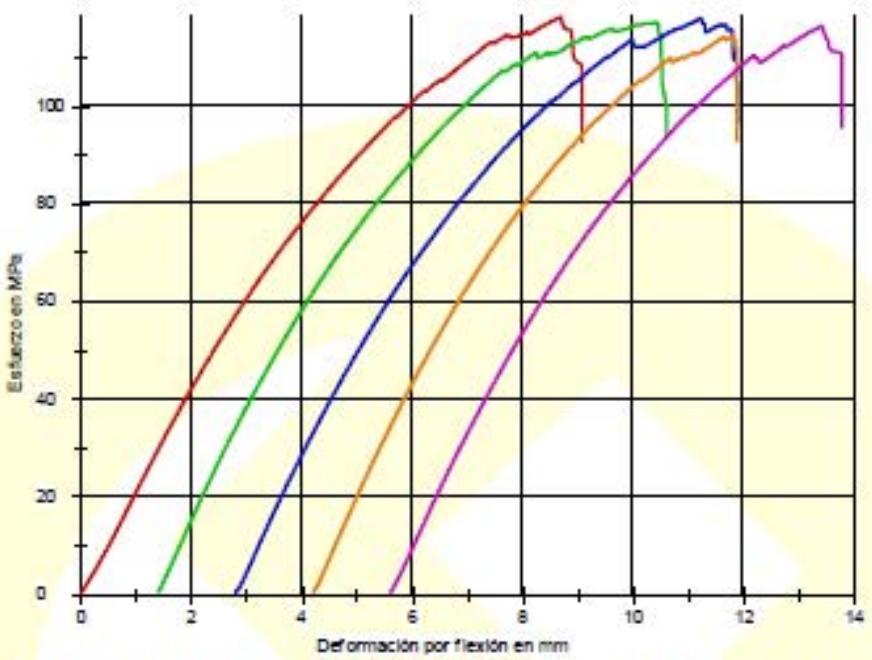

Figura 1. Gráfica esfuerzo-deformación obtenida en el ensayo de flexión de "Probetas de referencia"
Figure 1. Stress-strain graph of flexural test of "Reference specimens"

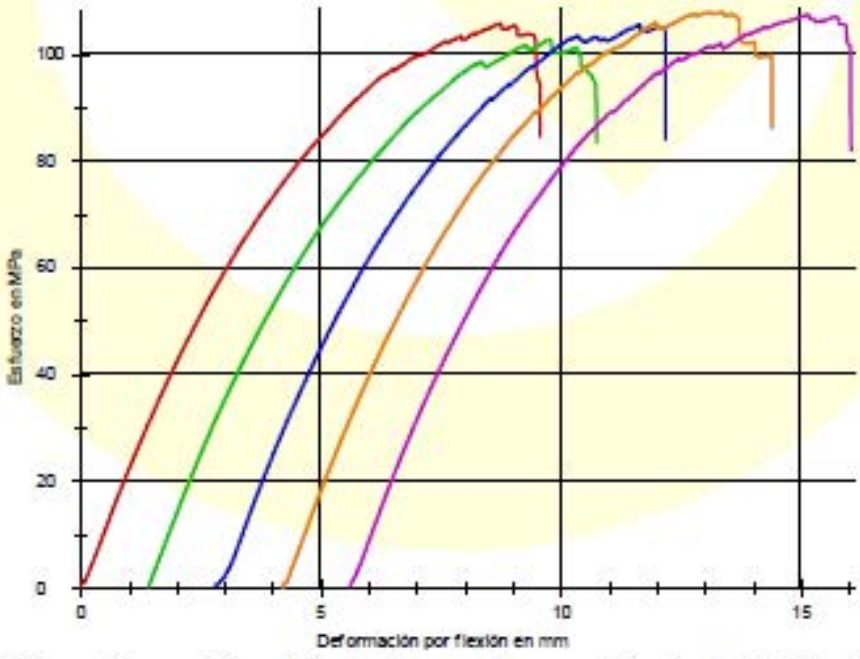

Figura 2. Gráfica esfuerzo-deformación obtenida en el ensayo de flexión de "Probetas fase líquida"
Figure 2. Stress-strain graph of flexural test of "Liquid phase specimens"

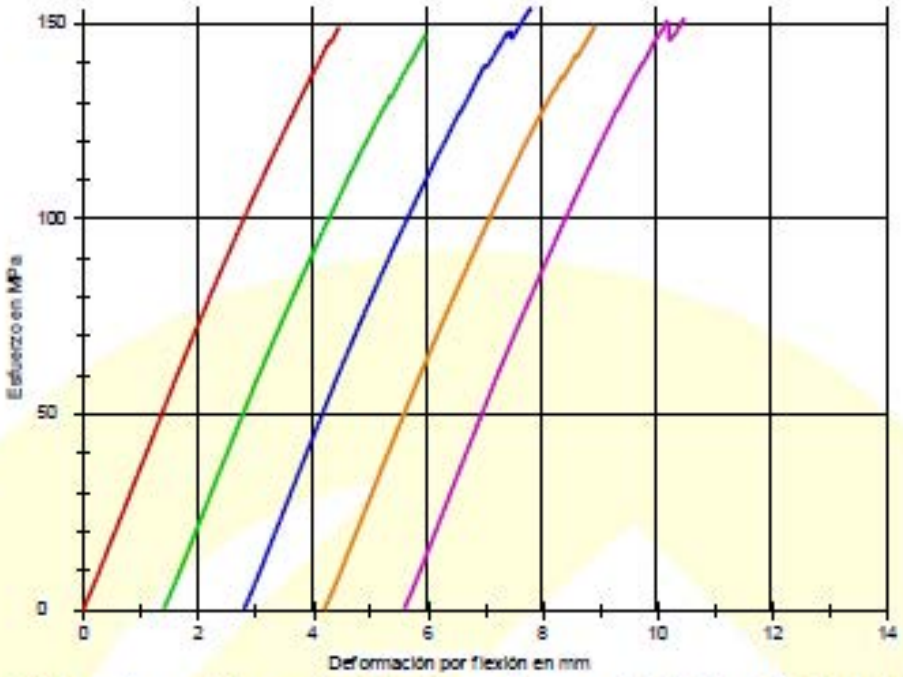

Figura 3. Gráfica esfuerzo-deformación obtenida en el ensayo de flexión de "Probetas fase aérea"
Figure 3. Stress-strain graph of flexural test of "Air phase specimens"

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Certification

Awarded to

RAFIBRA SL

AVDA. RIBERA ALTA N° 30 – 46260 – ALBERIC – VALENCIA – ESPAÑA

Bureau Veritas Certification certifies that the Management System has been audited and found to be in accordance with the requirements of standard:

STANDARD

ISO 9001:2015

Scope of certification:

LIQUID PETROL PRODUCTS TANKS REPARATION AND COATING. TIGHTNESS TEST ON SUCH TANKS. WATERTIGHT MANHOLE COVER MANUFACTURE.

Certificate Number:	ES115160-1
Original approval date:	14-11-2008
Effective date:	15-11-2020
Certificate expiration date:	14-11-2023

This certificate is valid, subject to the general and specific terms and conditions of certification services

Bureau Veritas Iberia S.L.
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Nº 04/C-SC004

Bureau Veritas Certification

Certification

Awarded to

RAFIBRA SL

AVDA. RIBERA ALTA N° 30 – 46260 – ALBERIC – VALENCIA – ESPAÑA

Bureau Veritas Certification certifies that the Management System has been audited and found to be in accordance with the requirements of standard:

STANDARD

ISO 45001:2018

Scope of certification:

LIQUID PETROL PRODUCTS TANKS REPARATION AND COATING. TIGHTNESS TEST ON SUCH TANKS. WATERTIGHT MANHOLE COVER MANUFACTURE.

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ENAC CERTIFICACIÓN
Nº 04/C-SG029

Spanish standard

UNE 62422

July 2014

TITLE

Construcción de tanques de doble pared por transformación *in situ* de tanques de acero

Construction of double skin tanks by transforming "in situ" steel tanks.

Construction de réservoirs à double paroi par la transformation «in situ» de réservoirs en acier.

CORRESPONDENCE

COMMENTS

This standard repeals and replaces Standard UNE 62422:2011.

BACKGROUND

This standard was produced by the technical committee AEN/CTN 62 *Industrial capital goods and pressure equipment*, of which BEQUINOR serves as Secretary.

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10 pages

0 Introduction

Double-skin tanks for liquid fuels, with an interstitial space between them, were designed to avoid spillages, and hence contamination of the subsoil. The outer tank would contain any leaks caused by the perforation of the inner tank, and vice versa. To monitor sound functionality, a leak detection system is installed to provide information, and in some cases allow a visible and/or audible signal to be emitted in the event that fluid enters the interstitial space, constituting a preventive and permanent control and protection system for the tank.

1 Purpose and field of application

This standard is intended to define the technical specifications guaranteeing the construction procedure for a double skin tank *in situ* by converting an existing steel tank (single or double skin). This standard covers any type of rigid lining application systems.

The in-situ conversion of a single or double skin steel tank as a fundamental part of a permanent leak detection system is performed on old tanks that have retained their initial structural performance, after conducting work under the conditions defined in Report UNE 53991 IN, on the repairing and internal covering of metallic tanks, used for the storage of liquid fuel, with reinforced plastics.

Technical Committee CEN/TC 393 belonging to the CEN (European Committee for Standardization) has developed the series of EN 13160 Standards with regard to leak detection systems, part 7 of which defines the general requirements and test methods for interstitial spaces, leak detection linings and leak detection jackets. This same path develops the technical conditions that must be fulfilled by leak detection linings, distinguishing between:

1) rigid internal leak detection linings (Chapter 6 of Standard UNE-EN 13160-7);

2) leak detection jackets (Chapter 7 of Standard UNE-EN 13160-7). The last of these are excluded from this standard as they are not used for tanks that are already installed underground.

NOTE Steel tanks that have been lined in accordance with the procedure established in Report UNE 53991 IN may be converted to a double skin system by complying with Standard UNE 53935, in place of this standard. If the internal lining is eliminated and the tank is left with a steel structure, Standard UNE 62422 could nonetheless apply.

2 Standards for consultation

The documents cited below are essential for the application of this standard. Only the edition of those documents with a listed publication date applies. Meanwhile, the latest edition (including any existing amendment) will apply to those documents that do not have a date reference.

UNE 53935, *Construction of double skin tanks by transforming in situ of glass-reinforced plastic (GRP) tanks.*

UNE 53968 IN, *Standardized procedures for the assessment of tightness verification and leak detection systems in the storage facilities of liquid oil products.*

UNE 53991 IN, *Plastics. Repairing and internal covering of metallic tanks, used for the storage of liquid fuel, with reinforced plastics.*

UNE-EN 13160-1, *Leak detection systems. Part 1: General principles.*

UNE-EN 13160-7, *Leak detection systems. Part 7: Requirements and test/assessment methods for interstitial spaces, leak detection linings and leak detection jackets.*

UNE-EN ISO 14125, *Fibre-reinforced plastic composites. Determination of flexural properties. (ISO 14125:1998).*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

3.1 interstitial space:
Material used to separate the primary and secondary skins of the tank, which may or may not be attached to one of the two skins or to both, guaranteeing the separation between the primary and secondary skins.

3.2 atmospheric pressure conditions:
Pressure conditions of between 0.08 MPa (0.85 bar) and 0.11 MPa (1.1 bar).

3.3 pressure leak detector:
Device which detects a leak by using air or an inert gas as the leak detection medium.

NOTE With pressure leak detectors, in the event of a leak, the pressure drop in the interstitial space triggers an alarm.

3.4 liquid system leak detector:
Device which detects a leak by using a liquid as the leak detection medium; any leak in one of the skins of the system is reflected in a drop in the level of the leak detection fluid.

3.5 vacuum leak detector:
Device which detects a leak by using air as the leak detection medium; with this type of detector, in the event of a leak, the increase in the pressures in the interstitial space triggers an alarm.

3.6 gas detector:
Device which detects the presence of a gas or vapour.

3.7 liquid detector:
Device which detects the presence of a liquid.

3.8 leak indicator device:
Device which detects the functional status and alarm of all connected leak sensors or detectors.

3.9 liquid fuel repair company:
Natural or legal person that repairs and maintains the liquid fuel facility storage (extending the field of activity to all operations that need to be performed within confined spaces), and that has in place the technical and human resources, within the categories and conditions established in ITC MI-IP 05 (supplementary technical instruction for liquid fuel fitters or repairers and fitting or repair companies).

3.10 containment space:
System designed to prevent a leak from a primary system from entering the environment, and which allows a leak to be detected.

3.11 laminate:
Lining layer.

3.12 LEL and UEL:
Lower and upper explosive limits, respectively, as a percentage by volume of the fuel/air mixture.

NOTE They define the minimum and maximum percentages of fuels, in a fuel/air mixture, between which such mixtures are flammable.

3.13 primary skin:
Primary layer in contact with the existing skin of the tank, which, in association with the intermediate layer and the secondary layer, creates an appropriate interstitial space.

3.14 secondary skin:
Secondary layer in contact with the stored product, which, in association with the intermediate layer and the secondary layer, creates an appropriate interstitial space.

3.15 leak protection lining:
Combination of both skins, primary and secondary, which on their own or in association with intermediate material, create an appropriate interstitial space.

3.16 sensor system:
Arrangement in which a liquid and/or vapour detector is/are used in interstitial or containment spaces monitored by a leak indicator device for leak containment purposes.

3.17 Leak detector system:
Combination of elements allowing early detection of loss of tightness and/or leaks, including all the equipment needed to detect a leak.

3.18 double skin tank:
Tank comprising primary and secondary skins with an interstitial space, in which the maximum filling level does not exceed the height of the interstitial space.

3.19 single skin tank:
Tank with just one skin.

3.20 isolation valve:
Valve used to interrupt the flow of a liquid beyond a certain point in a connection line.

3.21 ice protected zone:
Zone where the temperature does not drop below 0° C.

7.2 Atmospheric VOC emissions

During the construction process, atmospheric VOC emissions will be monitored in accordance with the environmental legislation in force, with the best available techniques being applied.

7.3 Continuity test in the interstitial space

The continuity of the interstitial or detection space must be verified in each tank.

The repair company must have a method in place to confirm the continuity of the interstitial space. For example, one valid method could be to feed in a fluid which can be viewed throughout the interstitial space or would detect a possible discontinuity.

7.4 Installation of the automatic and permanent leak detection system in the interstitial space

7.4.1 Once the double skin system has been built, a permanent and automatically detection system will be fitted to the interstitial space. This may be as defined as Class I, Class II or Class III in Standard UNE-EN 13160-1.

7.4.2 The permanent and automatic detection system must carry the CE marking in accordance with Standard UNE-EN 13160-1.

In Class I pressure systems, the manufacturer or the repair company must demonstrate that the material comprising the space is impermeable. It will otherwise not be possible to pressurise the interstitial space with air, and an inert gas must be used, such as nitrogen.

7.4.3 In Class I vacuum systems, the automatic vacuum regeneration system must comply with Royal Decree 400/1996, of 1 March 1996, issuing provisions for the application of Directive 94/9/EC, concerning equipment and protective systems intended for use in potentially explosive atmospheres (ATEX).

8 Standard tests

8.1 Adhesion

The adhesion test will be performed on the primary skin in accordance with Report UNE 53991 IN, fulfilling the minimum values specified therein.

8.2 Chemical resistance of the materials

The purpose is to ascertain the required resistance of the component materials of the coating, to the components with which they are to enter into contact inside the tank.

The test will be performed under the conditions described in subsection 7.4.2 of Report UNE 53991 IN, complying with the minimum values specified therein.

8.3 Mechanical strength

If materials other than GFRP are used, a flexural strength test will be performed in accordance with Standard UNE-EN ISO 14125, with the stated values being verified for the primary and secondary skin in accordance with subsections 6.1 and
6.4 of the standard.

8.4. Hardness

A Barcol hardness test or Persoz or Shore-D hardness test will be performed, in accordance with the methods described in Report UNE 53991 IN, complying with the minimum values specified therein.

9 Final verification

Once all the work has been completed, the repair company must confirm the tightness of the interstitial space.

10 Marking of the tank converted to double skin, and certificate from the repair company

10.1 Marking of the converted tank

Each converted double skin tank must be marked by means of a permanent plate, which must be resistant to corrosion and the products stored.

The plate must be affixed to the converted tank either inside the manhole inspection box or in the vicinity, guaranteeing that it remains permanently in a visible and accessible location.

The plate must at least contain the following information:

- name and address of the repair company;
- month and year of the conversion to double skin;
- identification of the converted tank number, according to the installation diagram;
- number/ID of the installation;
- type of material employed.

10.2 Certificate of the repair company

For each converted tank, the repair company must provide a certificate placing on record the tests performed, as established in Chapter 8 of this standard, and its conformity.

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I, **Verónica González Pérez, English Sworn Translator** duly authorised by the Spanish Foreign Affairs since 1.999 to translate official documents from Spanish into English and vice versa, CERTIFY HEREBY:

That the above document is a true and faithful translation into English of its original document drawn up in Spanish.

IN WITNESS WHEREOF, this present Certificate is signed and stamped by me.

In Alicante, 09/05/2022

VERÓNICA GONZÁLEZ PÉREZ
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norma española

UNE 62422

Julio 2014

TÍTULO

Construcción de tanques de doble pared por transformación *in situ* de tanques de acero

Construction of double skin tanks by transforming «in situ» steel tanks.

Construction de réservoirs à double paroi par la transformation «in situ» de réservoirs en acier.

CORRESPONDENCIA

OBSERVACIONES

Esta norma anula y sustituye a la Norma UNE 62422:2011.

ANTECEDENTES

Esta norma ha sido elaborada por el comité técnico AEN/CTN 62 *Bienes de equipo industriales y equipos a presión* cuya Secretaría desempeña BEQUINOR.

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10 Páginas

0 Introducción

Los tanques de doble pared para productos petrolíferos, con una cámara intersticial entre ellas, fueron diseñados para evitar derrames y por consiguiente la contaminación del subsuelo. El tanque exterior retendría las fugas producidas por la perforación del tanque interior y viceversa. Para controlar el buen funcionamiento, se instala un sistema de detección de fugas que informa y en algunos casos permite la emisión de una señal visible y/o audible frente a la entrada de fluido en la cámara intersticial, constituyendo un sistema de control y protección preventivo y permanente del tanque.

1 Objeto y campo de aplicación

Esta norma se plantea para definir las especificaciones técnicas que garanticen el procedimiento de construcción para un tanque de pared doble *in situ* mediante la transformación de un tanque preexistente de acero (de simple o doble pared). Esta norma cubre cualquier tipo de sistemas de aplicación de revestimientos rígidos.

La reconversión in situ de un tanque de acero de simple a doble pared como parte fundamental de un sistema de detección permanente de fugas se realiza en tanques antiguos que hayan conservado las prestaciones estructurales iniciales, después de efectuar los trabajos en las condiciones que se definen en el Informe UNE 53991 IN, de reparación y revestimiento con plásticos reforzados en tanques metálicos para almacenamiento de productos petrolíferos.

El Comité Técnico CEN/TC 393 perteneciente al CEN (Comité Europeo para la Normalización) ha desarrollado la serie de Normas EN 13160 referente a sistemas de detección de fugas, en la que se definen, en su parte 7, los requisitos generales y métodos de ensayo para espacios intersticiales, revestimientos interiores y envolturas protectoras frente a las fugas. En esta misma parte, se desarrollan las condiciones técnicas que deben cumplir los revestimientos protectores de fugas, distinguiéndose entre:

1) revestimientos rígidos interiores protectores de fugas (capítulo 6 de la Norma UNE-EN 13160-7);

2) envolturas protectoras de fugas (capítulo 7 de la Norma UNE-EN 13160-7). Éstas últimas quedan excluidas de esta norma por no destinarse a tanques que ya estén enterrados.

NOTA Los tanques de acero que hayan sido revestidos siguiendo el procedimiento establecido en el Informe UNE 53991 IN, podrán transformarse a doble pared cumpliendo la Norma UNE 53935 en lugar de la presente norma. Si se elimina el revestimiento interior y queda el tanque de acero, sí que se podría aplicar la Norma UNE 62422.

2 Normas para consulta

Los documentos que se citan a continuación son indispensables para la aplicación de esta norma. Únicamente es aplicable la edición de aquellos documentos que aparecen con fecha de publicación. Por el contrario, se aplicará la última edición (incluyendo cualquier modificación que existiera) de aquellos documentos que se encuentran referenciados sin fecha.

UNE 53935, *Construcción de tanques de doble pared por transformación in situ de tanques de plástico reforzado con fibra de vidrio (PRFV).*

UNE 53968 IN, *Procedimientos normalizados para evaluar sistemas de verificación de la estanquidad y detección de fugas en instalaciones de almacenamiento de productos petrolíferos líquidos.*

UNE 53991 IN, *Plásticos. Reparación y revestimiento interior de depósitos metálicos, para el almacenamiento de productos petrolíferos líquidos, con plásticos reforzados.*

UNE-EN 13160-1, *Sistemas de detección de fugas. Parte 1: Principios generales.*

UNE-EN 13160-7, *Sistemas de detección de fugas. Parte 7: Requisitos generales y métodos de ensayo para espacios intersticiales, revestimientos interiores y envolturas protectoras frente a las fugas.*

UNE-EN ISO 14125, *Compuestos plásticos reforzados con fibras. Determinación de las propiedades de flexión. (ISO 14125:1998).*

3 Términos y definiciones

Para los fines de este documento, se aplican los términos y definiciones siguientes:

3.1 cámara intersticial:
Material utilizado para separar las paredes primaria y secundaria del tanque, que puede fijarse o no a una de las dos paredes o a las dos y, garantizar la separación entre las paredes primaria y secundaria.

3.2 condiciones de presión atmosférica:
Condiciones de presión comprendidas entre 0,08 MPa (0,85 bar) y 0,11 MPa (1,1 bar).

3.3 detector de fugas por presión:
Dispositivo que detecta una fuga utilizando el aire o un gas inerte como medio de detección de fugas.

NOTA Con los detectores de fugas por presión, en caso de fuga, la caída de presión en la cámara intersticial dispara una alarma.

3.4 detector de fugas por sistemas de líquidos:
Dispositivo que detecta una fuga utilizando un líquido como medio de detección de fugas; cualquier fuga en una de las paredes del sistema se refleja en una caída del nivel del fluido de detección de fugas.

3.5 detector de fugas por vacío:
Dispositivo que detecta una fuga utilizando el aire como medio de detección de fugas; con este tipo de detector, en caso de fuga, el aumento de las presiones en la cámara intersticial dispara una alarma.

3.6 detector de gas:
Dispositivo que detecta la presencia de un gas o vapor.

3.7 detector de líquido:
Dispositivo que detecta la presencia de un líquido.

3.8 dispositivo indicador de fugas:
Dispositivo que detecta el estado de funcionamiento y alarma de todos los sensores o detectores de fugas conectados.

3.9 empresa reparadora P.P.L.:
Persona física o jurídica que repara y mantiene el almacenamiento de las instalaciones de P.P.L. (ampliando su campo de actividad a todas las operaciones que sea necesario realizar dentro de recintos confinados), y que dispone de los medios técnicos y de personal, dentro de las categorías y condiciones que se establecen en la ITC MI-IP 05 (instrucción técnica complementaria para instaladores o reparadores y empresas instaladoras o reparadoras de productos petrolíferos líquidos).

3.10 espacio de contención:
Sistema diseñado para evitar que una fuga de un sistema primario penetre en el medio ambiente y que permite detectar una fuga.

3.11 laminado:
Capa de revestimiento.

3.12 L.I.E y L.S.E:
Límites inferior y superior, respectivamente, de explosividad, en tanto por ciento en volumen de mezcla combustible/aire.

NOTA Delimitan los porcentajes mínimos y máximos de combustibles, en mezcla combustible/aire, entre los que dichas mezclas son inflamables.

3.13 pared primaria:
Capa primaria en contacto a la pared existente del tanque, que asociada a la capa intermedia y a la capa secundaria, crean una cámara intersticial adecuada.

3.14 pared secundaria:
Capa secundaria en contacto con el producto almacenado que, sola o asociada con el material intermedio, crea una cámara intersticial adecuada.

3.15 revestimiento protector de fugas:
Conjunto de las dos paredes, la primaria y la secundaria, que solas o asociadas con un material intermedio, crean una cámara intersticial adecuada.

3.16 sistema de sensor:
Disposición en la que se utilizan detector de líquido y/o vapor en espacios de contención o intersticial controlados por un dispositivo indicador de fugas para fines de detención de fugas.

3.17 sistema detector de fugas:
Conjunto de elementos que permiten la detección temprana de pérdida de estanquidad y/o fugas e incluye todos los equipos necesarios para detectar una fuga.

3.18 tanque de doble pared:
Tanque compuesto por paredes primaria y secundaria con una cámara intersticial, en el que el nivel de llenado máximo no sobrepasa la altura de la cámara intersticial.

3.19 tanque de simple pared:
Tanque con una única pared.

3.20 válvula de corte:
Válvula utilizada para interrumpir el caudal de un líquido más allá de un punto determinado en una línea de conexión.

3.21 zona protegida del hielo:
Zona cuya temperatura no desciende por debajo de 0 °C.

7.2 Emisiones de COV a la atmósfera

Durante el proceso de construcción, se controlarán las emisiones de COV a la atmósfera según la legislación vigente en materia de medio ambiente y se aplicarán las mejores técnicas disponibles.

7.3 Ensayo de continuidad en la cámara intersticial

Se deberá verificar la continuidad de la cámara intersticial o de detección en cada tanque.

La empresa reparadora deberá disponer de un método para comprobar la continuidad de la cámara intersticial. Por ejemplo, un método válido puede ser la introducción de un fluido que permita ser visualizado en toda la cámara intersticial, o detectar una posible discontinuidad.

7.4 Instalación del sistema de detección permanente y automático de fugas en la cámara intersticial

7.4.1 Una vez construido el sistema de doble pared, se montará un sistema de detección permanente y automático de fugas sobre la cámara intersticial que podrá ser de los expuestos como Clase I, Clase II o Clase III en la Norma UNE-EN 13160-1.

7.4.2 El sistema de detección permanente y automático de fugas deberá disponer del marcado CE de acuerdo con la Norma UNE-EN 13160-1.

En los sistemas de Clase I por presión, el fabricante o la empresa reparadora deberán justificar que el material con el que se conforma la cámara es impermeable. De lo contrario, no se podrá presurizar con aire la cámara intersticial y se deberá utilizar un gas inerte, por ejemplo el nitrógeno.

7.4.3 En los sistemas de Clase I por vacio, el sistema de regeneración automático de vacío deberá estar conforme con el RD 400/1996, de 1 de marzo, por el que se dictan las disposiciones de aplicación de la Directiva 94/9/CE, relativa a los aparatos y sistemas de protección para uso en atmósferas potencialmente explosivas (ATEX).

8 Ensayos de tipo

8.1 Adherencia

Se realizará el ensayo de adherencia en la pared primaria, conforme al Informe UNE 53991 IN cumpliendo los valores mínimos en él especificados.

8.2 Resistencia química de los materiales

Tiene como finalidad comprobar la resistencia que deben tener los materiales componentes del revestimiento, frente a los componentes con los cuales han de entrar en contacto en el interior del tanque.

El ensayo se realizará bajo las condiciones que se describen en el apartado 7.4.2 del Informe UNE 53991 IN cumpliendo los valores mínimos en él especificados.

8.3 Resistencia mecánica

En caso de utilizar materiales distintos al PRFV se realizará un ensayo de resistencia a flexión conforme a la Norma UNE-EN ISO 14125 y se verificarán los valores expuestos para la pared primaria y secundaria en los apartados 6.1 y 6.4 de la norma.

8.4 Dureza

Se realizará un ensayo de dureza Barcol, dureza Persoz o dureza Shore-D según los métodos descritos en el Informe UNE 53991 IN cumpliendo los valores mínimos en él especificados.

9 Verificación final

Después de finalizar todos los trabajos, la empresa reparadora deberá comprobar la estanquidad de la cámara intersticial.

10 Marcado del tanque convertido a doble pared y certificado de la empresa reparadora

10.1 Marcado del tanque convertido

Cada tanque convertido a doble pared deberá marcarse mediante una placa permanente, que debe ser resistente a la corrosión y al producto almacenado.

La placa deberá fijarse al tanque convertido o en el interior de la arqueta de boca de hombre o en sus proximidades, garantizando su permanencia, en un lugar visible y accesible.

La placa deberá llevar, como mínimo, la información siguiente:

- nombre y dirección de la empresa reparadora;
- mes y año de la conversión a doble pared;
- identificación del número de tanque convertido, según croquis de la instalación;
- número/Identificación de la instalación;
- tipo de material empleado.

10.2 Certificado de la empresa reparadora

Para cada tanque convertido, la empresa reparadora deberá facilitar un certificado en el que consten los ensayos realizados, según lo establecido en el capítulo 8 de esta norma, y la conformidad a la misma.

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09 MAYO 2022

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Appendix B

Sales Information Brochure

The Rafibra System is used on:

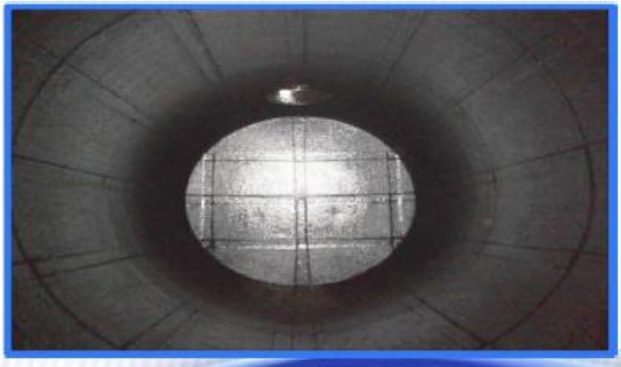
- Underground and aboveground storage tanks
- Vertical and horizontal fuel tanks
- Retail and private fueling stations
- Oil refineries, Petrochemical and other fuel storage facilities
- Double wall tanks which are past their life expectancy
- Single wall steel and fiberglass tanks being converted to double wall tanks

Advantage of our Method:

- The process takes only 7 days per tank as opposed to an average of 2 months for the traditional tank replacement project
- Project can be scheduled within weeks as opposed to several months for a tank replacement
- The structural strength is superior and without a match in the industry and can withstand a pressure test of 70 PSI. A typical shop fabricated tank can only withstand 3 to 5 PSI
- Most cities and towns do not require special construction permits and approvals for this system
- Does not have the risk of "change orders" for shoring or dewatering often part of a traditional tank replacement project
- The cost is less than half of a traditional tank replacement
- Facilities can remain open while the tanks are built in-situ

Before

After



Rafibra

407-747-7003 Ldiaz@donwoodinc.com

Appendix C

Installation Instructions

Appendix D

Integrity Testing & Maintenance

Pol. Ind. Alberic C/ Avda. Ribera alta, nº 30 46260 Alberic VALENCIA Tfn: 962 443 646 Fax: 962 443 648

TECHNCAL REPORT

COMPLETE MAINTENANCE OF ATMOSPHERIC TANKS

Pol.ind. Alberic C/Avda. Ribera alta, No. 30 46260 Alberic VALENCIA

DOUBLE WALL IN-SITU CONSTRUCTION

RAFIBRA RDP SYSTEM

IN ACCORDANCE WITH R.D. 1523/1999, EN-13160, UNE 53991 AND UNE 62422 REGULATIONS

PETITIONER: RAFIBRA, S. L.

TECHNICAL REPORT WRITTEN BY

JOSE LUIS FOLGADO GARCIA

TECHNICAL INDUSTRIAL ENGINEER
COLLEGIATE No. 6548 (COPITI VALENCIA)
VALENCIA, SPAIN 09-10-2012

Pol. Ind. Alberic C/ Avda. Ribera alta, nº 30 46260 Alberic VALENCIA Tfn: 962 443 646 Fax: 962 443 648

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Pol. Ind. Alberic C/ Avda. Ribera alta, nº 30 46260 Alberic VALENCIA Tfn: 962 443 646 Fax: 962 443 648

0 INTRODUCTION

Double wall tanks for petroleum products with interstitial space are designed to prevent leaks which can result in soil and groundwater contamination.

The outer wall prevents leaks that could result from the failure of the inner wall and vice versa. To ensure proper operation a leak detection system is installed. If liquid were to enter the interstitial space an audible and visual alarm is activated.

1 SUBJECT AND APPLICATION

The Technical Committee CEN/TC 221 under the CEN (European Committee for Standards), has developed the Standard series EN 13160, which refers to leak detection system, as defined in part 7 of the standard which includes general requirements, test measures, interstitial spaces, interior coatings, and leak protecting wrappers, distinguishing the following:

1 Interior coating protection against leaks (Chapter 6 of the standard UNE-EN-13160-7:2003)
   a. Interior coating protection for flexible leaks
   b. Interior cover protection against rigid leaks, (GRP)
2 Protected wrappers against leak (Chapter 7 of the standard UNE-EN 13160-7:2003). These two rules are excluded from the standard because they do not include tanks which are underground.

This procedure has the objective of establishing the standards to be followed by RAFIBRA, S.L. It defines the specific techniques to be followed to guarantee the proper construction of the In-situ double wall tank in a preexisting steel tank underground or aboveground.

This In-situ construction with a permanent leak detection system can be installed in the following:

a) New underground steel tanks used for the storage of petroleum products.

b) Existing fiberglass and steel underground steel tanks used for the storage of petroleum products which have maintained their structural integrity.

c) Existing fiberglass and steel tanks that have been properly repaired in accordance with standard UNE 53.991.

2.- ADVANTAGES

1. Through the installation of this system, you transform the simple wall tank into a double wall tank. The method is completed with the permanent installation of an automatic leak detection in the interstitial space created for a permanent detection system.
2. The system prevents the contamination of the environment.

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3. The system is compatible with other available leak detection systems in the interstitial space. It can be used with vacuum, pressure, and dry interstitial space sensors.
4. In the event of a failure of the primary wall, product would be contained in the secondary containment.
5. The new primary containment, interstitial space and secondary containment form a monolithic system since all the materials are of identical properties. The resin and fiberglass comply with the standards required in UNE 53991. Having a monolithic system prevents tension between layers which could result on separation.
6. The system considerably increases the structural integrity as well as the chemical resistance of the tank.

3 STANDARDS

UNE-EN 13160-1:2003 Leak Detection System. *Part 1: General Principles.*

UNE-EN 13160-2:2003 Leak Detection System. *Part 2: Pressure and vacuum Systems.*

UNE-EN 13160-7:2003 Leak Detection System. *Part 7: General Requirements and Test methods for interstitial space, interior coating and wrap protection against leaks.*

UNE-EN ISO 14125:1999 *Fiber-reinforced plastic composites — Determination of flexural properties (ISO 14125:1998).*

UNE 53991:2011 IN "Plastics. Repair and interior coating of steel tanks designed for the storage of liquid petroleum product using reinforced plastics."

UNE 53968:2005 IN Procedures for tank tightness test and leak detection on installations of petroleum storage tanks.

UNE 62422:2011 IN Construction of double wall tanks via In-situ transformation of steel tanks from single wall to double wall tanks.

4 TERMS AND DEFINITIONS

For this procedure, apply the terms and definitions, as follows:

4.1 Interstitial Space

Material used for the separation of the primary and secondary wall of the tank, which may be adhere or not to one of the two walls or to the two of them to guarantee the separation between the primary and the secondary wall.

4.2 Conditions of atmospheric pressure:

Conditions of pressure between 0.08 MPa (11.60 PSI) and 0.11 MPa (15.95 PSI)

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4.3 Leak detection by pressure:

Device which detects a leak using air or an inert gas as a medium to detect leak.

NOTE: With the leak detector by pressure, if there is a leak, the pressure drop in the interstitial space triggers an alarm.

4.4 Leak detection system by liquid (Brine):

The devices that detect a leak using the level of the liquid in the interstitial space.

4.5 Leak detection system by vacuum:

Device that detects a leak using air as a means of leak detection. With this type of detector, in case of a leak, the increase of the pressure in the interstitial space activates an alarm.

4.6 Gas Detector:

Device that detects the presence of a gas or vapor.

4.7 Liquid Detector:

Device that detects the presence of liquid.

4.8 Leak Detector:

Device that detects the conditions and status of all the leak sensors.

4.9 Authorized/Qualified installation company

Legal or physical person that repairs and provides maintenance to the storage in the facilities of fuel storage tanks.

4.10 Containment:

System designed to avoid the penetration of a leak of a primary system into the environment, resulting in the detection of a leak.

4.11 LEL (Lower explosive limit) and UEL (Upper explosive limit):

LEL, lowest concentration of gas or vapor which will burn or explode if ignited.

UEL, the highest concentration of gas or vapor which will burn or explode if ignited.

4.12 Primary wall:

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The ability of an enclosed tank designed or constructed to directly contact a confined liquid while in normal condition.

4.13 Secondary Wall:

The ability of a tank design or construction to directly contact and confine a liquid in abnormal use (from primary leakage) without leakage.

4.14 Retrofit system:

The combination of the two walls, the primary and the secondary, by themselves or associated with an intermediate material, create an adequate interstitial space.

4.15 Sensor System:

Provision that uses a liquid detector and/or vapor in contained or interstitial space controlled by a device used for leak detection.

4.16 Leak detector System:

Combination of elements that allow the early detection of the loss of strength of the walls of the tank and or leak, including all the equipment necessary for the detection of a leak.

4.17 Double wall Tank:

Tanks containing primary walls and secondary walls with an interstitial.

4.18 Single Wall Tank:

Tank with only one wall.

4.19 Shut-off Valve:

Valve used to interrupt the flow of a liquid beyond a point in a line connection.

4.20 Freeze protected zone:

Zone with temperature that does not go below the 32°F.

4.21 FRP

Fiberglass reinforced plastic.

4.22 LOAD

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Relative inert solid used to modify the resistance, stability, working conditions or other characteristics.

4.23 Epoxy, Vinyl ester and Polyester

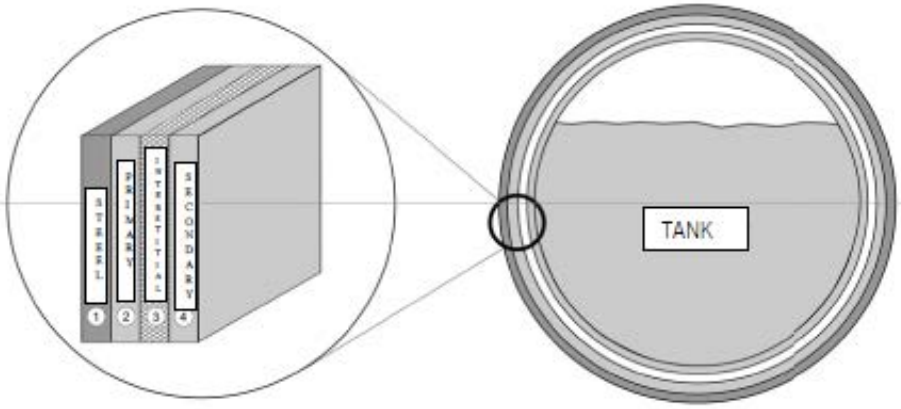
Epoxy, vinyl ester and polyester coating are the combination of 2 different materials which complement each other by their characteristics; a liquid resin that by polymerization results in a solid thermostable and insoluble fiber coating incorporated in the interior of the resin given strength to the traction efforts, while the solidified resin works develops a compression, improving the composition of the mix.
A resin solidified is known as matrix and the mix of resin and coating is also known as the composed material.

4.24. Polymerization.

Is the process in which various molecules of monomer identical or different, are united by adhesion or by condensation, forming a macromolecule known as polymer in the case of the resin thermostable, the polymerization produces a solid red tridimensional infusible and practically insoluble by the technical process known cured.

Explanation:

1 Steel
2 Primary wall (next to the steel wall)
3 Interstitial Space
4 Secondary wall (in contact with the product)



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5 MATERIALS

5.1. General Technical Features

The interior coating for leak protection (chapter 6 of standard UNE-EN 13160-7:2003) states, the following:

a) Interior coating protectors against flexible leaks.

They are made with flexible materials and are designed as a function of the dimension of the tank. The sheets should not have blisters, fissures, pores, and any other no-homogeneity. The irregularities which are evident and easily detectable, must be identified by means of visual examination.

The quality and compatibility of the materials must be approved and confirmed by a specific test, pursuant to the requirements determined in chapter 7 and 8 of the standard "Quality Control" and Tests, respectively.

b) Interior Coating protectors against rigid leak FRP.

The interior coating protectors against leakage may be reinforced with fiberglass, resin, of polyester, resin polyester non saturated resin (FRP-UP) and resin epoxy reinforced with fiberglass (FRP-EP). It can also be used with other adequate material.

The fitness of the materials must approve and confirmed by a specific test, pursuant to the requirements determined in chapters 7 and 8 of the Standard of Quality Control and Tests, respectively.

5.2. RAFIBRA Materials System - RDP

5.2.1.- Resins

Thermostable resin will be used, such as epoxy, vinyl, polyester, or other types of resin; with specifics features and special properties which are resistant dissolving action of the petroleum products, including the oxygenates; These resins must have enough coefficient of thermically dilatation superior to iron, to be able to support the movements of the tank. In the case of the RAFIBRA – RDP System, Epoxy vinyl ester resin is used without solvents (styrene) reinforced with fiberglass.

5.2.2.- Fiber Reinforcement

The reinforcements are made with fiberglass "E", composed of plastic compatible with resins used in the manufacturing of the product.

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Each reconstructed tank will be marked by RAFIBRA, S.L. by means of a permanent plate which is resistant to corrosion as well as to the storage product.

The permanent plate will be fixed to the converted tank or on the manway cover of the tank or close to it. The plate should be visible and accessible.

The permanent plate will contain, as a minimum, the following information:

- Name and Address of RAFIBRA, S.L.
- Month and Year the tank was reconstructed.
- Identification number of the reconstructed tank in accordance with the sketch of the facilities.
- Number/Identification Number of the facility.
- Type of material Used.

11.2 Certificate of the repair company

For each tank converted, RAFIBRA, S.L. will issue a certificate indicating the details of the tests conducted pursuant, to chapter 8 standards.

12. MANAGEMENT OF WASTE

All the contaminated liquids obtained during the cleaning process of the tanks will be properly managed and disposed of at an authorized facility.

13. REFERENCES AND RAFIBRA S.L. PROFILE

13.1.- BACKGROUND OF THE COMPANY (ANNEX VIII)

13.2.- TECNICAL MEDIA

RAFIBRA, S.L., in its facilities of Alberique, has machines and the space necessary for the repair and coating of atmospheric deposits underground and for the verification of the tightness of said deposits described on the previous section, including the vehicles which the technical people use to conduct maintenance operations.

RAFIBRA S.L has the following characteristics:

- Has Worldwide presence
- Has the know-how of systems, materials, and advanced procedures.

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- Proven experience in the procedure of in situ conversions
- Capacity to manage and coordinate each one of the job phases.
- Has the required inventory of the material, equipment, and instruments to effect and guarantee the treatment of surface, cleaning, and product application, etc.,
- System of residue extraction.
- Autonomous System of ventilation.
- Equipment for the ventilation and extraction of air.
- System to measure the thicknesses of the metallic structure of the bank and the coating using ultrasonic methods.
- High pressure submergible pumps and auto absorption centrifuge, of diverse rates of flows.
- Luminaries with protection of ant deflagrant to be used in the interiors of the tanks and lantern of intrinsic securities.
- Compressors of different types and sizes.
- Oxygen and gases control Systems.
- Measurement instruments to measure and verify the thickness of the coated tanks.
- Means of Transportation for the personnel.
- Transportation of residuals in adequate containers to the appropriate plant.

Its technical department has studied and designed, using the latest information technology available, the different methos of thickness tank verification which after a specific and carefully test, conducted in our facilities, as well as, by other approved laboratories, we have developed the RAFIBRA-VSN VERIFICATION SYSTEM OF THICKNESS, accompanied by its continuing upgrades, resulting in the most dependable thickness verification system in the market.

We also design logistics systems that allow a more rapid response from the intervention of our equipment.

Considering the technical means available to the company, we cannot forget the human factor. RAFIBRA, S.L. has in its payroll a selected group of technical personnel with college degrees and without college degrees, engineers, experts in business administration, installers of petroleum product, as well as the technical petroleum product people that make possible the compliance and control of our services.

14.- ATTACHEMENTS

- ANNEX I: Industrial Registration of RAFIBRA, S.L. responsible for the installation, maintenance, and repair of tanks - RPPL - 3
- ANNEX II: Continuity Test in the interstitial space of the wall of the tank.
- ANNEX III: Market receipt C.E. from the manufacturer regarding the detector CLASS 1

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- ANNEX IV: Receipt compliance with rule 13160, detention of leakage detection system CLASS II
- ANNEX V: Test for the adherence effected by an approved Laboratory for the Testing Procedure.
- ANNEX VI: Tests of Chemical Resistance and strength effected by laboratories approved for the testing Procedure.
- ANNEX VII: Tests of Mechanic Resistance effected by approved laboratories specialized in testing procedures.
- ANNEX VIII: Authorizations from Portugal, France, and Italy.

-

Alberic, March 7, 2022

Fdo.: José Luis Folgado García
Rafibra S.L.

Appendix E

Operability Testing

The Rafibra Annual Operability Test

The installation of a leak detection system in the interstitial space of the tank will be the choice of the tank owner. Once the double-wall system is constructed, a permanent leak detection system shall be installed for the detection of leaks in the interstitial space in accordance with Florida Department of Environmental Protection requirements. Rafibra upgraded tanks using pressure and vacuum systems will be required to use the operability tests prescribed in the Equipment Registration with the FDEP. Liquid float electronic sensors used for leak detection shall be tested by inverting the liquid float and confirming an alarm on the automatic tank gauge, and then clearing the alarm before putting the sensor back into service. Any tank using a visual release detection method shall be required to visually check the low-point sump with a gauge stick or similar tool for liquids.

Appendix F

Materials Compatibility

Gaiker
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

TEST REPORT

SUBJECT Nº/REPORT: P-22-23858/2/I
COMPANY: **RAFIBRA, S.L.**
ADDRESS: Av. De la Ribera Alta 30, 46260, Alberic, Valencia

TESTED MATERIAL: 1 RESIN COATED COMPOSITE PIECE

DATE OF RECEPTION: 04.26.2022

DATE OF ANALYSIS: 05.02.2022

Nº OF PAGES
4
(INCLUDING THIS COVER SHEET)

The results of the analysis only refer to the tested material.

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This test report is a translation of the original P-21-23858/2, in Spanish. In case any conflict arises, the Spanish version will prevail.

A. Matellanes
E & C Coordination
Zamudio, 10th May 2022

Gaiker
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

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48170 Zamudio . Bizkaia .Spain
T.: 34 94 600 23 23
mark@gaiker.es;www.gaiker.es

Gaiker
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

TEST REPORT

SUBJECT Nº/REPORT: P-22-23858/3/I
COMPANY: **RAFIBRA, S.L.**
ADDRESS: Av. De la Ribera Alta 30, 46260, Alberic, Valencia

TESTED MATERIAL: 1 RESIN COATED METAL PIECE

DATE OF RECEPTION: 26.04.2022

DATE OF ANALYSIS: 02.05.2022

Nº OF PAGES
4
(INCLUDING THIS COVER SHEET)

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A. Matellanes
E & C Coordination
Zamudio, 10th May 2022

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TEST REPORT

SUBJECT Nº/REPORT: P-22-23858/4/I
COMPANY: **RAFIBRA, S.L.**
ADDRESS: Av. De la Ribera Alta 30, 46260, Alberic, Valencia

TESTED MATERIAL: 1 RESIN COATED COMPOSITE PIECE

DATE OF RECEPTION: 04.26.2022

DATE OF ANALYSIS: 05.02.2022

Nº OF PAGES
4
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A. Matellanes
E & C Coordination
Zamudio, 10th May 2022

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AIMPLAS
INSTITUTO TECNOLÓGICO DEL PLÁSTICO

ilac-MRA ENAC ENSAYOS Nº 58/LE158

** Las actividades marcadas no están amparadas por la acreditación de ENAC.*
** The marked activities are not covered by the ENAC accreditation.*

LABORATORIO DE ENSAYO | TESTING LABORATORY

INFORME/ REPORT 21-0370-BI/1
21-0370

EMPRESA | COMPANY

RAFIBRA, S.L.
AVDA. RIBERA ALTA, Nº 30
46260 ALBERIC
VALENCIA

SOLICITANTE | PETITIONER
Alberto López

ASUNTO | SUBJECT

Asistencia técnica Homologación resinas conforme a normas ASTM
Technical assistance Resin homologation according to ASTM standards

Firma electrónica del personal autorizado | Electronic signature of authorized personnel

NEUS|SORIANO|MARCO
Characterization Group Leader
2021.09.27 17:36:46 +02'00'

CONTENIDO DEL INFORME | REPORT CONTENT

ENSAYO A

* Propiedades de flexión

21-0370-2

Ensayo de flexión RDP RAFIBRA según norma ASTM D 790

Método de ensayo

Norma:	ASTM D790 (2017)
Método:	A
Velocidad de ensayo (mm/min):	1
Célula de carga (kN):	10
Distancia entre apoyos (mm):	53
Radio de apoyo (mm):	5
Radio del útil de carga (mm):	5
Puntos de carga:	3 puntos
Cara de la probeta en contacto con el útil de carga:	Rugosa
Indicador de fuerza (exactitud ISO 7500):	Clase 0,5
Indicador de deformación (exactitud ISO 9513):	Clase 0,5
Tipo de indicador de desplazamiento:	Brazo flexión-compresión
Naturaleza y forma del material:	Laminado
Tipo de probeta:	Ancho de 12,7 mm
Dimensiones:	Se indican en las tablas de resultados
Nº de probetas:	5
Preparación:	Mecanizadas por máquina de control numérico
Acondicionamiento previo:	88 horas a (23±2)ºC;(50±10)%HR
Condiciones ambientales durante el ensayo:	(23±2)ºC;(50±10)%HR

Resultados

Fecha inicio ensayo: 14/09/2021
Fecha fin ensayo: 14/09/2021

Tabla 1

Probeta	Espesor (mm)	Ancho (mm)	Módulo de Elasticidad (MPa)	Resistencia a flexión (MPa)	Flecha a fuerza máxima (mm)
1	3,244	12,732	6440	91,6	3,2
2	3,339	12,699	6020	88,7	4,3
3	3,241	12,729	6190	106	4,8
4	3,340	12,724	6760	101	3,9
5	3,267	12,756	6440	98,5	4,3
Valor Medio			**6370**	**97,2**	**4,1**
Desviación estándar			280	7,0	0,6

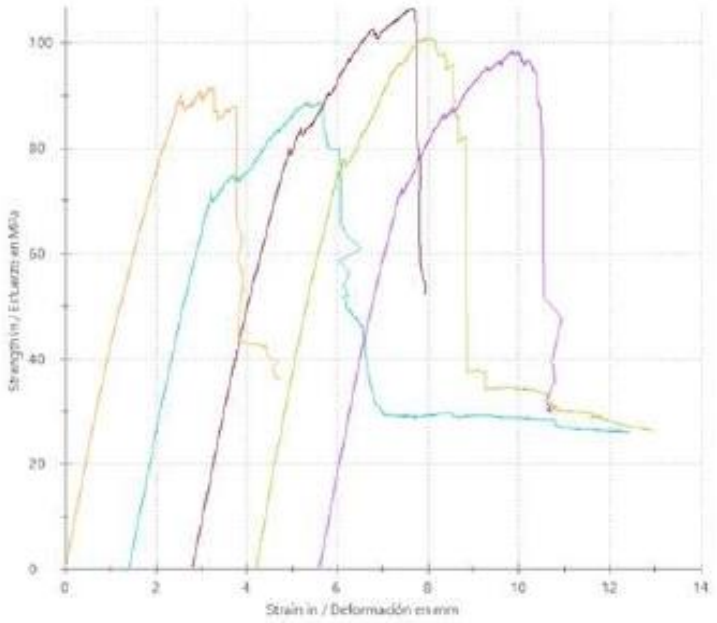

Figura 1. Gráfica Flexión-deformación

ENSAYO B

Dureza Barcol

21-0370-3

Ensayo de Dureza Barcol RDP RAFIBRA según norma ASTM D 2583

Método de ensayo

Norma	ASTM D2583

Resultados

Fecha inicio ensayo: 13/09/2021
Fecha fin ensayo: 13/09/2021

Tabla 2

	Dureza Barcol
Valor medio	**48**
Desviación estándar	2

TABLAS RESUMEN

21-0370-2

Ensayo de flexión RDP RAFIBRA según norma ASTM D 790

	Ensayo	Norma	Propiedades	Resultado
A	* Propiedades de flexión	ASTM D 790:2017	Resistencia a flexión (MPa)	97,2

21-0370-3

Ensayo de Dureza Barcol RDP RAFIBRA según norma ASTM D 2583

	Ensayo	Norma	Propiedades	Resultado
B	Dureza Barcol	ASTM D2583	Dureza Barcol	Valor medio: 48

PRESCRIPCIONES

1.- AIMPLAS responde únicamente de los resultados sobre los métodos de análisis consignados en el informe y referidos exclusivamente a los materiales o muestras que se indican en el mismo, limitando a éstos la responsabilidad profesional y jurídica del Centro. Salvo mención expresa, las muestras han sido libremente elegidas, referenciadas y enviadas por el solicitante.

2.- Este Instituto no se hace responsable en ningún caso de la interpretación o uso indebido que pueda hacerse de este documento, cuya reproducción parcial está totalmente prohibida.

3.- Los resultados se consideran como propiedad del solicitante y, sin autorización previa, AIMPLAS se abstendrá de comunicarlos a un tercero.

4.- Ninguna de las indicaciones formuladas en este informe puede tener el carácter de garantía para las marcas comerciales que en su caso se citen.

5.- Ante posibles discrepancias entre informes, se procederá a una comprobación dirimente en la sede central del Instituto. Así mismo, el solicitante se obliga a notificar a este Centro cualquier reclamación que reciba, con causa en el informe, eximiendo a este Centro de toda responsabilidad caso de no hacerlo así.

6.- Los materiales o muestras sobre los que se realicen los ensayos se conservarán en AIMPLAS durante el mes posterior a la emisión del informe, procediéndose posteriormente a su destrucción, por lo que toda petición relacionada con los materiales ensayados, se deberá realizar en el plazo indicado.

7.- AIMPLAS se exime de cualquier responsabilidad derivada de la obtención de resultados anómalos en el caso de que la muestra no se considere adecuada para el ensayo y así se haya comunicado previamente al solicitante.

8.- AIMPLAS es responsable de la información que aparece en el informe, pero no de la proporcionada por el cliente que pueda afectar a la validez de los resultados.

9.- Los informes de ensayo, al no estar elaborados con carácter de dictamen pericial para su utilización como tal ante un órgano judicial, no podrán utilizarse con tal carácter ante ningún órgano jurisdiccional.

10.- Cuando el cliente precise la utilización judicial de los informes/certificados emitidos, la participación de AIMPLAS se llevará a cabo preferentemente por videoconferencia. En caso de que ello no fuera posible, el cliente se hará cargo de los costes de desplazamientos, dietas u otros gastos adicionales que se generen, que serán previamente presupuestados por AIMPLAS para su conocimiento y aprobación

11.- Este documento firmado electrónicamente es el válido a efectos legales y el que debe conservarse. Cualquier impresión o representación gráfica que se haga de él será una copia y solo es válido en los términos que determine el destinatario de la firma.

12.- Este informe se ha emitido con la información disponible y aportada por el cliente en la aceptación de la oferta correspondiente, por lo que en ningún caso se podrá emitir otro informe a posteriori con información diferente a la que consta en el presente informe, y que no haya sido aportada con anterioridad.

13.- La incertidumbre estimada para cada uno de los ensayos del presente informe se encuentra en AIMPLAS a disposición del cliente.

TEST A

* Flexural Properties

21-0370-2

Ensayo de flexión RDP RAFIBRA según norma ASTM D 790

Test method

Standard:	ASTM D790 (2017)
Method:	A
Test speed (mm/min)	1
Load cell (kN):	10
Span (mm):	53
Radius supports (mm):	5
Radius of the striking edge (mm):	5
Points load:	3
Force indicator (accuracy ISO 7500):	Class 0,5
Deformation indicator (accuracy ISO 9513):	Class 0,5
Extensometer:	Flexural-compression arm
Material:	Laminated
Specimen type:	12,7 mm width
Number of secimen:	5
Specimen prepartion	Numerical control machine machinig
Pre-conditioning	88 h at (23±2)ºC;(50±10)%RH
Environmental conditons:	(23±2)ºC;(50±10)%HR

Results

Start date: 2021/09/14
Finish date: 2021/09/14

Table 1

Specimen	Thickness (mm)	Width (mm)	Flexural modulus (MPa)	Flexural strength (MPa)	Deflection at flexural strength (mm)
1	3,244	12,732	6440	91,6	3,2
2	3,339	12,699	6020	88,7	4,3
3	3,241	12,729	6190	106	4,8
4	3,340	12,724	6760	101	3,9
5	3,267	12,756	6440	98,5	4,3
Mean value			**6370**	**97,2**	**4,1**
Standard deviation			280	7,0	0,6

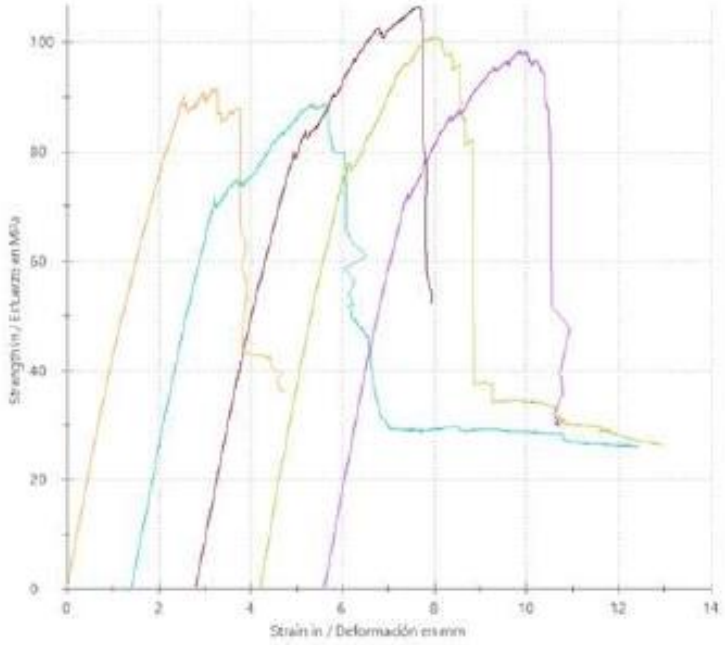

Figure 1. Bending-strain graph

TEST B

Barcol Hardness

21-0370-3

Ensayo de Dureza Barcol RDP RAF|BRA según norma ASTM D 2583

Test method

Standard	ASTM D2583

Results

Start date: 2021/09/13
Finish date: 2021/09/13

Table 2

	Barcol hardness
Mean value	**48**
Standard deviation	2

SUMMARY TABLES

21-0370-2

Ensayo de flexión RDP RAFIBRA según norma ASTM D 790

	Test	Standard	Properties	Result
A	* Flexural Properties	ASTM D 790:2017	Flexural strength (MPa)	97,2

21-0370-3

Ensayo de Dureza Barcol RDP RAFIBRA según norma ASTM D 2583

	Test	Standard	Properties	Result
B	Barcol Hardness	ASTM D2583	Barcol hardness	Mean value: 48

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Appendix G

Release Detection

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Spanish standard

UNE-EN 13160-4

December 2003

Leak detection systems

Part 4: Liquid and/or vapour sensor systems for use in leakage containments or interstitial spaces

This standard has been prepared by the Technical Committee CTN 62 *Industrial equipment goods and pressure equipment* the Secretariat of which is held by BEQUINOR.

BEQUINOR

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UNE-EN 13160-4

Leak detection systems
Part 4: Liquid and/or vapour sensor systems for use in leakage containments or interstitial spaces

Sistemas de detección de fugas. Parte 4: Sistemas de detección de líquido y/o gas en espacios de contención o intersticiales.

Systèmes indicateurs de fuites - Partie 4: Systèmes de détection de liquide et/ou gaz dans des espaces de confinement ou des espaces interstitiels

This standard is the official English version of EN 13160-4:2003.

This standard was published as UNE-EN 13160-4:2003, which is the definitive Spanish version.

The remarks to this document must be sent to:

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13160-4

May 2003

ICS 23.020.01; 23.040.99; 29.260.20

English version

Leak detection systems - Part 4: Liquid and/or vapour sensor systems for use in leakage containments or interstitial spaces

Systèmes indicateurs de fuites - Partie 4: Systèmes de détection de liquide et/ou gaz dans des espaces de confinement ou des espaces interstitiels

Leckanzeigesysteme - Teil 4: Flüssigkeits- und/oder Gassensorensysteme in Leckage oder Überwachungsräumen

This European Standard was approved by CEN on 10 March 2003.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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Ref. No. EN 13160-4:2003 E

Contents

Foreword

This document (EN 13160-4:2003) has been prepared by Technical Committee CEN /TC 221, "Shop fabricated metallic tanks and equipment for storage tanks and for service stations", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2003, and conflicting national standards shall be withdrawn at the latest by November 2003.

This European Standard consists of 7 parts:

Leak detection systems;

Part 1: General principles

Part 2: Pressure and vacuum systems

Part 3: Liquid systems for tanks

Part 4: Liquid and/or vapour sensor systems for use in leakage containments or interstitial spaces

Part 5: Tank gauge leak detection systems

Part 6: Sensors in monitoring wells

Part 7: General requirements and test methods for interstitial spaces, leak protecting linings and leak protecting jackets

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the requirements for leak detection systems - class III for use in the interstitial space of double-skin systems or in leakage containments of single skin systems designed for water polluting fluids. This European Standard is not applicable to leak detection systems using non re-usable sensors.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 13160–1:2003, *Leak detection systems — Part 1: General principles.*

EN 13160–7, *Leak detection systems — Part 7: General requirements and test methods for interstitial spaces, leak protecting linings and leak protecting jackets.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 13160-1:2003 apply.

4 General

General principles according to EN 13160-1.

Where the requirement is for low temperature performance the alternative test temperature is shown in brackets [...].

Liquid or vapour sensors shall be installed in such a way that they can detect specific liquids or their vapours present in or entering the leakage containment or interstitial space.

The leakage containment can take the form of a

— sump or riser containing spills from leaks in double wall lines or pumps;

— bund, designed to contain leakage from a storage tank or from any other facility containing liquids;

— other facilities in which sensors can be installed to detect the presence of liquids or vapours.

5 Interstitial space

General requirements concerning the interstitial space according to EN 13160–7.

The design of the interstitial space intended to detect liquid shall allow detection of a minimum amount of 10 l of a specific liquid present in or entering the interstitial space.

The interstitial space shall allow an installation of the sensor at the deepest point of the interstitial space.

The interstitial space shall be constructed so that the leakage liquid shall reach the deepest point of the interstitial space.

For a tank, the system shall be designed so that there are no connections to the inner tank through the interstitial space, below the maximum filling level.

For a pipe, the system shall be designed so that there are no connections to the inner pipe through the interstitial space.

The interstitial space shall be capable of being tested for integrity.

6 Leakage containment

The design of leakage containment intended to detect liquid shall allow detection of a minimum amount of 10 l of a specific liquid present in or entering the containment.

The number of sensors of the system shall correspond to the intended number of low points in the leakage containment.

NOTE The design of a leakage containment should allow that liquid leaking from any point in the primary system will collect in at least one of a number of low points in the leakage containment.

The leakage containment shall be liquid tight and impervious to the stored product, water or any other substance with which it is likely to come into contact, and shall have no outlets below the level of the maximum contained volume.

If protection against ingress of water is not possible, technical measures have to be taken to avoid impairment of the function of the leak detector.

No penetrations through the walls of the leakage containment shall be made which might interfere with its functions as leakage containment.

It shall be possible to test the leakage containment for leaks.

If the leakage containment is used as a bund for a primary system holding liquids then the walls of the bund shall fully surround the system and shall be capable of containing the entire contents of the primary system.

7 Liquid sensor

Liquid sensors shall detect specific liquids they can normally come into contact with (e. g. stored product, water).

Liquid sensors shall comply with the test criteria according to clauses 10 or 11, as appropriate.

8 Vapour sensor

Vapour sensors shall detect specific vapours from stored products.

Vapour sensors shall comply with the test criteria according to clause 12.

9 Leak indicating device

A leak indicating device shall be provided.

An alarm shall indicate when the presence of stored product and/or water is detected.

10 Type test of the liquid sensors

10.1 Test objective

The aim of the test is to verify the suitability of a sensor system to detect the ingress of liquid into the interstitial space or leakage containment, where this space is normally dry. Tests shall be performed to verify:

— the response time of the sensor system in indicating the presence of liquid, where the liquid level is rising at a given rate;

— the recovery time of the sensor system from a liquid-indicating condition following its removal from the presence of liquid.

A sensor system shall be qualified for use with each type of liquid that it shall be required to detect. Where possible, tests shall be performed using these actual liquids, however where significant hazards may result, a less harmful test liquid may be used having similar chemical and physical properties. For example, a substitute for petroleum spirit would be petroleum naphtha (an aliphatic petroleum distillate).

10.2 Evaluation

Tests shall be deemed to have been passed where:

— the presence of liquids is not indicated when no liquid is present;

— the presence of liquid is indicated within 30 min after liquid is first introduced into the test system at the rate of 10 l/h;

— the presence of liquid is indicated within 6 min after liquid is first introduced into the test system at the rate of 50 l/h;

— the sensor has a measurable recovery time of max 20 h after removal of the test liquid.

These criteria shall be satisfied over the range of environmental conditions specified in the test in 10.4.

The system shall remain in the alarm condition until the sensor has recovered and the alarm has been reset.

10.3 Test equipment

A test vessel in the form of a flat-bottomed vertical cylinder, having a horizontal cross-sectional area of (0,1 ± 0,002) m^2 (i.e. a liquid depth of 0,01 m corresponds to a volume of 1 l) and a minimum depth of 0,6 m. One or more fittings flush with the inside surface of the vessel shall be provided in the floor of the vessel for the introduction of liquids. A similar fitting shall be provided having a drain cock capable of emptying the vessel at a rate of 5 l/min.

Suitable quantities of each liquid for qualification (or suitable test liquids).

A calibrated metering pump (with a reservoir of minimum 6 l capacity) capable of delivering liquid into the test vessel, at the rates specified in 10.2, with an accuracy of 2 %.

An environmental chamber the temperature of which can be varied over the range from - 25 °C to + 70 °C with an accuracy of 2 K.

For the test in a temperature range from – 40 °C to + 40 °C an environmental chamber the temperature of which can be varied over a range from – 50 °C to + 40 °C with an accuracy of 2 K.

A stop clock having a time indication in steps of 1 s to a minimum total of 24 h, with an accuracy of 2 s.

10.4 Test method

10.4.1 Preparation

The sensor under test shall befixed in its normal orientation ensuring contact with the floor of the test vessel but away from any ports for the entry or extraction of liquid. The manufacturer's fittings should be used wherever possible. The test vessel and metering pump reservoir shall be mounted inside the environmental chamber. The sensor under test shall be connected to the leak indicating device which shall be mounted outside the environmental chamber in ambient laboratory conditions.

Prior to the series of tests for each liquid for which the sensor system shall be qualified, the metering pump reservoir shall be charged with the appropriate liquid or test liquid.

Power shall be applied to the sensor system, which shall then be initialised by means specified in the manufacturer's operating instructions to obtain fully operational conditions.

10.4.2 Stabilisation

Prior to each test to be conducted, and with the sensor system fully operational, the environmental chamber shall be preset to the required test temperature and shall be allowed to stabilize for 30 min after the internal temperature reaches the prescribed test temperature ± 2 K.

10.4.3 Procedure

For each test to be conducted, the following procedure shall be used:

— the leak indicating device shall be checked. If the presence of liquid is indicated, the test shall be terminated;

— the metering pump shall be set to the specified pumping rate;

— zero the stop clock;

— the metering pump shall be started;

— at the moment liquid starts to flow from the inlet fitting into the test vessel, the stop clock shall be started;

— at the moment when the leak indicating device first indicates the presence of liquid, by means specified in the manufacturer's instructions, or if the maximum response time is exceeded, the stop clock and the metering pump shall be stopped;

— the stop clock elapsed time (measured response time) shall be recorded;

— zero the stop clock;

— the test vessel drain cock shall be opened;

— at the moment the vessel is empty of liquid the stop clock shall be started;

— at the moment when the leak indicating device indicates the absence of liquid, by means specified in the manufacturer's instructions, or if a period of 20 h is exceeded the stop clock shall be stopped;

— the stop clock elapsed time (measured recovery time) shall be recorded.

10.4.4 Test schedule

10.4.4.1 The following series of tests shall be performed twice for each liquid for which the sensor system is to be qualified:

10.4.4.2	Environmental temperature:	- 20 °C [- 40 °C]
	Metered pump rate:	10 l/h
	Maximum response time:	30 min
10.4.4.3	Environmental temperature:	- 20 °C [- 40 °C]
	Metered pump rate:	50 l/h
	Maximum response time:	6 min
10.4.4.4	Environmental temperature:	+ 20 °C [+ 40 °C]
	Metered pump rate:	10 l/h
	Maximum response time:	30 min
10.4.4.5	Environmental temperature:	+ 20 °C [+ 40 °C]
	Metered pump rate:	50 l/h
	Maximum response time:	6 min
10.4.4.6	Environmental temperature:	+ 60 °C
	Metered pump rate:	10 l/h
	Maximum response time:	30 min

10.4.4.7	Environmental temperature:	+ 60 °C
	Metered pump rate:	50 l/h
	Maximum response time:	6 min

Where the freezing point of the liquid for qualification is above - 25 °C [- 45 °C], tests 10.4.4.2 and 10.4.4.3 shall be performed at a temperature equal to the freezing point plus 5 K.

Where the flash point of the liquid for qualification is below + 70 °C, tests 10.4.4.6 and 10.4.4.7 shall be performed at a temperature equal to the flash point minus 10 K.

10.5 Test results

For each test in the schedule for a particular liquid, the measured response times shall be compared to the relevant criteria listed in 10.2 to determine whether the test has been passed or failed. If any criterium in any test is not met or if at any time a leak is indicated when no liquid is present (other than during the recovery time) the sensor system shall be deemed to have failed the test and shall not qualified for use with that liquid. Any such a failure will not prevent qualification for use with any other liquid for which the test is passed. The worst case response and recovery time for any of the series of tests shall be recorded.

10.6 Sensor marking

Each sensor shall carry the following markings:

— approved liquids – for which the sensor has been tested;

— response time – worst case from any test for each of the approved liquids;

— recovery time – worst case from any test for each of the approved liquids.

Alternatively, the sensor shall be marked with a reference to a specification incorporating the same information.

11 Type test of discriminating liquid sensors

11.1 Discriminating liquid sensors for bulk quantities of stored product and water

11.1.1 Test objective

The aim of the test is to verify the suitability of a sensor system to detect the presence of stored product and water in the monitored area. Tests shall be performed to verify:

— the response time of the sensor system in indicating the presence of the stored product, where the liquid level is rising at a given rate;

— the recovery time of the sensor system from a stored product-indicating condition following its removal from the presence of the stored product.

A sensor system shall be qualified for use with each type of liquid that it shall be required to detect. Where possible, tests shall be performed using these actual liquids, however where significant hazards may result, a less harmful test liquid may be used having similar chemical and physical properties. For example, a substitute for petroleum spirit would be petroleum naphtha (an aliphatic petroleum distillate).

11.1.2 Evaluation

Tests shall be deemed to have been passed where:

— the presence of stored product is not indicated when no stored product is present whether water is present or not;

— with the sensor submerged in water to varying degrees, the presence of stored product is indicated within 30 min after liquid is first introduced into the test system at the rate of 10 l/h;

— with the sensor submerged in water to varying degrees, the presence of stored product is indicated within 6 min after liquid is first introduced into the test system at the rate of 50 l/h;

— the sensor has to have a measurable recovery time of maximum 20 h after removal of the stored product.

These criteria shall be satisfied over the range of environmental conditions specified in the test in 11.1.4.

The system shall remain in the alarm condition until the sensor has recovered and the alarm has been reset.

11.1.3 Test equipment

A test vessel in the form of a flat-bottomed vertical cylinder, having a horizontal cross-sectional area of (0,1 ± 0,002) m^2 (i. e. a liquid depth of 0,01 m corresponds to a volume of 1 l) and a minimum depth of 0,6 m. One or more fittings flush with the inside surface of the vessel shall be provided in the floor of the vessel for the introduction of liquids. Where water is present and the test temperature is such that ice will form, liquid shall also be capable of being introduced into the test vessel from above. A similar fitting shall be provided having a drain cock, or suitable syphon system, capable of emptying the vessel at a rate of 5 l/min.

Suitable quantities of each liquid for qualification (or suitable test liquids).

A calibrated metering pump (with a reservoir of minimum 6 l capacity) capable of delivering liquid into the test vessel, at the rates specified in 11.1.2 within an accuracy of 2 %.

An environmental chamber the temperature of which can be varied over the range from - 25 °C to + 70 °C with an accuracy of 2 K.

For the test in a temperature range from – 40 °C to + 40 °C an environmental chamber the temperature of which can be varied over the range from – 50 °C to + 40 °C with an accuracy of 2 K.

A stop clock having a time indication in steps of 1 s to a minimum total of 24 h, with an accuracy of 2 s.

11.1.4 Test method

11.1.4.1 Preparation

The sensor under test shall be fixed in its normal orientation ensuring contact with the floor of the test vessel but away from any ports for the entry or extraction of liquid. The manufacturer's fittings should be used wherever possible. The test vessel and metering pump reservoir shall be mounted inside the environmental chamber. The sensor under test shall be connected to the leak indicating device under test which shall be mounted outside the environmental chamber in ambient laboratory conditions.

Prior to the series of tests for each liquid for which the sensor system shall be qualified, the metering pump reservoir shall be charged with the appropriate liquid or test liquid and the test vessel filled with water to the appropriate level.

Power shall be applied to the sensor system which shall be then initialised by means specified in the manufacturer's operating instructions such that the system is fully operational.

11.1.4.2 Stabilisation

Prior to each test to be conducted, and with the sensor system fully operational, the environment chamber shall be preset to the required test temperature, and shall be allowed to stabilize for 30 min after the internal temperature reaches the prescribed test temperature ± 2 K.

11.1.4.3 Procedure

For each test to be conducted, the following procedure shall be used, using the correct water level:

— the leak indicating device shall be checked. If the presence of test liquid is indicated, the test shall be terminated;

— the metering pump shall be set to the specified pumping rate;

— zero the stop clock;

— the metering pump shall be started;

— at the moment liquid starts to flow from the inlet fitting into the test vessel, the stop clock shall be started;

— at the moment when the leak indicating device first indicates the presence of the test liquid, by means specified in the manufacturer's instructions, or if the maximum response time is exceeded, the stop clock and the metering pump shall be stopped;

— the stop clock elapsed time (measured response time) shall be recorded;

— zero the stop clock;

— the test vessel drain cock shall be opened, or the syphon shall be started;

— at the moment when the vessel is empty of liquid, the stop clock shall be started;

— at the moment when the leak indicating device indicates the absence of liquid, by the means specified in the manufacturer's instructions, or if a period of 20 h is exceeded, the stop clock shall be stopped;

— the stop clock elapsed time (measured recovery time) shall be recorded.

11.1.4.4 Test schedule

The following series of tests shall be performed twice, initially with the test liquid alone, and then repeated with water present at depths of 10 %, 50 % and 90 % of the sensors effective length. This series shall be repeated for each liquid for which the sensor system is to be qualified:

11.1.4.4.1	Environmental temperature:	- 20 °C [- 40 °C]
	Metered pump rate:	10 l/h
	Maximum response time:	30 min
11.1.4.4.2	Environmental temperature:	- 20 °C [- 40 °C]
	Metered pump rate:	50 l/h
	Maximum response time:	6 min
11.1.4.4.3	Environmental temperature:	+ 20 °C [+ 40 °C]
	Metered pump rate:	10 l/h
	Maximum response time:	30 min

11.1.4.4.4	Environmental temperature:	+ 20 °C [+ 40 °C]
	Metered pump rate:	50 l/h
	Maximum response time:	6 min
11.1.4.4.5	Environmental temperature:	+ 60 °C
	Metered pump rate:	10 l/h
	Maximum response time:	30 min
11.1.4.4.6	Environmental temperature:	+ 60 °C
	Metered pump rate:	50 l/h
	Maximum response time:	6 min

Where the freezing point of the liquid for qualification is above - 25 °C [- 45 °C], tests 11.1.4.4.1 and 11.1.4.4.2 shall be conducted at a temperature equal to the freezing point plus 5 K.

Where the flash point of the liquid for qualification is below + 70 °C, tests 11.1.4.4.5 and 11.1.4.4.6 shall be conducted at a temperature equal to the flash point minus 10 K.

11.1.5 Test report

For each test in the schedule for a particular liquid, the measured response times shall be compared to the relevant criteria, listed in 11.1.2 to determine whether the test has been passed or failed. If any criterion in any test is not met, or if at any time a leak is indicated when no liquid is present (other than during the recovery time) the sensor system shall be deemed to have failed the test, and shall not be qualified for use with that liquid. Any such a failure will not prevent qualification for use with any other liquid for which the test is passed. The worst case response and recovery time for any of the series of tests shall be recorded.

11.1.6 Sensor marking

Each sensor shall carry the following markings:

— approved liquids – for which the sensor has been tested;

— response time – worst case from any test for each of the approved liquids;

— recovery time – worst case from any test for each of the approved liquids.

Alternatively, the sensor shall be marked with a reference to a specification incorporating the same information.

11.2 Discriminating liquid sensors for detection of thin films of stored product on water

11.2.1 Test objective

The aim of the test is to verify the suitability of a sensor system to detect the presence of stored product as a thin film floating on water in the monitored area, where the level of water in the monitored area may vary. Tests shall be performed to verify:

— that the worst response time of the sensor system to detect the presence of a film 0,5 mm thick of the stored product floating on water is less than 6 h.

— that the sensor can be quickly recovered, manually reset and reinstalled following its removal of the stored product, or that the recovery time of the sensor system from a stored product-indicating condition following its removal from the presence of the stored product does not exceed 20 h.

A sensor system shall be qualified for use with each type of liquid that it shall be required to detect. Where possible, tests shall be performed using these actual liquids, however where significant hazards may result, a less harmful test liquid may be used having similar chemical and physical properties. For example, a substitute for petroleum spirit would be petroleum naphtha (an aliphatic petroleum distillate).

11.2.2 Evaluation

The sensor shall be of a size such that it can be installed in a monitoring well or other housing having an internal diameter of 100 mm, and shall be capable of fulfilling its function when the level of liquid in the monitoring well or other housing varies by 500 mm. Tests shall be deemed to have been passed where:

— the presence of the stored product is not indicated when no stored product is present;

— the presence of a film 0,5 mm thick of stored product floating on water is detected within 6 h of its introduction;

— the sensor has to have a measurable recovery time after removal of the stored product, or be easily accessible for recovery, on-site manual resetting and reinstallation in which case an alarm condition shall be continue to be indicated until the reset has been effected. If a measurable recovery time is applicable it shall be achieved within a maximum of 20 h following removal of the stored product.

These criteria shall be satisfied at a temperature of (+ 10 ± 2) °C.

11.2.3 Test equipment

A test vessel in the form of a flat-bottomed vertical cylinder, having a horizontal cross-sectional area of (0,1 ± 0,002) m^2 (i. e. a liquid depth of 0,01 m corresponds to a volume of 1 l) and a minimum depth of 0,6 m. One or more fittings flush with the inside surface of the vessel shall be provided in the floor of the vessel for introduction of liquids but are not used in this test, shall be plugged during its duration. A similar fitting shall be provided having a drain cock capable of emptying the vessel at a rate of 5 l/min.

Suitable quantities of each stored product with which the sensor system shall be tested.

An environmental chamber the temperature of which can be varied over the range from 0°C to +20°C with an accuracy of 2 K.

A time-elapsed recorder having a time indication in steps of 1 min to a minimum total of 24 h which can be connected to the sensor system's leak indicating device and which will record the elapsed time from introduction of the film of stored product onto the water to that time when the leak indicating device indicates its presence.

A stop clock having a time indication in steps of 1 s to a minimum total of 24 h, with an accuracy of 2 s.

A pipette or similar device permitting the accurate measurement and dispensing of 50 ml of stored product.

11.2.4 Test method

11.2.4.1 Preparation

The test vessel shall be mounted inside the environmental chamber and shall be filled with water to an appropriate depth. The sensor under test shall then be installed in its normal orientation in relation to the water's surface. Wherever possible the manufacturer's fittings should be used for this purpose. The sensor under test shall be then connected to the leak indicating device which shall be mounted, connected to the time-elapsed recorder, outside the environmental chamber in ambient laboratory conditions. Power shall be applied to the sensor system which shall then be initialised by means specified in the manufacturer's operating instructions such that the system is fully operational.

11.2.4.2 Stabilisation

Prior to each test to be conducted, and with the sensor system fully operational, the environmental chamber shall be preset to the required test temperature (+ 10 ± 2) °C and shall be allowed to stabilise for 30 min after the internal temperature reaches the prescribed test temperature.

11.2.4.3 Procedure

For each test to be conducted, the following procedure shall be used:

— the leak indicating device shall be checked. If the presence of stored product is indicated the test shall be terminated;

— zero the time-elapsed recorder;

— using a pipette or similar device accurately 50 ml of the stored product shall be measured and this shall be dispensed onto the water's surface close to the sensor in the test vessel so that it spreads out to form a thin film on the water's surface;

— the time-elapsed recorder shall be started;

— the time-elapsed recorder shall be stopped at the moment when the leak indicating device first indicates the presence of the film of stored product on the water's surface. This measured response time shall be recorded;

— if a measurable recovery time is applicable, zero the stop clock;

— the test vessel drain cock shall be opened, or the syphon shall be started;

— at the moment when the vessel is empty of liquid, the stop clock shall be started;

— at the moment when the leak indicating device indicates the absence of liquid, by the means specified in the manufacturer's instructions, or if a period of 20 h is exceeded, the stop clock shall be stopped;

— the stop clock elapsed time (measured recovery time) shall be recorded.

11.2.4.4 Test schedule

The test of the sensor system shall be made with the water depth at the level of the midpoint of the sensor's effective length and also at points 10 % of the sensor's effective length from each extremity of its effective length. The test shall be performed twice.

11.2.4.5 Test report

The results for each test in the schedule for a particular liquid shall be compared with the criteria listed in 11.2.2. and if any of the measured response times were not achieved within 6 h, or if at any time the presence of stored product is indicated when no stored product is present (other than during the permitted recovery time, if applicable) or if the permitted maximum recovery time of 20 h is exceeded, the sensor system shall be deemed to be unsuitable for use with the stored liquid concerned. Any such failure will not prevent qualification for use for any other liquid for which the test is passed.

11.2.5 Sensor marking

Each sensor shall carry the following markings:

— approved liquids – for which the sensor has been tested;

— response time – worst case from any test for each of the approved liquids;

— recovery time – worst case from any test for each of the approved liquids.

Alternatively, the sensor shall be marked with a reference to a specification incorporating the same information.

12 Type test of vapour sense

12.1 Test objective

The aim of the test is to assess the suitability of a sensor system for detecting the ingress of vapour from a stored product into an area, which is free of such vapour in the absence of any leak from the primary storage system. Tests shall be performed to verify:

— the lower limit of detection of the concentration of a test gas representative of the vapour of a specific liquid or class of liquids.

— the response time of the sensor system in indicating the presence of a test gas concentration at the lower limit of detection.

— the recovery time of the sensor system from a vapour-indicating condition following its removal from the presence of a test gas.

A sensor system shall be qualified for use with each type of liquid whose vapour it shall be required to detect. Where possible, tests shall be performed using representative compounds whose phase at normal laboratory temperatures is gaseous. For example, substitutes for petroleum spirit vapour would be the hydrocarbon compounds Toluene or Methyl butane.

12.2 Evaluation

Tests shall be intended to determine the following parameters:

— lower detection limit - a measure of minimum test gas concentration that the sensor system will reliably detect;

— response time - the elapsed time from the sensor's first contact with the test gas to a stable output indication;

— recovery time - the elapsed time from removal of the sensor from contact with the test gas to a stable output indication.

In order for the sensor system to be qualified for use with a stored product of which the test gas is representative, it shall exhibit a lower detection limit less than or equal to the volume fraction of 1×10^{-3} with a response time of less than 24 h. The sensors shall have a recovery time of 24 h or less.

For the purpose of these tests, systems are considered to be qualitative, if a two-state output indication is available i.e. only the presence or absence of vapour is detected. Any quantitative system which shall be tested (i.e. one capable of the continuous measurement of concentration) shall have the facility to preset an "alarm" threshold at a given concentration in order to provide a qualitative output.

12.3 Test equipment

The following test equipment shall be required, assembled according to Figure 1:

— A test chamber which shall be gas-tight and manufactured from materials which are inert with respect to test gases. The following fittings shall be provided:

  — test atmosphere inlet;

  — test atmosphere vent;

  — vapour sensor connection;

  — temperature sensor connection.

The volume of the test chamber should be as small as is compatible with correct operation of the sensor under test, for example a pipe work manifold or the space within pipe work unions could be utilised.

— All fittings, glands and interconnecting pipes shall be constructed from materials which are inert with respect to test gases in order to avoid cross-contamination.

— Suitable quantities of each test gas, factory mixed with air to gas standard concentrations certified accurate to 2 % and supplied in compressed gas cylinders having pressure regulator fittings.

— Suitable quantities of air, having a volume fraction of less than $0,5 \times 10^{-6}$ of any test gas content and supplied in compressed gas cylinders having pressure regulator fittings.

— Two dual-stage regulators with stainless steel diaphragm and a working range from 0 Pa to 100 kPa (0 bar to 1 bar) minimum.

— Five gas flow meters having a minimum range from 0 l/min to 0,5 l/min.

— Four flow-controlling needle valves (may be integral to flowmeter)

— A temperature sensor, such as a thermocouple or platinum resistance thermometer, with temperature readout, accurate to within 1 K over a minimum range from + 5 °C to + 35 °C.

— A relative pressure manometer having a minimum working range from 2,5 kPa (25 mbar) with an accuracy of 5 %.

— A stop clock having a time indication in steps of 1 s to a minimum total of 24 h, within an accuracy of 2 s.

Four gas standard concentrations typically shall be required with a volume fraction of:

— $(5 \pm 2) \times 10^{-6}$

— $(50 \pm 5) \times 10^{-6}$

— $500 \pm 10) \times 10^{-6}$

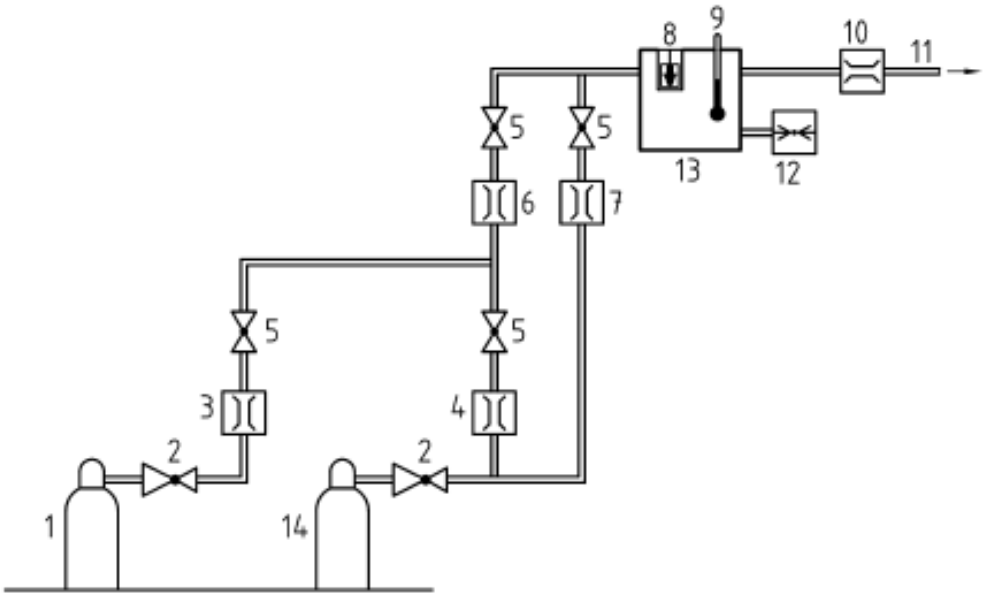
— $(1000 \pm 50) \times 10^{-6}$

These may be diluted with air to give the ten required test gas concentrations, as shown in Table 1:

Table 1 — Test gas concentrations

Test gas number	Test gas concentration volume fraction $x 10^{-6}$	Gas standard concentration volume fraction $x 10^{-6}$	Dilution with air %
1	1,25	5	75
2	2,5	5	50
3	5	5	0
4	12,5	50	75
5	25	50	50
6	50	50	0
7	125	500	75
8	250	500	50
9	500	500	0
10	1 000	1 000	0

The required dilutions are achieved by setting the valves shown in Figure 1 such that the flow rates indicated in gas flowmeter 1 to 4, expressed as a proportion of the total required flow rate, are as given in Table 2:



Key

1 bottle with test gas
2 pressure reducer
3 measuring instrument for volume flow 1
4 measuring instrument for volume flow 2
5 valve
6 measuring instrument for volume flow 3
7 measuring instrument for volume flow 4
8 test sensor
9 thermometer
10 measuring instrument for volume flow 5
11 exhausting line
12 measuring device for pressure
13 test vessel
14 bottle with air

Figure 1 — Test equipment

Table 2 — Flowmeter dilution ratios

Dilution %	Flowmeter 1	Flowmeter 2	Flowmeter 3	Flowmeter 4
75	0,25	0,25	0,5	0,5
50	0,5	0,5	1	0
0	1	0	1	0

12.4 Test method

12.4.1 Preparation

The sensor under test shall sealed into the test chamber so as to be fixed in its normal orientation. The manufacturer's fittings should be used wherever possible. The sensor under test shall be connected to the leak indicating device under test in accordance with the manufacturer's instructions.

Power shall applied to the sensor system which shall then initialised by means specified in the manufacturer's operating instructions such that the system is fully operational. The entire apparatus shall be left in ambient laboratory conditions for a period of at least 2 h, with the sensor system fully operational, to allow temperature equalisation.

12.4.2 Temperature and pressure monitoring

All tests shall be conducted at (+ 15 ± 10) °C. The test chamber temperature sensor shall be monitored continuously throughout testing. The results of any test during which this temperature varies by more that 3 K about the initial ambient value shall be discarded, and the test repeated.

Tests shall be conducted at a constant test chamber internal pressure, maintained by equalising inlet and vent flow rates. The test chamber pressure shall be monitored continuously, using the manometer, throughout each test. The results of any test during which this pressure varies by more than 50 Pa (0,5 mbar) shall be discarded, and the test repeated.

12.4.3 Procedure

For the purposes of this procedure, a "steady state reading" shall be taken to mean that the output indication does not change state during a one-minute period.

Prior to testing, the test chamber shall be purged via the introduction of ultra-high purity air at a rate of 0,2 l/min for a period of 4 min, or until the leak indicating device shows a steady state reading, whichever is the longer.

For each test to be conducted, the following procedure shall be used:

— Zero the stop clock;

— the compressed gas cylinder for the appropriate test gas shall be connected to the pressure regulator. The required mixture of gas and ultra-high purity air shall be introduced into the chamber such that a steady flow rate of 0,2 l/min is produced through the test chamber vent;

— at the moment the flow rate is steady, the stop clock shall be started;

— the leak indicating shall be monitored until a steady state reading (indicating the presence of vapour) is achieved, or until twice the manufacturer's stated maximum response time is exceeded, or until 24 h have elapsed, whichever is the shortest. The stop clock shall be stopped;

— the stop clock elapsed time shall be recorded (measured response time) and whether the presence of vapour was indicated;

— the flow of test gas shall be shut off and zero the stop clock;

— the chamber via the introduction of ultra-high purity air shall be purged, such that a steady flow rate of 0,2 l/min is produced through the test chamber vent;

— at the moment when the vent flow rate is steady, the stop clock shall be started;

— the leak indicating device shall be monitored until a steady state reading (indicating the absence of vapour) is achieved, or until twice the manufacturer's stated maximum recovery time is exceeded, or until 24 h have elapsed, whichever is the shortest. The stop clock shall be read;

— the stop clock elapsed time (measured recovery time) shall be recorded and whether the absence of vapour was indicated;

— if the measured recovery time is less than 4 min, continue purging until a 4 min period has elapsed;

— the flow of ultra-high purity air shall be shut off.

12.4.4 Test schedule

The test shall be performed twice. The objective of the test schedule shall be to identify the minimum test gas concentration which can be detected reliably. This shall be taken to be the lowest of the ten compositions from Table 1 which can be detected with no failures in six repeated tests.

Where a manufacturer's lower detection limit is specified, or is known from previous testing, the first test shall be conducted using a concentration from Table 1 which shall be less than half of the specified limit. Where no manufacturer's limit is specified, testing shall begin using test gas number 1.

The procedure in 12.4.3 shall be carried out repeatedly using each test composition in turn in ascending order. Up to six tests shall be conducted at each concentration. If in any test the presence of vapour is not detected, the remaining repetitions at that concentration shall be abandoned, and a new set of six tests shall begun with the appropriate increase in gas concentration.

When all six tests using a particular test gas, x, result in the detection of vapour, one further set of six tests shall be carried out using test gas $x + 1$. If these six tests all result in the detection of vapour, the six tests using test gas x shall be repeated. If six positive detections are again recorded, the lower limit of detection is given by concentration x. If any of the tests results in a failure to detect, the lower limit of detection shall be concentration $x + 1$.

Should any failure to detect vapour be recorded using test gas $x + 1$, testing of each composition in turn shall be resumed using test gas $x + 2$. Should any test using test gas 10 result in a failure to detect, the lower limit of detection shall be indeterminate.

Should six positive detections be recorded for the first time using test gas 10, the "$x + 1$" tests shall not be carried out, but a further six tests using test gas 10 shall be conducted, all of which shall record positive results if the lower limit of detection shall be classified as the concentration of test gas 10. Otherwise, the lower limit of detection shall be indeterminate.

12.5 Test report

The result of tests under the following three conditions shall be reported:

— the lower limit of detection which can be detected reliably (i.e. in six tests out of six) using a test gas concentration less than or equal to a volume fraction of 1×10^{-6};

— the worst case response time recorded in any test at the lower limit of detection;

— the worst case recovery time recorded in any test at the lower limit of detection.

If at any time the presence of vapour is indicated when no test gas is present (other than during the recovery time) the sensor system shall not be qualified for use with the liquid of which the test gas is representative. Any such failure will not prevent qualification for use with any other liquid.

The test report shall state the lower detection limit, response time and the recovery time (as defined above) for each liquid with which the sensor is deemed to be qualified.

12.6 Sensor marking

Each sensor shall carry the following markings:

— approved liquids – for which the sensor has been tested;

— lower detection limit – for each approved liquid;

— response time – worst case from any test in any test gas;

— recovery time – worst case from any test in any test gas.

Sensors which are not tests according to clause 13 shall be marked "not suitable for submersion in water".

Alternatively, the sensor shall be marked with a reference to a specification incorporating the same information.

13 Type test of submerged vapour sensors

13.1 Test objective

The aim of the test is to verify the suitability of a vapour sensor to give an alarm on submersion in water. Tests shall be performed to verify:

— the response time of the vapour sensor system in indicating the presence of water where the water level is rising at a given rate;

— the recovery time of the sensor system from a water-indicating condition following its removal from the presence of water.

This test is only necessary where the risk that the sensor will be submerged in water exists.

13.2 Evaluation

Tests shall be deemed to have been passed where:

— the presence of water is not indicated when no water is present;

— the presence of water is indicated within 30 min after water is first introduced into the test system at the rate of 10 l/h;

— the presence of water is indicated within 6 min after water is first introduced into the test system at the rate of 50 l/h;

— the sensor has a measurable recovery time of max 20 h after removal of the water.

These criteria shall be satisfied over the range of environmental conditions specified in the test in 13.4.

13.3 Test equipment

A test vessel in the form of a flat-bottomed vertical cylinder, having a horizontal cross-sectional area of (0,1 ± 0,002) m^2 (i. e. a water depth of 0,01 m corresponds to a volume of 1 l) and a minimum depth of 0,6 m. One or more fittings flush with the inside surface of the vessel shall be provided in the floor of the vessel for the introduction of water. A similar fitting shall be provided having a drain cock capable of emptying the vessel at a rate of 5 l/min.

Suitable quantities of water.

A calibrated metering pump (with a reservoir of minimum 6 l capacity) capable of delivering water into the test vessel, at the rates specified in 13.2, with an accuracy of 2 %.

A stop clock having a time indication in steps of 1 s to a minimum total of 24 h, with an accuracy of 2 s.

13.4 Test method

13.4.1 Preparation

The vapour sensor under test shall be fixed in its normal orientation ensuring contact with the floor of the test vessel but away from any ports for the entry or extraction of water. The manufacturer's fittings should be used wherever possible. The sensor under test shall be connected to the leak indicating device, which shall be mounted in ambient laboratory conditions.

Prior to the series of tests the metering pump reservoir shall be charged with water.

Power shall be applied to the vapour sensor system, which shall be then initialised by means specified in the manufacturer's operating instructions to obtain fully operational conditions.

13.4.2 Procedure

For each test to be conducted, the following procedure shall be used:

— the leak indicating device shall be checked. If the presence of water is indicated, the test shall be terminated;

— the metering pump shall be set to the specified pumping rate;

— zero the stop-clock;

— the metering pump shall be started;

— at the moment water starts to flow from the inlet fitting into the test vessel, the stop clock shall be started;

— at the moment when the leak indicating device first indicates the presence of water, by means specified in the manufacturer's instructions, or if the maximum response time is exceeded the stop clock and the metering pump shall be stopped;

— the stop-clock elapsed time (measured response time) shall be recorded;

— zero the stop clock;

— the test vessel drain cock shall be opened;

— at the moment the vessel is empty of water the stop clock shall be started;

— at the moment the leak indicating device indicates the absence of water, by means specified in the manufacturer's instructions, or if a period of 20 h is exceeded the stop-clock shall be stopped;

— the stop-clock elapsed time (measured recovery time) shall be recorded.

13.4.3 Test schedule

13.4.2.1 The following series of tests shall be performed twice:

13.4.3.2

Temperature:	+ 15 °C ± 10 °C
Metered pump rate:	10 l/h
Maximum response time:	30 min

13.4.3.3 Temperature: + 15 °C ± 10 °C

Metered pump rate: 50 l/h

Maximum response time: 6 min

13.5 Test result

For each test in the schedule the measured response times shall be compared to the relevant criteria listed in 13.2 to determine whether the test has been passed or failed. If any criterion in any test is not met or if at any time water is indicated when no water is present (other than during the recovery time) the vapour sensor system shall be deemed to have failed the test. The recovery time shall be stated.

For information regarding the development of standards contact:

Asociación Española de Normalización
Génova, 6
28004 MADRID-España
Tel.: 915 294 900
info@une.org
www.une.org

For information regarding the sale and distribution:

AENOR INTERNACIONAL S.A.U.
Tel.: 914 326 160
normas@aenor.com
www.aenor.com

Spanish standardization body in:

COMPLETE MAINTENANCE OF ATMOSPHERIC DEPOSITOS

Pol. Ind. Alberic C/ Labradores Parc. 106 46260 Alberic VALENCIA Tfn: 962 443 646 Fax: 962 443 648

- **RE: LEAK DETECTION SYSTEMS IN THE INTERSTITIAL SPACE**

- I, José Luis Folgado García with DNI 20794319L, technical director and CEO of the RAFIBRA, L. S., Company, with N.I.F. B-46673711, located in Alberic, Valencia (Spain),

- **I HEREBY CERTIFY:**

- That the RAFIBRA RDP system complies with all the specifications of rule UNE-EN 13160-2 dated December 2003, prepared by the EUROPEAN RULE COMMITEE, with respect to the interstitial space that allows the installation of the LEAK DETECTION SYSTEMS IN THE INTERSTITIAL SPACE and, part 2: PRESSURE AND DRY SYSTEMS.

- In compliance with all the technical requirements of the manufacturers, as well as the technical requirement of their equipment with respect to pressure and dry interstitial space leak detection system.

- This certification is issued to whom it may concern.

Cordially yours,

José Luis Folgado García
Tecnical Director of RAFIBRA, S.L.

Documentation

Pressure Leak Detector DL ..

Please read instructions prior to commencing any work

As of: 09/2021

Item no.: 603022

Design Variations

DL pressure leak detectors are available in different versions that are described more precisely by the suffix characters. The levels of availability and the possible combinations depend on the device. Please contact our sales team: +49 271 48964-0, sgb@sgb.de

DL .. ELC P FC M 8S

Up to 8 leak detection probes can be connected to the leak detector to monitor access chambers, sumps, etc.

"Manometer": The leak detector is equipped with a digital pressure indicator in the housing cover.

"Filter Control": The leak detector is equipped with a dry filter monitoring system which issues a separate signal when the dry material has been used up.

"Protected": Leak detector version in a weather-protected housing (stainless steel).

"Economic Leak Control": Combined leak detector and indicating unit. The leak detector is equipped with an integrated manifold for connecting up to 6 tanks.

As this version is always weather-protected, the "P" is omitted.

".." = Numerical value which stands for the alarm pressure of the leak detector. The alarm pressures range from 50 mbar to 3000 mbar.

"Pressure leak detector": The leak detector operates with overpressure towards the atmosphere.

Table of Contents

1. General

1.1 Information

These instructions provide important notes on using the DL leak detector. The prerequisite for workplace safety is the adherence to all safety and handling instructions specified in this manual.

Furthermore, any local regulations for prevention of accidents applicable at the site of use of the leak detector and general safety instructions must be complied with.

1.2 Explanation of Symbols

In these instructions, warnings are marked with the adjacent symbol.

The signal word expresses the level of hazard.

DANGER:
Imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING:
Potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION:
Potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

INFORMATION:
Highlights useful tips, recommendations, and information.

1.3 Limitation of Liability

All information and instructions in this documentation have been compiled considering the applicable standards and regulations, the state of the art, and our longstanding experience.

SGB does not assume any liability in the case of:

- Noncompliance with these instructions
- Improper use
- Use by unqualified personnel
- Unauthorized modifications
- Connection to systems not approved by SGB

1.4 Copyright

1.5 Warranty Conditions

We provide warranty for the DL leak detector for a period of 24 months from the day of installation on site in accordance with our General Terms & Conditions.

The maximum warranty period is 27 months from our date of sale.

Warranty is subject to submission of the functional/test report on initial commissioning by qualified personnel.
The serial number of the leak detector must be stated.

The obligation of warranty shall cease to exist in case of
- inadequate or improper installation
- unintended use
- modifications/repair works without the manufacturer's consent.

Our warranty does not include parts, which may be perished premature due to their consistence or category of usage (e.g. pumps, valves, gaskets, etc.). Furthermore, we are not liable for defects or corrosion damages caused by humid or inappropriate installation environments.

1.6 Customer Service

Our customer service is available for any inquiries.

For information on contacts please refer to our website www.sqb.de/en or the label of the leak detector.

2. Safety

2.1 Intended Use

- Pressure leak detector for double-walled containers, where pressure is maintained via a pump.
- Connection of interstitial spaces **only in the case of below-ground** interstitial spaces.
- Components that can generate explosive vapors must be contained within double-walled containers, tubs, or surface sealings whose medium-side walls are permeation-tight.

Note/exclusion: If a permeation into the interstitial space that can lead to formation of an explosive atmosphere in the interstitial space occurs due to the stored material and the material composition of the inside container walls (e.g., in the case of double-walled GRP tanks), the DL leak detector must NOT be used.
The DLG leak detector can be used as an alternative in this case. Please familiarize yourself with this version!

- The alarm pressure must be at least 30 mbar higher than any pressure against the interstitial space (from inside and/or outside).
- Grounding (if applicable) in accordance with applicable regulations[1].
- The leak detection system is leak-proof according to the table in section 7.3.5 of this documentation.
- Leak detector installed outside of the explosive area.
- Lead-throughs for the pneumatic hoses are sealed gas-tight.
- Leak detector (electric) cannot be turned off.

CAUTION: The device may not be adequately protected if it is not used as specified by the manufacturer.

2.2 Obligation of the Operating Company

WARNING!
Danger in case of incomplete documentation

The DL leak detector is used in a commercial environment. The operating company is therefore subject to statutory occupational safety obligations.

In addition to the safety instructions in this documentation, all applicable safety, accident prevention, and environmental regulations must be adhered to. In particular:

- Compiling a risk assessment and implementing its results in a directive
- Performing regular checks as to whether the directive is in compliance with the current standards
- The directive includes information on how to react to an alarm that might arise
- Arranging for an annual functional check

[1] For example, in accordance with EN 1127

2.3 Qualification

WARNING!

Danger to humans and the environment in the case of inadequate qualification

The personnel must be capable of independently recognizing and avoiding potential risks based on their qualifications.

Companies commissioning leak detectors should have completed relevant training with SGB, through SGB, or through its authorized representative.

National guidelines must be adhered to.

For Germany:
Technical service qualification for mounting, commissioning, and maintenance of leak detection systems.

2.4 Personal Protective Equipment (PPE)

Personal protective equipment must be worn during work.

- Wear the necessary protective equipment for the work in question
- Note and comply with on-site PPE signs

Entry in the "Safety Book"

Wear HV vest

Wear safety footwear

Wear hard hat

Wear gloves – where necessary

Wear safety goggles – where necessary

2.4.1 Personal protective equipment for systems that may be subject to risk of explosion

The points listed here refer exclusively to safety when working with systems that may be subject to risk of explosion.

If work is performed in areas in which an explosive atmosphere must be expected, the minimum required equipment is as follows:

- Suitable clothing (risk of electrostatic charge)
- Suitable tools (in accordance with EN 1127)

- Suitable combustible gas indicator calibrated to the existing vapor-air mixture (work should be performed only at a concentration of 50 % below the lower explosion limit[2])
- Measuring equipment to determine the oxygen content of the air (Ex/O meter)

2.5 Fundamental Hazards

DANGER

From electric current

When working on the leak detector, it must be disconnected from the power supply unless stated otherwise in the documentation.

Comply with relevant regulations regarding electrical installation, explosion protection (e.g., EN 60 079-17), if necessary, and accident prevention.

DANGER

From explosive vapor-air mixtures

Ensure there is no gas present prior to performing work

Comply with explosion regulations, e.g., German Ordinance on Industrial Safety and Health (Betriebssicherheitsverordnung, BetrSichV) (and/or directive 1999/92/EC and the laws of the respective member states resulting therefrom) and/or others.

DANGER

From working in chambers

The leak detectors are mounted outside the access chambers. Pneumatic connection is usually performed inside the access chamber. Therefore, the chamber must be entered in order to complete the mounting process.

Before entering, the appropriate protective measures should be taken. Ensure no gas is present and that sufficient oxygen is available.

[2] Other countries' or companies' regulations may provide different percentages.

3. Technical Data

3.1 General Data

3.1.1 DL 50 to DL 450 and DL 330 P

Dimensions and drilling pattern		see Appendix, section 12.1
Weight		2.3 kg
Storage temperature range		-40°C to +70°C
Operating temperature range		0°C to +40°C
- DL 330 P version		-20°C to +50°C
Max. height[3]		≤ 2000 m above sea level
Max. relative humidity[3]		95 %
Buzzer volume		>70 dB(A) at a distance of 1 m
Housing protection class,	plastic stainless steel	IP 30 IP 66

3.1.2 DL 590 to DL 3000 and DL 50 PM to DL 3000 PM

Dimensions and drilling pattern		see Appendix, section 12.1
Weight		2.7 kg
Storage temperature range		-40°C to +70°C
Operating temperature range		0°C to +40°C
- DL .. PM version		-40°C to +60°C
Max. height[3]		≤ 2000 m above sea level
Max. relative humidity[3]		95 %
Buzzer volume		>70 dB(A) at a distance of 1 m
Housing protection class,	plastic stainless steel	IP 30 IP 66

3.2 Electrical Data

3.2.1 DL 50 to DL 450 and DL 330 P

Power supply	230 V, 50 Hz
Supply tolerance (network)	± 10 %
Input capacity (without external signal)	50 W
Terminals 5, 6, external signal	230 V, 50 Hz, max. 200 VA min. 20 mA
Terminals 11, 12 (potential-free)	max. 230 V, 50 Hz, 3 A min. 6 V/10 mA
External fuse for leak detector **Note**: Acts as a separating point for the device and should be attached as close as possible.	max. 10 A
Overvoltage category	2
Degree of soiling	PD2

[3] For safe operation

3.2.2 DL 590 to DL 3000 and DL 50 PM to DL 3000 PM

Power supply	100 to 240 V, 50/60 Hz
optional:	24 V DC
Input capacity (without external signal)	50 W
Terminals 5, 6, external signal	24 V DC; max. 300 mA
Terminals 11…13 (potential-free)	DC≤ 25 W or AC≤ 50 VA
Terminals 17…19 (potential-free)	DC≤ 25 W or AC≤ 50 VA
External fuse for leak detector	max. 10 A
Note: Acts as a separating point for the device and should be attached as close as possible.	
Overvoltage category	2
Degree of soiling	PD2

3.3 Pneumatic Data (Requirements for Measuring Gauge)

Nominal size	min. 100
Class precision	min. 1.6
End scale value	suitable

3.4 Data for applications that fall under the Pressure Equipment Directive (PED) in case of an error

Note: The leak detector, installation kits, and manifolds are pressure accessories without a safety function.

Volume	Leak detector DL ..	0,05 liter
	Leak detector DL .. P	0,04 liter
	Manifold 2…8	0,02…0,08 liter
Max. operating pressure		see Chap. 3.5, col. p_{PA}

3.5 Switching Values

Type DL	p_{TS} [mbar]	p_{AE} [mbar]	p_{PA} [mbar]	P_{0DV1}[4] [mbar]	$p_{PRÜF}$ [mbar]
50	20	> 50	< 100	170 ± 20	≥ 200
100	70	> 100	< 150	220 ± 20	≥ 250
230*	200	> 230	< 310	360 ± 10	≥ 400
280**	250	> 280	< 330	360 ± 10	≥ 400
290	260	> 290	< 350	420 ± 20	≥ 450
325**	300	> 325	< 360	385 ± 10	≥ 400
330	300	> 330	< 410	465 ± 20	≥ 500
400	370	> 400	< 500	565 ± 20	≥ 600
450	420	> 450	< 510	565 ± 20	≥ 600
590	560	> 590	< 700	770 ± 30	≥ 850
750	720	> 750	< 850	940 ± 30	≥ 1000
1000	970	> 1000	< 1400	1590 ± 50	≥ 1750
1100	1070	> 1100	< 1450	1650 ± 70	≥ 1820
1500	1450	> 1500	< 1900	2100 ± 50	≥ 2350
2000	1950	> 2000	< 2400	2650 ± 50	≥ 3000
2300	2250	> 2300	< 2770	3100 ± 100	≥ 3500
2500	2450	> 2500	< 2900	3200 ± 50	≥ 3550
3000	2950	> 3000	< 3400	3750 ± 50	≥ 4150
	Special switching values agreed to by SGB and customers				

The following abbreviations are used in the table:

p_{TS} Maximum pressure on the tank floor, incl. overburden pressure

p_{AE} Switching value "Alarm ON"; the alarm will be triggered at this pressure level at the latest

p_{PA} Switching value "Pump OFF" (= operating pressure)

p_{0DV1} Opening pressure for overpressure valve 1 (interstitial space)

$p_{PRÜF}$ Minimum test pressure of the interstitial space

* added to the table at a later date

** only for below-ground containers; values were added to the table at a later date

Supplement to the table:

p_{AA} Switching value "Alarm OFF"; the alarm will be deactivated if this value is exceeded
The switching value "Alarm OFF" is approx. 15 mbar higher than the switching value "Alarm ON" for pressure levels < 1000 and approx. 100 mbar higher for pressure levels > 1000
(p_{AA} = p_{AE} + ~15 mbar (pressure levels < 1000) ~ 100 mbar (pressure levels > 1000))

p_{PE} Switching value "Pump ON"
The switching value "Refilling ON" is approx. 15 mbar lower than the switching value "Refilling OFF" for pressure levels < 1000 and approx. 100 mbar lower for pressure levels > 1000.
(p_{PE} = p_{PA} - ~15 mbar (pressure levels < 1000) ~ 100 mbar (pressure levels > 1000))

[4] The table lists the opening pressure for overpressure protection at which the volume flow of the pump is diverted. The operating pressure (initial opening) is lower.

3.6 Field of Application

3.6.1 Interstitial space requirements

- Proof of pressure resistance of the interstitial space (see section 3.5 Switching Values, column "p_{PROOF}" minimum test pressure of the interstitial space)
- Proof of suitability of the interstitial space (for Germany: proof of usability from construction authority)
- Sufficient passage in the interstitial space
- Tightness of the interstitial space according to this documentation
- The number of interstitial spaces of **below-ground containers** to be monitored depends on the total interstitial space volume. According to EN 13160, 8 m³ may not be exceeded. To make it possible to test the tightness of the interstitial space, it is recommended not to exceed 4 m³.

3.6.2 Containers/interstitial spaces

- Below-ground and above-ground double-walled steel or plastic containers, without leak detection liquid in the interstitial space, in factory or on-site production design, whose interstitial space is suitable for connection of a DL .. in accordance with section 3.5.
- Below-ground and above-ground single-walled steel or plastic containers with pressure-resistant leak protection lining or leak protecting jacket, whose interstitial space is suitable for connection of a DL .. in accordance with section 3.5.
- Double-walled collecting tubs or surface sealings, whose interstitial space is suitable for connection of a DL .. in accordance with section 3.5.

3.6.3 Stored material

Water-hazardous liquids, with consideration given to the following points:

- The leak detection medium (air) must not react with the stored material.
- Vapor-air mixtures, arising from
  - the stored liquid,
  - the stored liquid combined with air/humidity or condensation,
  - the stored liquid combined with components (materials) with which the liquid comes into contact

  must be classifiable in gas group II A and II B as well as in temperature code T1 to T3.

  Attention must be paid to the permeation tightness of the inner wall.

4. Design and Function

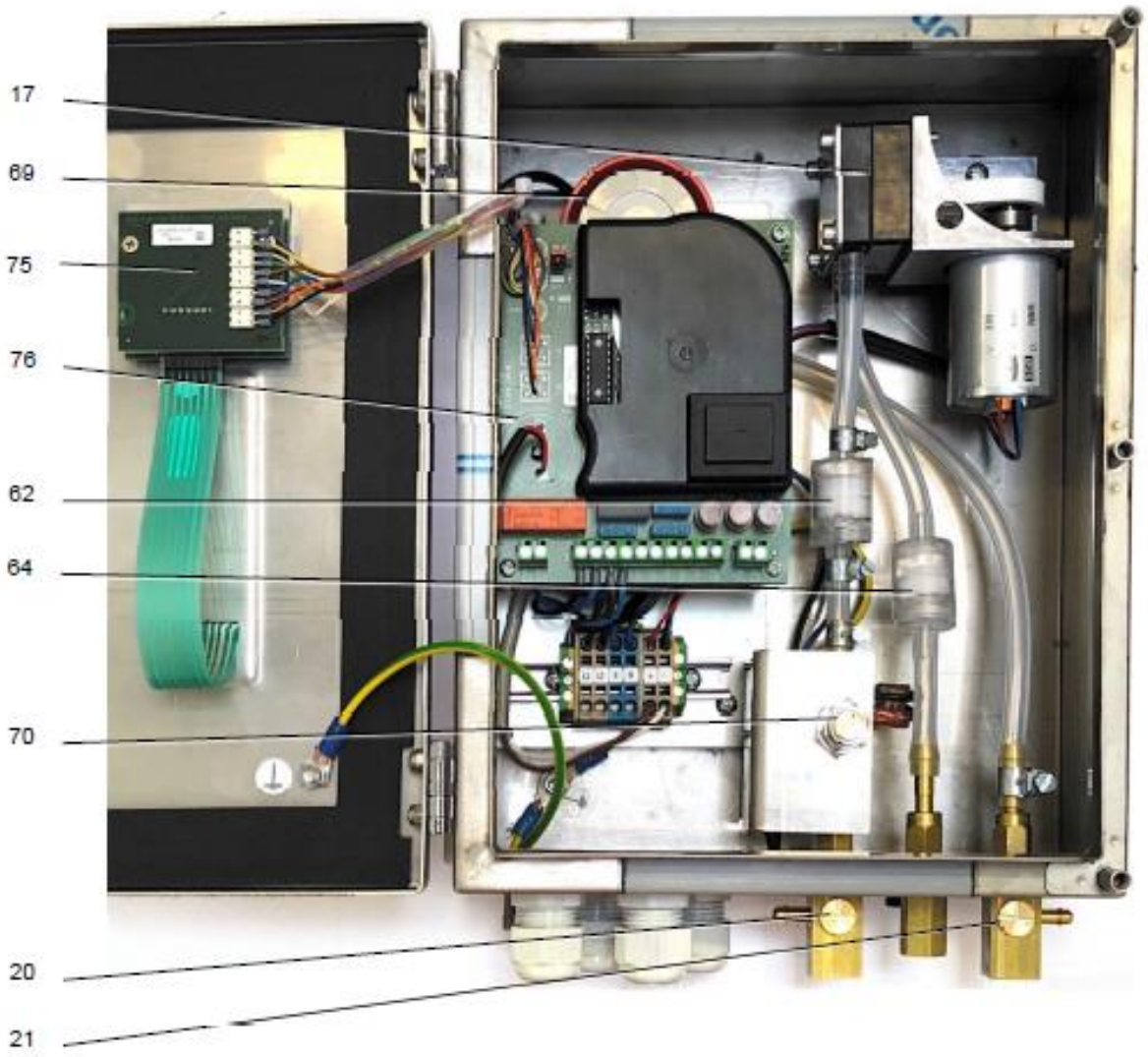
4.1 System Design

4.1.1 Plastic housing

Interior view with:

01	Signal lamp "alarm", red
09	Signal lamp "operation", green (white)
17	Overpressure pump
20	Three-way valve in the pressure line
21	Three-way valve in the measuring line
62	Check valve
64	Dust filter
69	Buzzer
70	Overpressure valve (interstitial space)
71	"Mute" button
76	Main board
140	Contact for serial data transfer

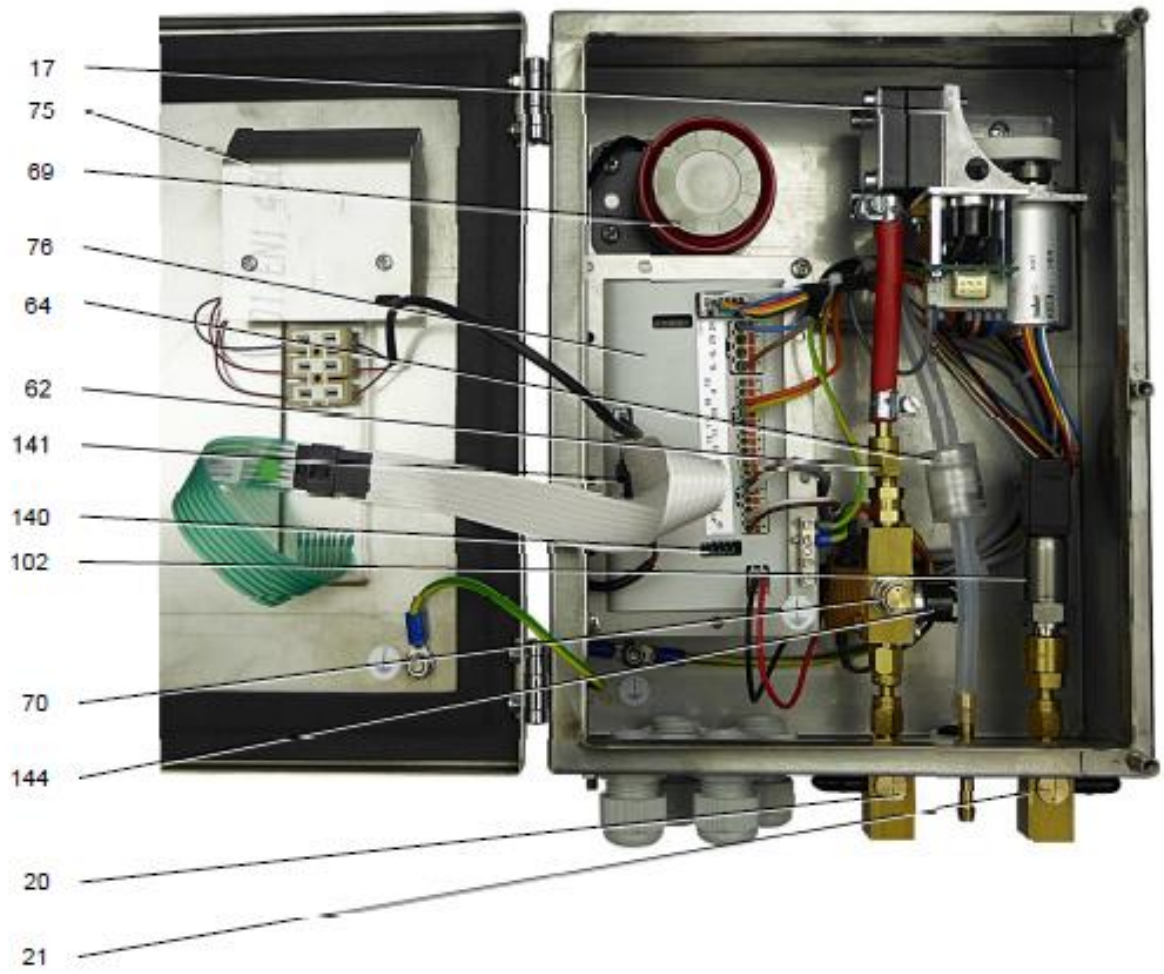
4.1.2 Stainless steel housing for DL 330 P



Interior view with:

17	Overpressure pump
20	Three-way valve in the pressure line
21	Three-way valve in the measuring line
62	Check valve
64	Dust filter
69	Buzzer
70	Overpressure valve
75	Display board
76	Main board

4.1.3 Stainless steel housing for DL 50 PM to DL 3000 PM



Interior view with:

17	Overpressure pump
20	Three-way valve in the pressure line
21	Three-way valve in the measuring line
62	Check valve
64	Dust filter
69	Buzzer
70	Overpressure valve
75	Display board
76	Main board
102	Pressure sensor
140	Contact for serial data transfer
141	Keypad terminal strip
144	Temperature switch, frost protection

The DL .. pressure leak detector monitors both walls of a container for leaks. The monitoring pressure is so high that leaks are displayed below or above the liquid level (stored material and groundwater) due to pressure drops.

To build pressure, an integrated pump takes in external air through a dry filter and forwards it to the interstitial space.

The dry filter will dry the external air to a relative humidity of approximately 10 %. Drying is necessary to prevent moisture or condensation accumulation in the interstitial space. Used dry filter fillings must be regenerated or exchanged.

Note for devices with an alarm pressure > 590:

- Values of less than 50 mbar or less than 0.73 PSI will not be displayed.
- Values between 50 and 999 mbar will be displayed in mbar without any decimal places.
- Values from 1 bar are displayed in bar with two decimals and from 10 bar with one decimal.

Values in PSI are displayed with one or two decimals.

4.2 Normal Operating Condition

The pressure leak detector is connected with the interstitial space(s) via the pressure and measuring lines. The overpressure generated by the pressure generator is measured and controlled by a pressure sensor.

When the operating pressure is reached (Refilling OFF), the pressure generator shuts off. The pressure drops off slowly due to unavoidable leaks in the leak detector system. When the "Refilling ON" switching value is reached, the pressure generator will be turned on and the operating pressure will be built up again.

Under normal operating conditions, the leak detector will move between these two pressure values, with short run times and longer idle times, depending on the degree of impermeability and temperature variations of the overall system.

4.3 Function in Case of Leaks

If a leak occurs below or above the liquid level or groundwater, leak detection medium seeps out of the interstitial space. The pressure will fall until the pressure generator is turned on to reestablish the operating pressure. If the volume flow exiting the leak is larger than the refilling output, the pressure in the system will fall even though the pressure generator is activated.

An enlargement of the leak will lead to a further drop in pressure until the alarm pressure is reached. This triggers the visual and audible alarms.

4.4 Dry Filter

The air supplied to the interstitial space is fed through a dry filter in the suction line. The dry filter dries the air to about 10 % relative humidity to avoid corrosion and condensation accumulation[5] in the interstitial space.

The dry filter is designed for one year as long as it is used as intended and no additional temperature variances occur.

A used dry filter, which is orange in the beginning, will become colorless (or green). Exchange or regenerate used drying material immediately.

- For the FC option (FC = Filter Control/dry filter monitoring), see section 4.4.1 Devices with FC

Dry filter for <u>below-ground</u> containers:

TF 180 (the larger dry filters can also be used)

Dry filter for <u>above-ground</u> containers:

Type	Max. volume of the interstitial space with				
	TF 180	TF 200	TF 400	TF 600	TF 1200
DL 50	350	750	1400	2100	4800
DL 100					
DL 230					
DL 290	300	600	1100	1600	3700
DL 330					
DL 400	250	520	1000	1500	3500
DL 450					
DL 590	240	500	900	1350	3000
DL 750					
DL 1000	210	400	750	1150	2600
DL 1100					
DL 1500	150	300	550	800	1850
DL 2000					
DL 2300	130	250	400	700	1600
DL 2500					
DL 3000	110	230	350	600	1400

[5] Condensation accumulations in the interstitial space can result in an impermissible rise in pressure.

4.4.1 Devices with FC (dry filter monitoring)

- Function

There is a sensor installed in the pump suction line, between the pump and the dry filter, which measures the moisture in the air that is drawn in.

The increase in relative humidity when the dry material has been used up is detected by the sensor. In the event of insufficient drying capacity, the visual, audible, and potential-free signals will be triggered.

The signal is indicated visually via alternate flashing of
- the two red alarm indicator lights (up to DL 450), or
- the red and yellow alarm indicator lights (DL 590 and above) The potential-free signal is indicated at terminals 31 to 34:
31/32 Contact opens in the event of a signal
31/34 Contact closes in the event of a signal

- Replacing the dry material

When a "Dry filter used up" signal is triggered, the dry material should be replaced within a reasonable time.

The audible signal can be acknowledged by pressing the key briefly. The visual and potential-free signals will continue.

The whole signal can be acknowledged by pressing the "Acknowledge dry filter signal" key for longer (until the bottom LED flashes). When the pump is next activated (or, if this function is performed while the pump is running, after approx. 30 seconds), the signal will be triggered again if the residual moisture is too high.

Once the dry material has been replaced, the dry filter signal must be acknowledged as described.

- Usage limits

The following usage limits must be observed with regard to the dry filter monitoring system:

1. The pump must run for at least 30 seconds in order to obtain a meaningful measurement. During or after commissioning of the leak detector, the time between pump ON and OFF should be measured to establish whether this minimum run time is achieved.

2. It is not possible to obtain meaningful measurement results at low temperatures (below 5°C). The measurement function is therefore deactivated below 5°C.

4.5 Overpressure Valve

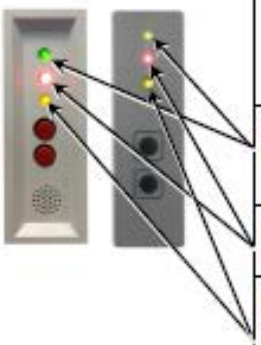
The overpressure valve installed in the pressure line is designed for the protection of the interstitial space against impermissibly high overpressures (exceeding of the test pressure). Impermissibly high overpressures can occur due to:

- Temperature increase resulting from environmental influences (e.g., sunlight)
- Temperature increase resulting from hot filling (absolutely contact the manufacturer!)

The installer/operator must determine whether any further measures are to be taken in consideration of the interstitial space volume.

4.6 Displays and Controls

4.6.1 Display



Indicator light	Operating condition	Alarm condition	Alarm, audible alarm acknowledged	Probe alarm	Probe alarm, acknowledged	Malfunction
OPERATION: green	ON	ON	ON	ON	ON	ON
ALARM: red	OFF	ON	FLASHING	OFF	OFF	ON
LED: yellow (red for DL 50 to 450)				ON	FLASHING	OFF
	Not used or, with FC dry filter monitoring, the yellow and red LEDs flash alternately					

4.6.2 "Turn off audible alarm signal" function

Briefly press "Mute" button once; audible signal turns off, and the red LED flashes.

Pressing the button again will turn the audible signal on.

This function is not available during normal operating conditions and malfunctions.

4.6.3 "Testing the visual and audible alarm signal" function

Press and hold the "Mute" button (for about 10 seconds). The alarm will be triggered until the key is released.

This inquiry is only possible if the pressure in the system has exceeded the "Alarm OFF" pressure.

4.6.4 "Tightness inquiry" function

Press and hold the "Mute" button until the signal lamp "Alarm" starts flashing rapidly, then release it. A value for the tightness is indicated as follows:

a) Without display: The signal lamp "Alarm" will flash between 0 and 10 times, or

b) With display (M): The numerical value will be displayed digitally.

This display disappears after 10 seconds and the current pressure in the system is displayed again.

For the "Tightness inquiry" function, the leak detector must have performed at least 1 automatic refilling interval in normal operating

conditions (i.e., without external filling/evacuation, e.g., by an installation pump) to achieve a valid statement.

This inquiry is recommended before performing a regular functional check of a leak detector. In this way, it is possible to estimate immediately whether it is necessary to look for leaks.

Number of flash signals	Assessment of tightness
0	Very tight
1 to 3	Tight
4 to 6	Sufficiently tight
7 to 8	Maintenance recommended
9 to 10	Maintenance urgently recommended

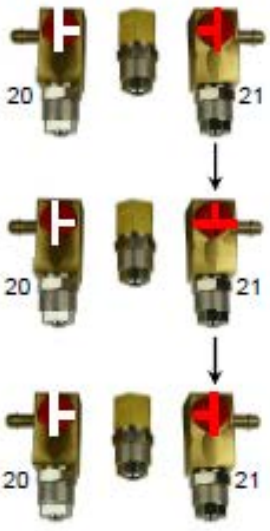
The smaller the above value, the tighter the system. The significance of this value also depends on temperature fluctuations and should thus be considered a reference point.

4.6.5 "Acknowledge dry filter signal" function (only if FC filter monitoring is present)

Briefly press the "Acknowledge dry filter signal" key to shut off the audible signal. The visual signal (alternate flashing of the red and yellow LEDs) continues.

To reset the dry filter signal completely, press and hold the key until an audible signal sounds.

4.6.6 Zero-point adjustment[5]



Turn three-way valve 21 90° clockwise from the operating position. The alarm is triggered and the pump runs.

Press and hold the "Mute" button until the signal lamp "Alarm" starts flashing rapidly (approx. 5 seconds), then release the button and press and release it again.

The zero-point adjustment is confirmed with a visual and audible signal (3x).

Return three-way valve 21 to the operating position.

A repetition of the zero-point adjustment is not possible until the operating pressure has been built up.

[6] Function only available for DL 50 to DL 450

5. Mounting the System

5.1 Basic Instructions

- Prior to commencing work, the documentation must be read and understood. In case of ambiguities, please ask the manufacturer.
- Comply with the safety instructions in this documentation.
- Only qualified service companies may be used for installation[7].
- Comply with relevant regulations for prevention of accidents.
- Comply with explosion regulations (if required), e.g., BetrSichV (and/or Directive 1999/92/EC and the laws of the respective member states resulting therefrom) and/or others.
- Before entering inspection chambers, the oxygen content must be tested and the inspection chamber flushed if necessary.
- If metallic connection lines are used, it must be ensured that the power supply grounding is at the same potential as the tank to be monitored.
- Follow the instructions regarding personal protective equipment (PPE) in sections 2.4 and 2.4.1.

5.2 Leak Detector

(1) Generally mounted on walls with plugs and screws.

(2) In a dry room, or outdoors in a suitable protective box.
Devices with a plastic housing: To allow the ventilation slots to work properly, make sure there is a side clearance of at least 2 cm from other objects and walls.

(3) If mounted in a protective box: additional external signal or alarm forwarding via potential-free contacts to a switchboard or similar device.

(4) **NOT in potentially explosive areas.**

(5) The distance between the leak detector and the interstitial space should be kept to a minimum.

(6) For housing dimensions and drilling patterns, see section 12.1.

(7) Prior to closing the housing lid, make sure that the function of the overpressure valve is not impeded.

5.3 Dry Filter

(1) Near the leak detector, if possible. If the leak detector is installed in the protective box, the dry filter can be installed in the protection box or outdoors.

(2) Fastening with the installation material provided.
TF 180: Vertical with suction opening pointing down

[7] For Germany: Specialist service companies as per German water legislation that also have basic knowledge in the area of fire and explosion protection.

TF 200, 300, 400, 600, 1200: Vertical with suction opening pointing up, beneath the leak detector if possible

(3) Connect the dry filter and the suction port of the leak detector via a PVC hose (or similar).

(4) Turn over the transport lock for the dry filter (ventilation cap).

5.4 Requirements for Pneumatic Connection Lines (Between Leak Detector and Tank)

(1) Metal (generally Cu) or plastic pipes with a pressure resistance at least corresponding to the test pressure in the interstitial space. Also applies to fittings and screwed connections. Note temperature range, especially when using plastic.

(2) Make sure that the correct screw connections and matching threads are used.

(3) Inside clearance: min. 6 mm

(4) A distance of 50 m should not be significantly exceeded, but if this happens: Install pipe/tube with greater inside clearance using appropriate transition pieces.

(5) Color coding:
Measuring line: red
Pressure line: white (or clear)

(6) The full cross section must be maintained. Do not push in or bend[8].

(7) Install metal or plastic pipes that are installed underground or overground exposed on the surface in protective pipes.

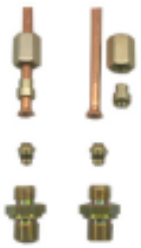
(8) Before connecting cut pipes, deburr and clean them (free of chips).

(9) Seal the protective pipe gas-tight and protect from moisture.

(10) Avoid the buildup of electrostatic charges (e.g., while inserting and pulling lines).

5.5 Completing Pneumatic Connections

5.5.1 Flanged screw connection (for flanged pipes)



(1) Lubricate O-rings

(2) Insert spacer ring loosely into the screw socket

(3) Slide union nut and pressure ring over the pipe

(4) Hand-tighten union nut

(5) Tighten union nut until need for increased force is clearly noticeable

(6) Final assembly: Tighten by another ¼ turn

[8] If necessary, install commercially available fittings for plastic pipes (specified bending radii).

5.5.2 Clamping ring screw connection for metal and plastic pipes

(1) Insert support sleeve into end of the pipe

(2) Insert pipe with support sleeve all the way to the stop

(3) Tighten the screw connection by hand until resistance becomes noticeable, then tighten a further 1 ¾ turns with a wrench

(4) Loosen nut

(5) Tighten the nut by hand up to a noticeable stop

(6) Final assembly of the screw connection by tightening a ¼ turn

5.5.3 Quick screw connections for PA tubing

(1) Cut PA pipe to length at a right angle

(2) Unfasten union nut and slide over the end of the pipe

(3) Slide pipe onto nipple up to the beginning of the thread

(4) Hand-tighten union nut

(5) Wrench-tighten union nut until need for increased force is noticeable (approx. 1 to 2 turns)

5.6 Electrical Connection

(1) Power supply: according to label imprint

(2) Recommended cable type: NYM 3 x 0,75 mm²

(3) Fixed wiring, i.e., no plug or switch connections.

(4) Devices with plastic housing may only be connected with a fixed cable.

(5) Regulations of power supply companies must be adhered to.[9]

Terminal layout for DL 50 to DL 450

1/2 230 V AC power connection

3/4 Occupied (with internal pump)

5/6 External signal (in the event of an alarm there will be a line voltage present; turned off by activating the "Mute" button).

11/12 Potential-free contacts (opened in case of alarm or loss of power)

[9] For Germany: also VDE regulations

Terminal layout for DL 330 P

1/2 230 V AC power connection

3/4 Occupied (with internal pump)

5/6 External signal (in the event of an alarm there will be a line voltage present; turned off by activating the „Mute" button)

11/12 Potential-free contacts (opened in case of alarm or loss of power)

Terminal layout for DL 590 to DL 3000 and DL 50 PM to DL 3000 PM

1/2 100–240 V AC power connection

40/41 24 V DC power connection

3/4 Occupied (with internal pump)

5/6 External signal (24 V DC in case of alarm, can be turned off by activating the "Sound off" key)

11/12 Potential-free contacts (opened in case of alarm or loss of power)

12/13 Potential-free contacts (closed in case of alarm or loss of power)

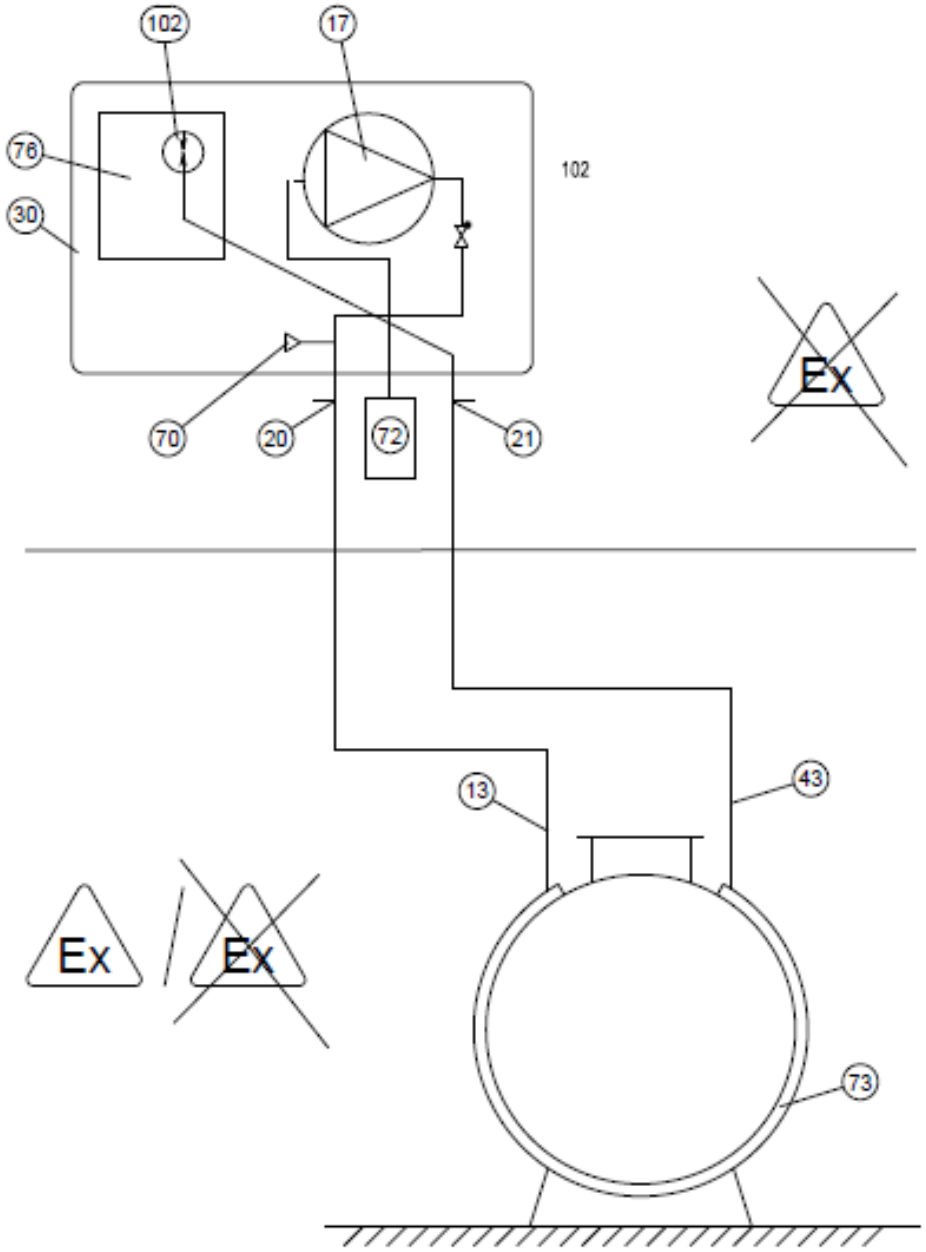
17/18 Potential-free contacts (opened in the event of active refilling)

18/19 Potential-free contacts (closed in the event of active refilling)

21/22 Occupied with internal sensor

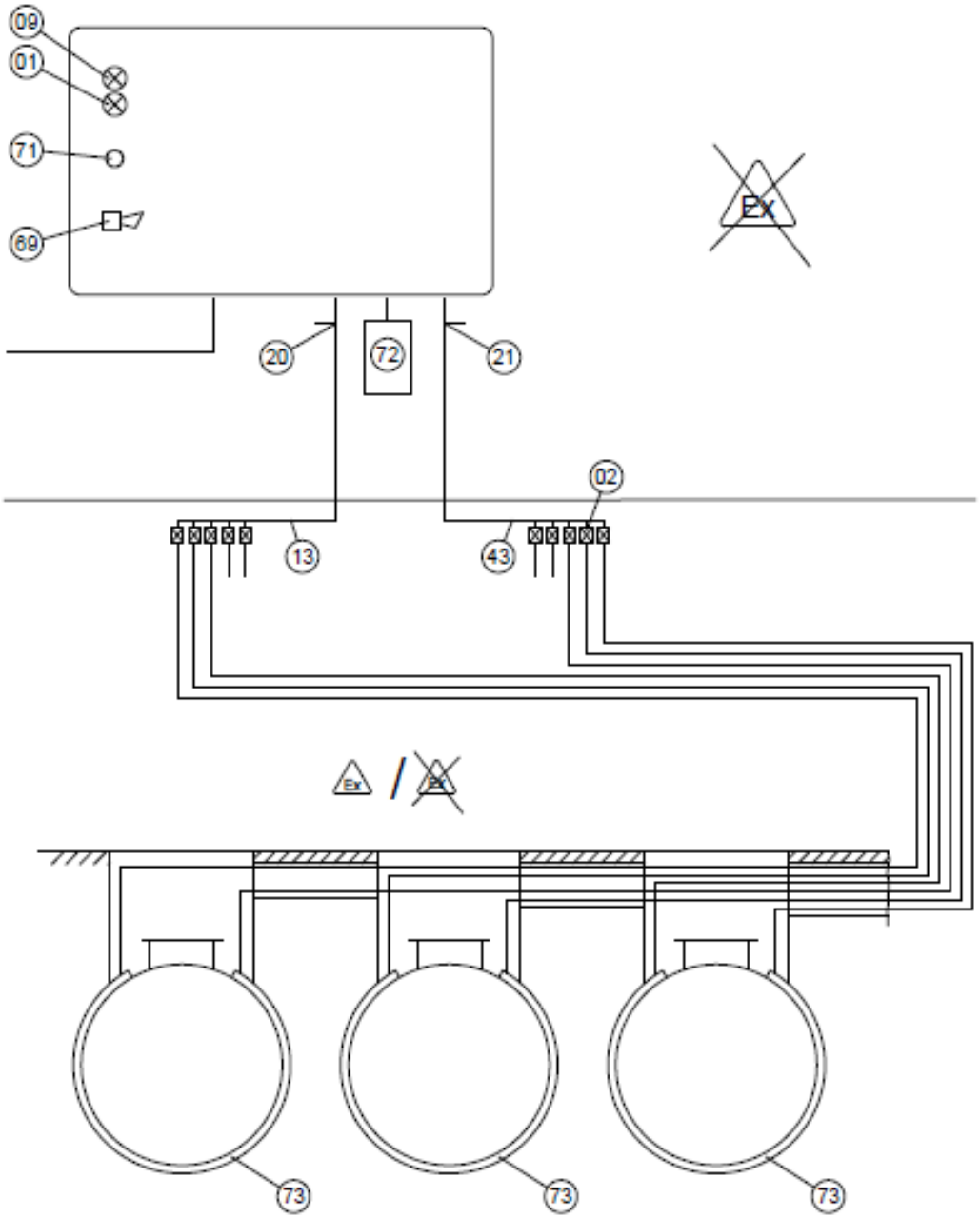
5.7 Installation Examples and Block Diagrams

5.7.1 DL connected to an aboveground container (M1–060 000)



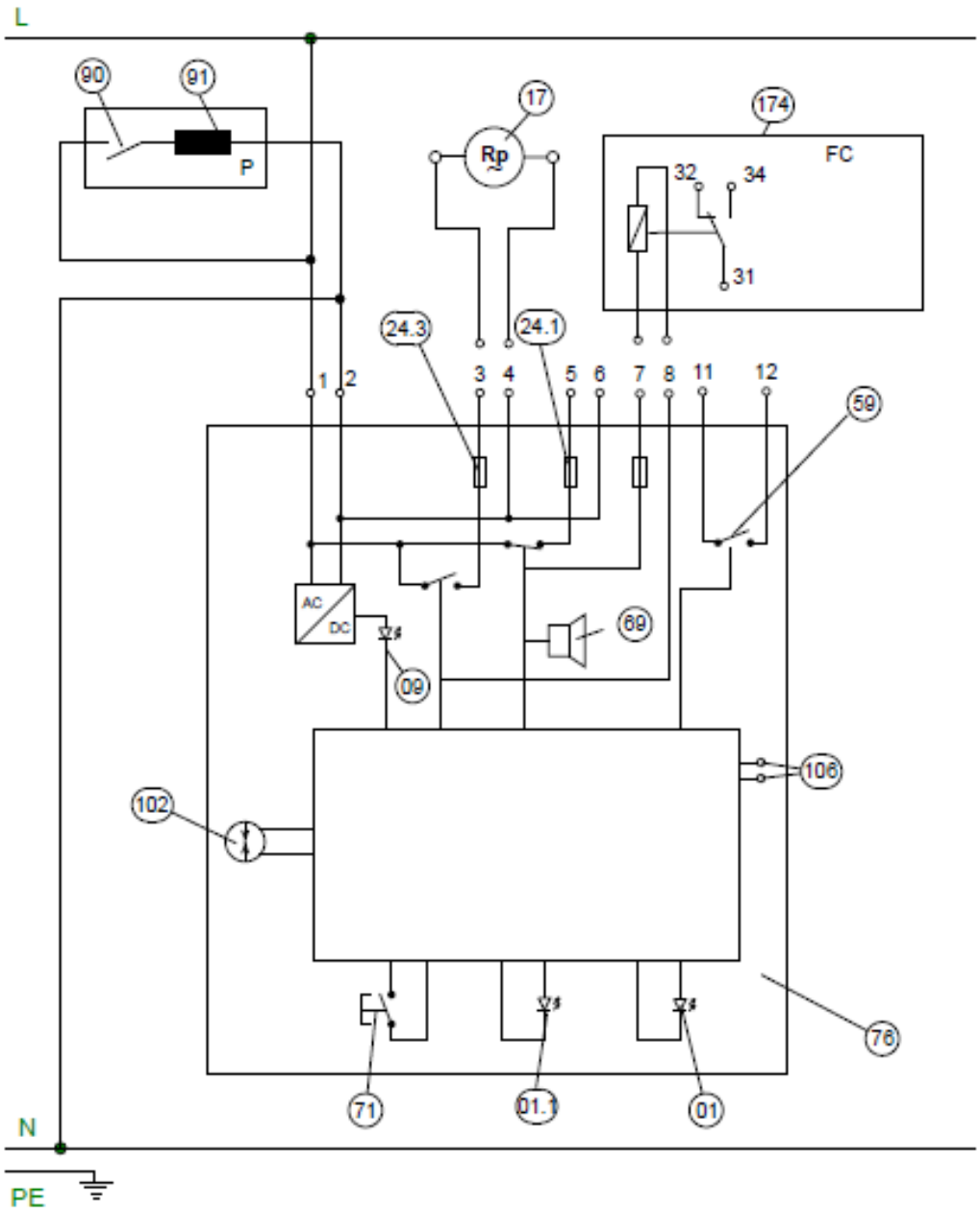
13	Pressure line
17	Overpressure pump
20	Three-way valve in the pressure line
21	Three-way valve in the measuring line
30	Housing
43	Measuring line
70	Overpressure valve
72	Dry filter
73	Interstitial space
76	Main board
102	Pressure sensor

5.7.2 DL connected to multiple below-ground containers via a manifold (M2–060 000)



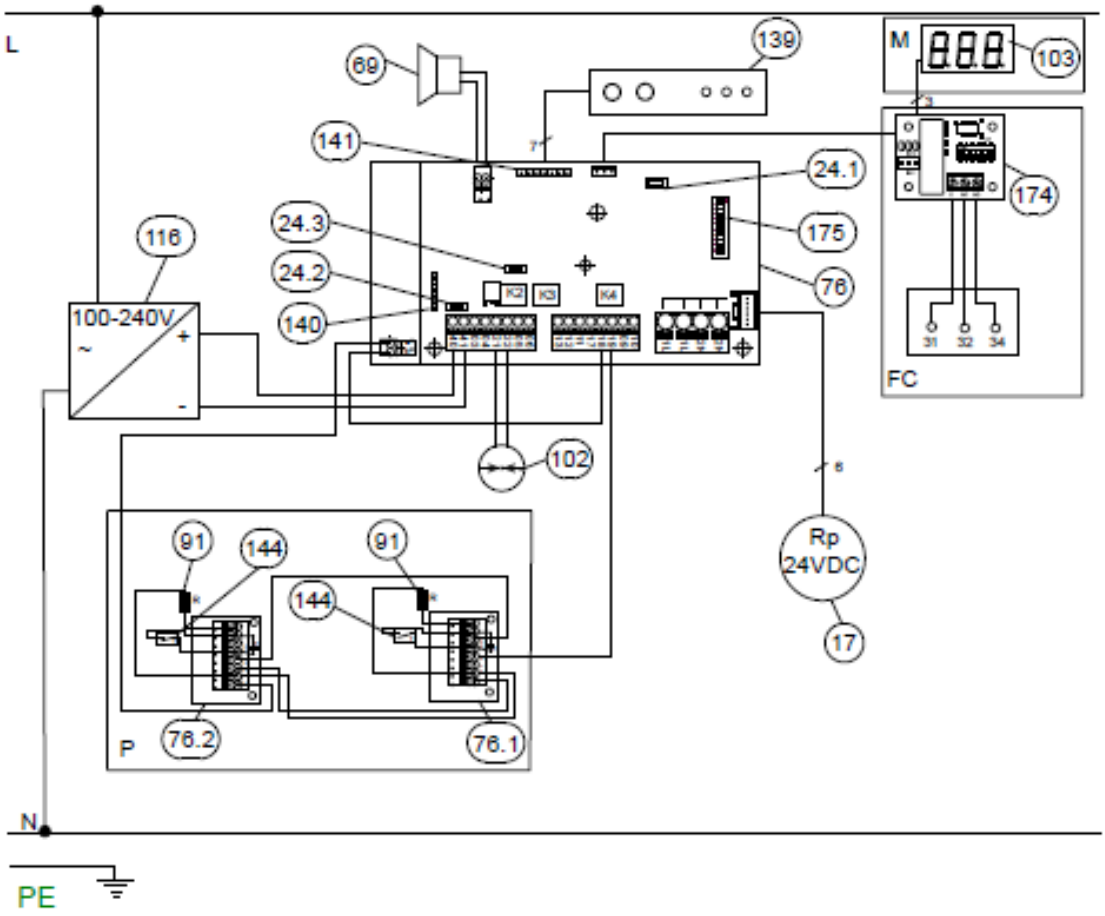
01	Signal lamp "Alarm", red
02	Shut-off valve
09	Signal lamp "Operation", green
13	Pressure line
20	Three-way valve in the pressure line
21	Three-way valve in the measuring line
43	Measuring line
69	Buzzer
71	"Mute" button
72	Dry filter
73	Interstitial space

5.7.3 Block diagram, DL 50 to DL 450 (P, M, and FC are options)



01	Signal lamp "Alarm", red
09	Signal lamp "Operation", green
17	Overpressure pump
24.1	"Power supply" fuse, 2 A
24.3	"External signal" fuse, 1 A
59	Relay
69	Buzzer
71	"Mute" button
76	Main board
102	Pressure sensor
105	Control unit
106	Contact for serial data transfer
174	Circuit board for signal forwarding

5.7.4 Block diagram, DL 590 to DL 3000 (P, M, and FC are options)



01	Signal lamp "Alarm", red
09	Signal lamp "Operation", green
17	Overpressure pump
24.1	"Power supply" fuse, 2 A
24.2	"Solenoid valve" fuse, 1.5 A
24.3	"External signal" fuse, 1 A
45	"Refilling" indicator light, yellow
59.2	Relay
59.3	Relay
59.4	Relay
69	Buzzer
71.1	"Mute" button
71.2	"Dry filter monitoring alarm" key
76	Main board
76.1	"Overpressure valve" heating board
76.2	"Pump" heating board
91	Heating resistor
102	Pressure sensor
103	Display
116	24 V DC power supply unit
139	Keypad
140	Contact for serial data transfer
144	Temperature switch, frost protection
174	Circuit board for signal forwarding

6. Commissioning

(1) Only perform commissioning once the steps in section 5 "Mounting" have been completed.

(2) If a leak detector is placed into operation on a container that is already filled, special protective measures must be taken (for example, testing for the presence of gas in the leak detector and/or the interstitial space). Additional measures may be necessary, depending on the local conditions, and must be assessed by qualified personnel.

6.1 Tightness Test

Prior to commissioning, ensure the leak-tightness of the interstitial space.

In the case of larger interstitial spaces, the pressure build-up should be achieved with the aid of an external pump (use dry filter!) or a nitrogen cylinder (use suitable pressure reducer!).

The test is generally considered to be passed if the overpressure does not drop by more than 1 mbar within a test period (in minutes) calculated from the interstitial space volume divided by 10.
Example: Interstitial space volume = 800 liters
Thus: 800/10 = 80
Thus: Test for 80 minutes for max. 1 mbar pressure drop.

6.2 Commissioning the Leak Detector

(1) Tightness of the interstitial space prior to commissioning is assumed.

(2) After completion of the pneumatic connection, connect the power.

(3) Ascertain lighting of "Operation" and "Alarm" indicator lights and sounding of the audible alarm. Press "Sound off" key.

(4) Turn three-way valve 21 180°.
Connect the measuring gauge.

(5) Apply the operating pressure to the leak detection system according to the "Switching values" table, section 3.4, page 11. (Use the installation pump with sufficiently dimensioned dry filter (!))

(6) Pressure can be built up with the installation pump directly via the pressure line or via three-way valve 20. In this case, turn the valve 90° clockwise.

ⓘ **Note:** If no pressure build-up is achieved with the installation pump connected, the leak must be located and corrected (check the performance of the installation pump as well if necessary).

(7) When the operating pressure of the leak detector has been reached (pump in the leak detector will turn off), reconnect the pressure line. Return both three-way valves to the operating position. Remove the measuring gauge.

(8) Perform a functional check according to section 7.3.

7. Functional Check and Maintenance

7.1 General Information

(1) If the leak detection system has been properly installed and is free of leaks, trouble-free operation can be assumed.

(2) Frequent switching on or continuous running of the pump indicates leaks, which should be corrected within a reasonable time.

(3) In the event of an alarm, determine the cause and fix it quickly.

(4) The leak detector must be disconnected from the power when performing any repairs.

(5) A loss of power is indicated by the "Operation" indicator light going off. Alarm signals are triggered via the potential-free relay contacts (if used for alarm transmission) if contacts 11 and 12 were used.
After the power loss, the green indicator light lights up again and the potential-free contacts no longer generate an alarm (unless the power loss has caused the pressure to drop below the alarm pressure).

(6) At regular intervals, the operating company must
   a) check the function of the signal lamp "Operation"
   b) check consumption of the dry filter. Used material – color change from orange to colorless/green, or from dark blue to pink – needs to be exchanged or regenerated.

(7) Use a dry cloth to clean the leak detector with a plastic housing.

7.2 Maintenance

- Maintenance work and functional checks must be performed by trained personnel only[10]
- Once a year to ensure functional and operational safety
- Test scope according to section 7.3 "Functional check"
- Compliance with the conditions in sections 5 and 6 must also be tested.
- Comply with explosion regulations, if required, e.g., BetrSichV (and/or Directive 1999/92/EC and the laws of the respective member states resulting therefrom) and/or others.

7.3 Functional Check

The functional and operational safety check must be performed:

- After each commissioning
- In accordance with the time intervals listed in section 7.2[11]
- Each time a malfunction has been corrected

[10] For Germany: Technical knowledge regarding installation service leak detection systems or under the supervision of a responsible expert in accordance with currently valid regulations.
[11] For Germany, national regulations must also be observed (e.g., AwSV).

7.3.1 Test scope

(1) Coordinate the work to be performed with those responsible for operation on site, if necessary

(2) Observe the safety instructions for working with the stored material

(3) Regenerating or replacing the filter filling

(4) Checking the free passage of air in the interstitial space (section 7.3.2)

(5) Testing the switching values (section 7.3.3)

(6) Checking the overpressure valve (section 7.3.4)

(7) Tightness test following commissioning or correction of malfunctions (section 7.3.5)

(8) Tightness inquiry at the beginning of the annually recurring functional check (section 7.3.6)

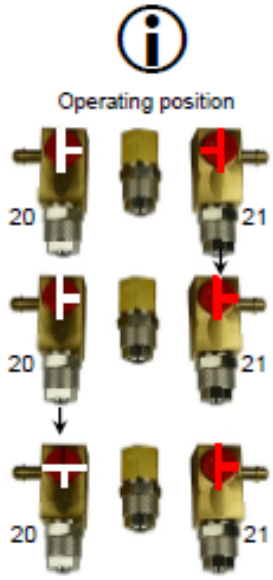
(9) Achieving the operating conditions (section 7.3.7)

(10) A qualified person must complete a test report, confirming functional and operational safety.

7.3.2 Checking the free passage of air in the interstitial space

Checking the free passage of air ensures that an interstitial space is connected to the leak detector and that the interstitial space has sufficient passage to cause an air leak to trigger an alarm.

If several interstitial spaces are connected, each interstitial space must be checked for free passage.



(1) If several interstitial spaces are each connected via a manifold in the pressure and measuring line with a shut-off device, close all shut-off valves on the manifolds.

(2) Attach the measuring gauge to the connection on three-way valve 21 and turn valve 180°.

(3) Turn three-way valve 20 90° clockwise so that the pressure line and interstitial space(s) are ventilated.

(4) Open shut-off valves of the first (following) container (measuring and pressure line in pairs).

(5) Check whether the measuring gauge registers a pressure drop. If no pressure drop occurs, locate and correct the cause.

(6) Close the shut-off valves opened in (4).

(7) Perform procedure in (5) to (7) with each additional container.

(8) Return three-way valves 20 and 21 to the operating position. Remove the measuring gauge.

(9) Open all shut-off valves on the manifolds with a connected container.

7.3.3 Testing the switching values

7.3.3.1 With testing device

(1) Connect the testing device to the free connections on three-way valves 20 and 21. Turn three-way valve 20 90°counterclockwise and three-way valve 21 90° clockwise.

(2) Connect the measuring gauge to the testing device.

(3) Close needle valve (testing device); pressure is built up to operating pressure.

(4) Vent using the needle valve; determine "Pump ON" and "Alarm ON" switching values (visual and audible); record values.

(5) Close the needle valve and determine "Alarm OFF" and "Pump OFF" switching values. Record the values. Open the needle valve a little, if necessary, so that the pressure rises slowly.

(6) Return three-way valves 20 and 21 to the operating position. Remove the testing device.

7.3.3.2 Without testing device

(1) If several containers are connected via a manifold system, close all shut-off valves on the manifold except for the shut-off valves for the container with the smallest interstitial space volume.

(2) Attach the measuring gauge to the connection on three-way valve 21.
Turn both three-way valves 180°.

(3) Vent through three-way valve 20; determine "Pump ON" and "Alarm ON" switching values (with visual and audible alarm) and record values.

(4) Turn three-way valve 20 to the operating position.
Determine "Alarm OFF" and "Pump OFF" switching values.
Record the values.

(5) Turn three-way valve 21 to the operating position.
Remove the measuring gauge.

(6) Open all shut-off valves on the manifold with a connected container.

7.3.4 Testing the overpressure valve

For this test, the operating pressure of the leak detector must be built up.

(1) Turn three-way valve 21 90° clockwise.
The pressure sensor is vented.
The pump switches on and the alarm is triggered.

(2) Turn three-way valve 20 90° counterclockwise.
Attach the measuring gauge to the connection on three-way valve 20.

(3) Determine the opening pressure of the overpressure valve (no further pressure increase), and record the value. If the opening pressure of the overpressure valve exceeds the test pressure of the container, it must be replaced or readjusted.

(4) Turn three-way valve 21 to the operating position.
The pump switches off.
Determine the closing pressure of the overpressure valve (no additional pressure drop[12]).
Record the value.

(5) Return three-way valve 20 to the operating position.
Remove the measuring gauge.

7.3.5 Tightness test following commissioning or correction of malfunctions[13]

(1) Check that all shut-off valves with connected containers are opened.

(2) Turn three-way valve 21 180°.
Connect the measuring gauge to three-way valve 21.

(3) Once the pressure has equalized, start the tightness test.

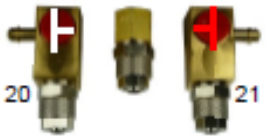
(4) Read off and record starting pressure and time.
Wait for test time to elapse and determine pressure drop.

(5) The test is considered to be passed if the pressure does not drop by more than 1 mbar in the test time.
The test time and allowed pressure drop can be extended or increased proportionally.

The test is positive if the values in the following table are met:

[12] If the pump switches on before the closing pressure is reached, determine the cause and repair it.
[13] Prerequisite: The operating pressure has been built up in the interstitial space and pressure equalization has occurred.

Interstitial space volume in liters	Max. 1 mbar (0.015 psi) pressure drop in
250	22 minutes
500	45 minutes
1000	1.50 hours
1500	2.25 hours
2000	3.00 hours
2500	3.75 hours
3000	4.50 hours
3500	5.25 hours
4000	6.00 hours



(6) Once the test has been completed, return three-way valve 21 to the operating position.
Remove the measuring gauge.

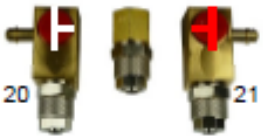
7.3.6 Tightness inquiry at the beginning of the annually recurring functional check

For the "Tightness inquiry" function, the leak detector must have performed at least 1 automatic refilling interval in normal operating conditions (i.e., without external filling/evacuation, e.g., by an installation pump) to achieve a valid statement. This means that point 7.3.6 does not apply to the initial commissioning.

(1) Perform a tightness inquiry (see section 4.6.4).

(2) Evaluate the displayed value (visible on the display for 10 seconds) according to section 4.6.4.

7.3.7 Achieving the operating conditions



(1) Seal the housing of the leak detector.

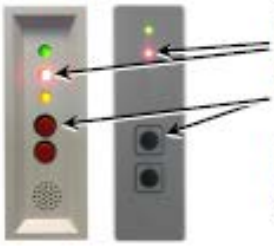
(2) Check that the three-way valves are in the correct position (operating position).

(3) If shut-off valves have been installed in the connection lines, they must be sealed in an opened position (if connected to an interstitial space).

(4) Exchange dry filter or restore original unused condition.

8. Alarm/Malfunction

8.1 Alarm



(1) The red signal lamp lights up, the audible signal sounds.

(2) Turn the audible signal off.

(3) Inform the installation company immediately.

(4) Determine the cause for the alarm, fix it, and then perform a functional check for the leak detection system according to section 7.3.

8.2 Malfunction

In case of a malfunction, only the red signal lamp will light up (yellow is off), and at the same time the audible signal cannot be acknowledged.

8.3 How to Behave

(1) Inform the installation company immediately and state the display from the preceding paragraph.

(2) Determine the cause for the alarm, fix it, and then perform a functional check for the leak detection system according to section 7.3.

9. Spare Parts

See shop.sgb.de/en

10. Accessories

See shop.sgb.de/en

11. Disassembly

11.1 Disassembly

For disassembly of systems which can cause an explosion risk, the following points must be observed in particular:

- Make sure the unit is free of gas before and during removal.
- Seal any openings through which an explosive atmosphere can carry over so they are gas-tight.
- Avoid using spark-producing tools (saws, parting grinders, etc.) for disassembly whenever possible. If this is unavoidable, be certain to observe EN 1127.
- Avoid electrostatic charges (e.g., from rubbing of plastic parts or wearing of unsuitable work clothing).
- Properly dispose of contaminated components (danger of gas release).

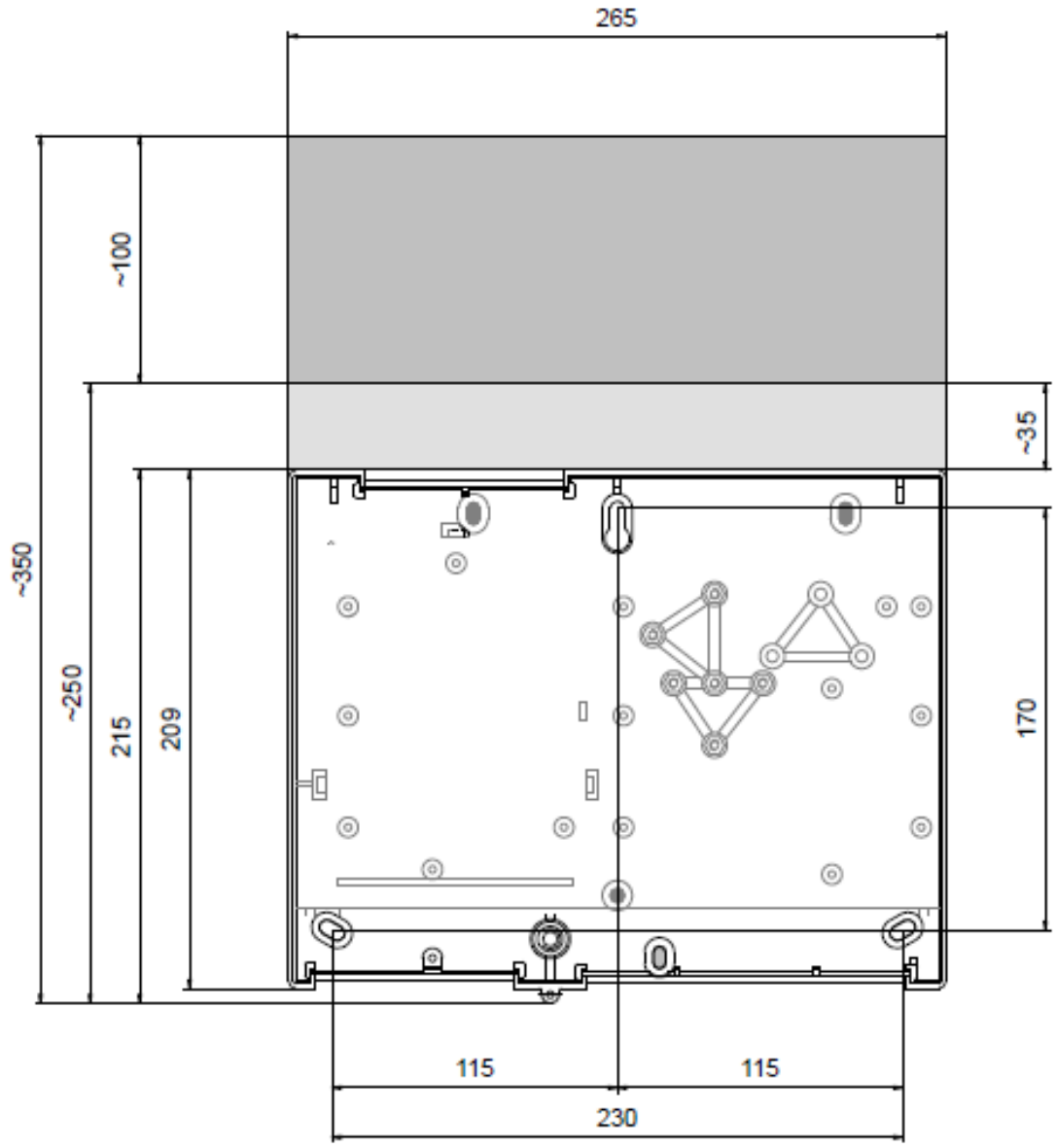
11.2 Disposal

Properly dispose of contaminated components (possibility of gas release). Properly dispose of electronic components.

12. Appendix

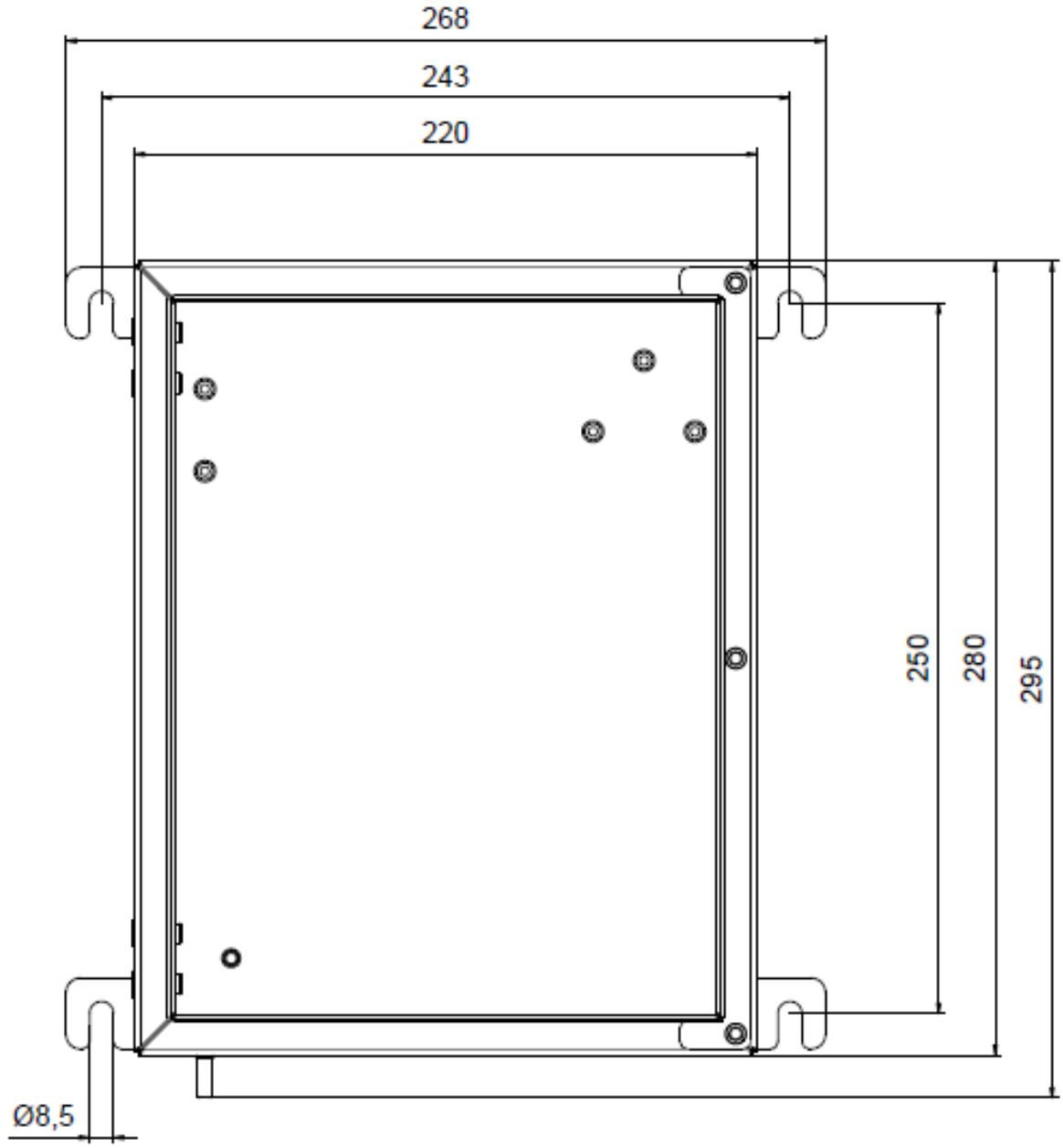
12.1 Dimensions and Drilling Patterns

12.1.1 Plastic housing



Depth = 110 mm

12.1.2 Stainless steel housing, "P" version



Depth = 120 mm

12.2 Version 8S "Leak Detection Probes for Monitoring Access and Monitoring Chambers"

12.2.1 Object

With the 8S version of the DL leak detector, it is possible to connect up to 8 leak detection probes.

The probes have an explosion-proof design and can therefore be mounted in Zone 1 (e.g., in the access chamber). The sensor cable is 1 m long and must be extended in a suitable terminal box. The extension should not be more than 250 m.

The probe will respond to an increase in liquid in the access chamber.

12.2.2 Design and function

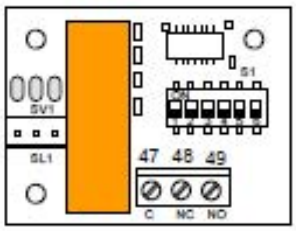
(1) The PCB can only be operated in conjunction with a leak detector and is installed at the manufacturer's factory.

(2) Once the leak detector has been switched on, a green LED lights up to indicate normal operating conditions.

(3) Each connected sensor must be activated via the relevant DIP switch.

If a channel is activated but there is no sensor connected, an alarm will be indicated. If, on the other hand, a sensor is connected and the channel is **not activated**, **nothing** will be indicated!

(4) If an alarm or a malfunction (short circuit, cable break, channel activated and no sensor connected) is detected on one of the probe channels (1 to 8), the red LED will light up.



(5) At the same time, the "probe alarm" will be triggered on the leak detector (see also section 4.6) and the potential-free contacts switch

47	C	(common)
48	NC	(normally closed)
49	NO	(normally open)
47/48	Normal operation: opened; probe alarm: closed	
47/49	Normal operation: closed; probe alarm: opened	

(6) Electrical connection (already completed by the manufacturer)

S+/S- Connection for probe contact on main board
L/N Power connection

(7) Electrical connection of the probes and the potential equalization

S1 to S8 Connection of the leak detection probes (by the customer)
PA Potential equalization, must be connected

12.3 EU Declaration of Conformity

We,

SGB GmbH

Hofstr. 10

57076 Siegen, Germany,

hereby declare in sole responsibility that the leak detector

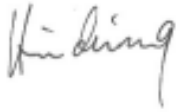
DL ..

is in conformity with the essential requirements of the EU directives listed below.

If the device is modified or used in a way that was not agreed with us, this declaration shall lose its validity.

Number/short title	Satisfied regulations
2014/30/EU EMC Directive	EN 61000-6-3:2012 EN 61000-6-2:2006 EN 61000-3-2:2015 EN 61000-3-3:2014
2014/35/EU Low Voltage Directive	EN 60335-1:2012 / A11:2014 / A13:2017 / A1:2019 / A2:2019 / A14:2019 EN 61010-1:2010 / A1:2019 EN 60730-1:2011
2014/34/EU Equipment for potentially explosive atmospheres	The pneumatic components of the leak detector may be connected to spaces (interstitial spaces of containers) that require category 3 devices (DL and DLG). The following documents have been consulted: EN 1127-1:2019 The ignition hazard assessment did not result in any additional hazards.

Conformity is declared by:



ppa. Martin Hücking
(Technical Director)

As of: 02/2021

12.4 Declaration of Performance (DoP)

Number: 006 EU-BauPVO 2014

1. Unique identification code of the product type:

   Pressure leak detector type DL ..

2. Use:

   Class I pressure leak detector for monitoring double-walled, below-ground or above-ground, pressurized or non-pressurized tanks

3. Manufacturer:

   SGB GmbH, Hofstraße 10, 57076 Siegen, Germany
   Tel.: +49 271 48964-0, e-mail: sgb@sgb.de

4. Authorized representative:

   n/a

5. System for assessment and verification of constancy of performance:

   System 3

6. In case of a declaration of performance for a construction product which is covered by a harmonized standard:

   Harmonized standard: EN 13160-1-2: 2003
   Notified body: TÜV Nord Systems GmbH & Co.KG, CC Tankanlagen, Große Bahnstraße 31, 22525 Hamburg, Germany
   Identification number of the notified testing laboratory: 0045

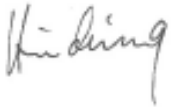
7. Declared performance:

Essential characteristics	Performance	Harmonized standard
Pressure switch points	Passed	EN 13160-2: 2003
Reliability	10,000 cycles	
Pressure test	Passed	
Volume flow rate test in the alarm switch point	Passed	
Function and tightness of the leak detection system	Passed	
Temperature resistance	0°C ... +40°C	

8. Signed for and on behalf of the manufacturer by:

   Dipl.-Ing. M. Hücking, Technical Director

   Siegen, 02/2021



12.5 Declaration of Compliance of the Manufacturer (ÜHP)

Compliance of the leak detector with the Specimen Administrative Provision of the Technical Building Regulations is hereby declared.

Dipl.-Ing. M. Hücking, Technical Director

Siegen, 02/2021

12.6 TÜV-Nord Certifications

Note:
By TÜV not certified translation of the German original version

TÜV NORD Systems GmbH & Co.

PÜZ (testing, supervision and certification) — centre for containers, pipelines and pieces of equipment for systems with substances hazardous to water

Identification number : 0045

Große Bahnstraße 31, 22525 Hamburg
Tel: +49(0)40 8557-0
Fax: +49(0)40 8557-2295
hamburg@tuev-nord.de
www.tuev-nord.de

Certification

Subject of test:	**Overpressure leak detector type DL../DLG..**
Client:	SGB GmbH Hofstraße 10 57076 Siegen
Manufacturer:	SGB GmbH
Type of test:	Initial examination of an overpressure leak detector type DL../DLG.. with leak indicator equipment and leak detector according to DIN EN 13160-1:2003/EN 13160-1:2010 and DIN EN 13160-2:2003 and BRL A, part 1, appendix 15.23 as a class I leak monitoring system
Testing period:	03/2015 to 09/2015
Testing location:	PÜZ testing lab TÜV NORD Systems GmbH & Co. KG
Test results:	**The overpressure leak detector DL../DLG.. corresponds with class I for leak monitoring systems according to DIN EN 13160-1:2003/EN 13160-1:2010 and fulfils the requirements of DIN EN 13160-2:2003 and BRL A, part 1, no. 15.43 with appendix 15.23. Regarding the area of application and installation, the specifications of the technical description "Document 603 000" as of 06/2014 apply**

Details of the test can be found in the test report PÜZ 8112235330 dated 03.09.2015.

Hamburg, 04.09.2015 Test laboratory supervisor

Page 1 of 1

Dated 01/2013
STPÜZ-QMM-321-032-02

Note:
By TÜV not certified translation of the German original version

TÜV NORD Systems GmbH & Co. KG
Manufacturer Certification Competence Center

Grosse Bahnstrasse 31, D-22525 Hamburg Phone: 040 8557-0 Fax: 040 8557-2295 hamburg@tuev-nord.de www.tuev-nord.de

Certificate no. 8117744963-1

Subject of the test:	**Overpressure leak detector type DL.. / DLG..**
Client:	SGB GmbH Hofstrasse 10 57076 Siegen
Manufacturer:	SGB GmbH
Test type:	Type testing of an overpressure leak detector with alarm device, type DL../DLG.. in accordance with EN 13160-2:2016. Classification of the leak detection system as per classifications in accordance with EN 13160-1:2016.
Test object	Leak detector with alarm device, type DL 330, device no. 1911430121
Test period:	02/2020
Test location:	Accredited test laboratory at TÜV NORD Systems GmbH & Co. KG
Test results:	**In the type test, the overpressure leak detector of type DL 330 met the essential characteristics of Table ZA.1 of EN 13160-2:2016 and corresponds to leak detection system class I in accordance with EN 13160-1:2016. The specifications in the technical description "Documentation 603 000" dated 11/2019 apply in relation to the field of application and installation.**

Note: The certificate is only valid in combination with the test report of TÜV NORD test laboratory PB 8117744963-1 dated February 19, 2020. Production inspection is not required in accordance with EN 13160-2:2016.

Hamburg, 2/21/2020

TÜV NORD Systems GmbH & Co. GK
Manufacturer Certification Competence Center

J. Straube

Page 1 of 1

As of 02/2020
STPD2-QMM-321-032-02

Note:
By TÜV not certified translation of the German original version

TÜV NORD Systems GmbH & Co. KG
Accredited test laboratory
Accreditation no.: D-PL-11074-04
Test center identifier: HHA02

Test report no.: 8117607335

Manufacturer:	SGB GmbH Hofstr. 10 57076 Siegen
Test object:	Float switch type CPTL07 (serial no.: 0719002) as category 1 leak detection probe in accordance with EN 13160:2016 Part 4 connected to a leak detector type DL 330 + L in accordance with EN 13160:2016 Part 2
Test date:	November 2019
Test basis:	EN 13160 -4:2016
Test location:	TÜV NORD Systems GmbH & Co. KG test laboratory
Test results:	As a category 1 leak detection probe in accordance with EN 13160:2016 Part 4, the float switch type CPTL07 meets the requirements with regard to reusability, software, and temperature resistance (sections 4.1.4, 4.1.5, 4.2.1 of EN 13160-4:2016). The documentation requirements set out in EN 13160-4 section 5.1.1 are fulfilled.
Note:	The float switch is only to be used in conjunction with a suitable alarm device in accordance with 13160 Part 1. Suitable evidence of the resistance of the float switch is to be provided, e.g. with the aid of the resistance list in EN 12285-1, Annex B. If the float switch comes into contact with the medium, it must be taken out of operation and checked to ensure its integrity before being used again.

The tests only refer to the test object.

The test report may only be published in its full form. The publication of shortened versions or excerpts requires prior written consent from the test laboratory.

This test report comprises 6 pages. Total number of pages: 6

Head of Test Laboratory
Head of Test Laboratory

Hamburg, 2019-12-09

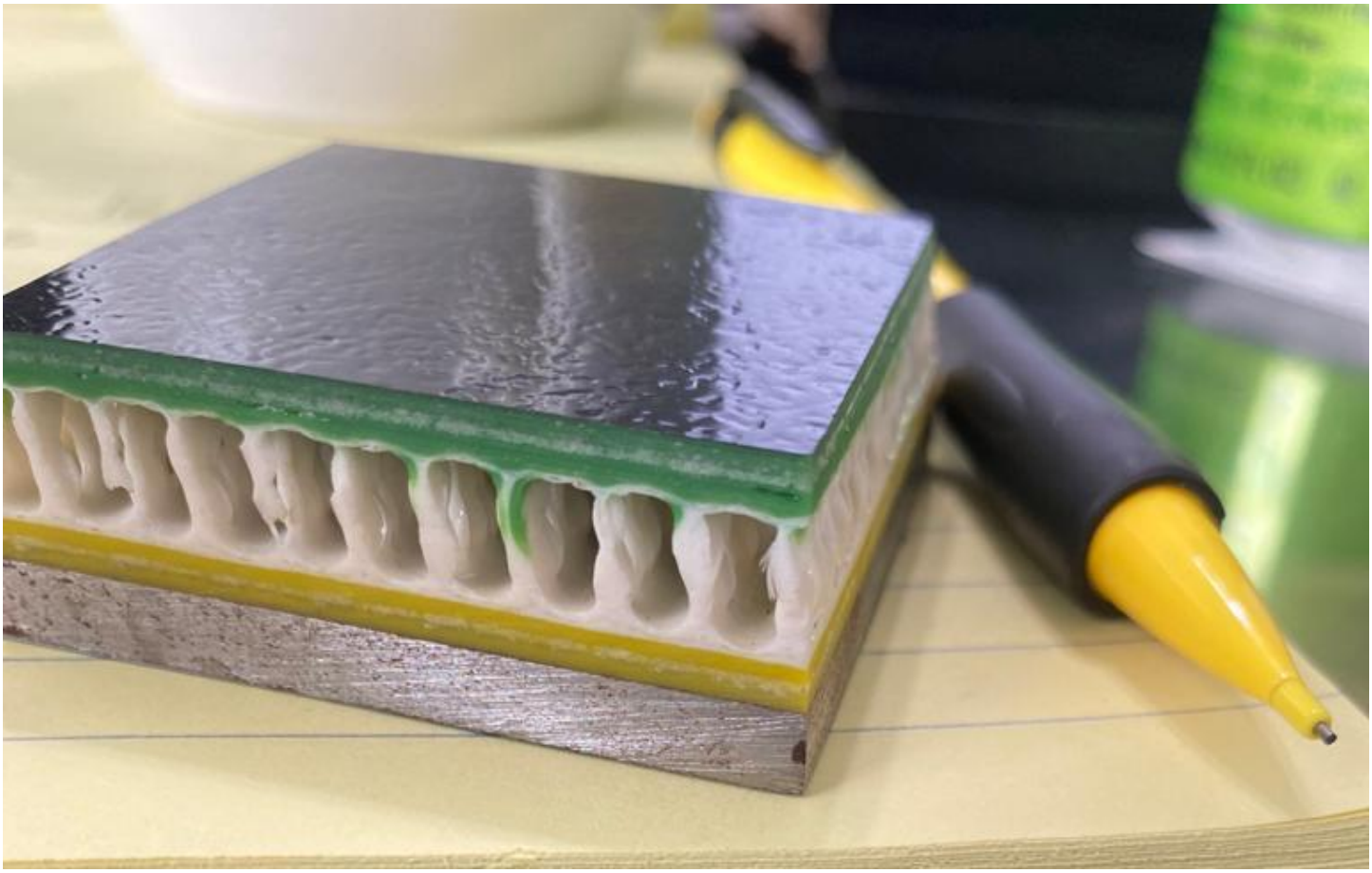
Legal notice

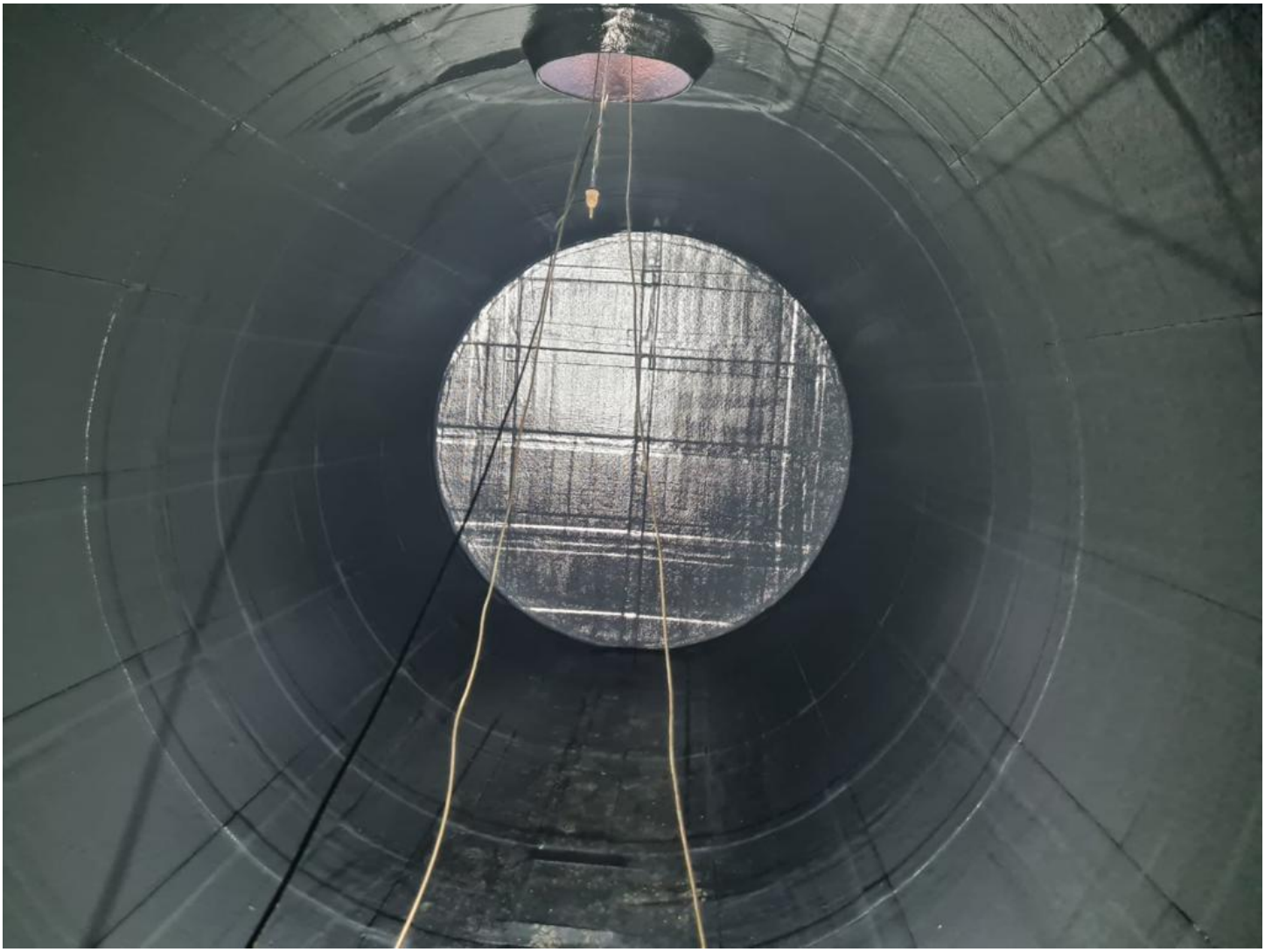
SGB GmbH
Hofstr. 10
57076 Siegen
Germany

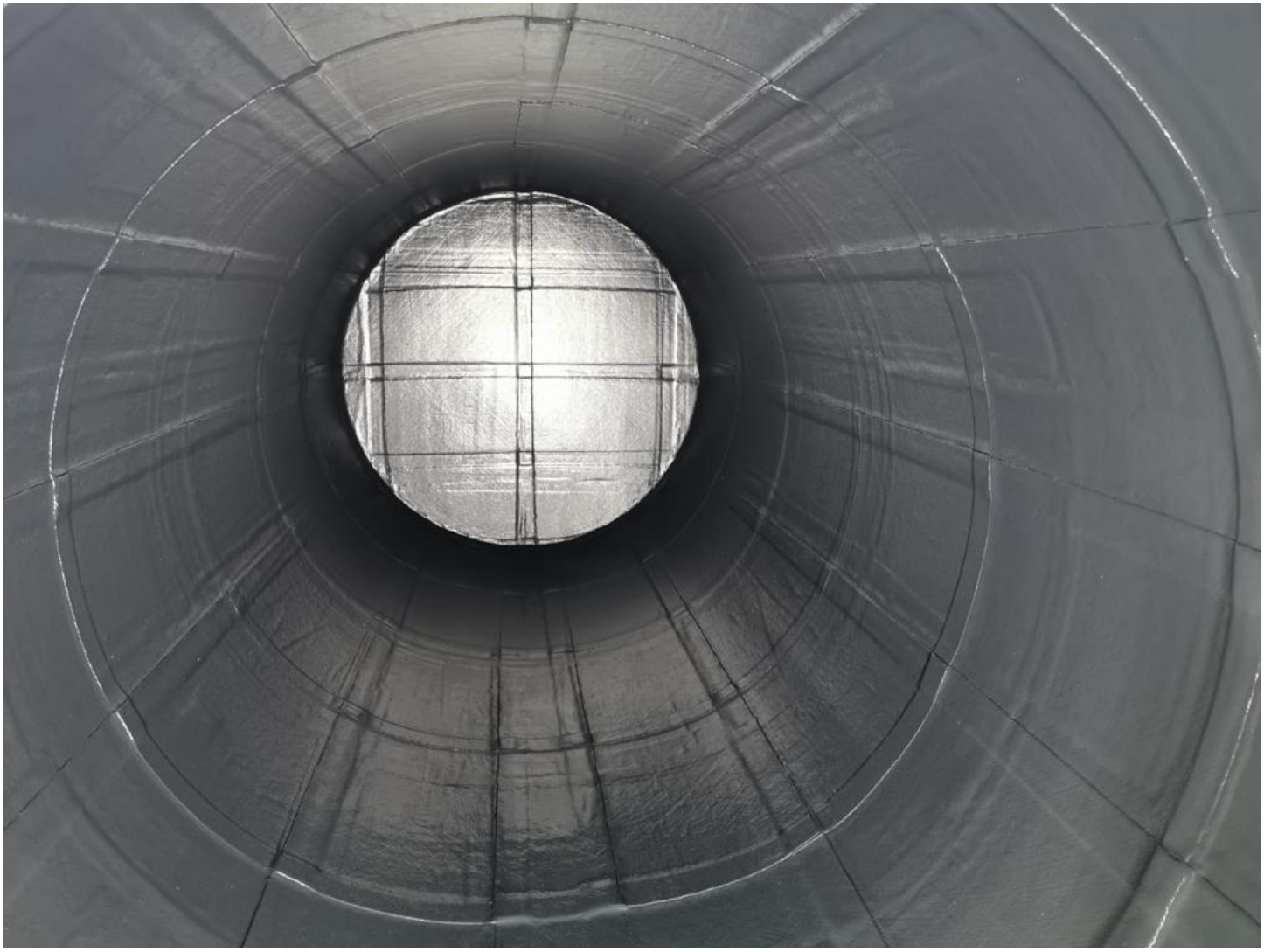
T +49 271 48964-0
E sgb@sgb.de
W www.sgb.de

Appendix H

Photographs







Appendix I

FDEP Form 62-761.900(9), F.A.C, Storage Tank System Equipment Registration Form

Department of Environmental Protection

2600 Blair Stone Road ♦ Tallahassee, Florida 32399-2400

DEP Form: 62-761.900(9)
Form Title: Storage Tank Equipment Registration Form
Effective Date: July 2019
Incorporated in Rule 62-761.850, F.A.C.

Storage Tank System Equipment Registration Form

Fill out completely

General Information

Company Name: Don Wood, Inc.
Contact Name: Luis A. Diaz
Company Address: 6501 Old Winter Garden Rd.
City, State: Orlando, Florida Zip: 32835
E-mail: ldiaz@donwoodinc.com
Contact Number: 407-293-0891
Product Name: Rafibra
Model Number(s): Rafibra
Product Type: Internal Field-Fabricated Sec. Containment
Rule(s) citation that registration is being requested within Chapter 62-761 (UST), and/or 62-762 (AST), 62-761.900 and 62-761.500(2)(f), F.A.C.

F.A.C.: Write a brief description of equipment registration request including product limitations:

Rafibra is an internal field-fabricated secondary containment system that is co-structural that can be used as an upgrade for a single-wall UST or a repair for an existing double-wall UST. It will be installed and managed in the United States by Don Wood, Inc.

Information Checklist (Choose Yes, No, or N/A - Not Applicable):

		Yes	No	N/A
1.	Third-party Certification by a Nationally Recognized Testing Laboratory? (Required)	☑	☐	
2.	Documentation of third-party evaluation that the equipment meets DEP Rules?	☑	☐	☐
3.	Documents included about the qualifications of the Nationally Recognized Testing Laboratory?	☑	☐	☐
4.	Technical information and drawings included?	☑	☐	☐
5.	Installation instructions included?	☑	☐	☐
6.	Annual Operability Testing Requirements (Rules 62-761.500, 62-762.501, & 62-762.502 F.A.C.)?	☑	☐	☐
7.	Integrity Testing Requirements (Rules 62-761.700, 62-762.701, & 62-762.702, F.A.C.)?	☑	☐	☐
8.	Compatible with fuel blends containing >10% ethanol or >20% biodiesel?	☑	☐	☐
9.	Has the product been approved or registered in other countries or states? (If so provide list)	☑	☐	☐
10.	Any requirements for company-certified installers or trainers?	☑	☐	☐
11.	Was this product(s) previously approved or registered by the Department? If yes, EQ-_____	☐	☑	☐
12.	Any changes or modifications to the equipment since the last submittal to DEP?	☐	☐	☑

Document Information: Provide supporting documents indicated as "Yes" above including this form via email to Tanknotify@floridadep.gov, or documents can be sent to FDEP, Division of Waste Management, 2600 Blair Stone Road, MS 4560, Tallahassee, FL 32399.

Write a brief description of equipment installation and performance in the U.S.:

The Rafibra System is similar to other FDEP approved internal field-fabricated secondary containment systems but meets stringent European standards. The system is widely used in Europe.

Equipment Registration Certification:

To the best of my knowledge and belief, all information submitted on this form is true, accurate and complete.

Luis A. Diaz
Printed Name and Title


Signature (right click to sign)

07/07/2022
Date

For Department Use Only:

Date Application Received: _____ Application complete: Yes: ☐ No: ☐

EQ- ☐ Date of complete or incomplete letter sent: _____ Date Equipment Requires Renewal: _____

Storage tank system equipment requires renewal every 5 years in accordance with subsection 62-761.850(2), F.A.C.

Contact Information

Luis A. Diaz
Don Wood, Inc.

6501 Old Winter Garden Rd.
Orlando, FL 32835

www.donwoodinc.com
Office - 407-293-0891
Cell – 407-747-7003
Fax - 407-299-0597

Equipment Registration Application to the Florida DEP Storage Tank Regulation Section prepared and completed by:

Marshall T. Mott-Smith, President
Mott-Smith Consulting Group, LLC
111 North Calhoun Street
Tallahassee, FL 32301
marshall@mott-smithconsulting.com
850-391-9835 work
850-591-1434 cell
www.mott-smithconsulting.com

Mott-Smith
Consulting Group LLC

Marshall Tipton Mott-Smith

July 7, 2022

Equipment Registration Amendment Submittal for EQ 979

to the

Florida Department of Environmental Protection's
Division of Waste Management
Compliance Assistance Program

By

Don Wood, Inc.

for the

Rafibra Internal Field-Fabricated Secondary Containment System

Submitted on April 15, 2024 by

Marshall T. Mott-Smith, President
Mott-Smith Consulting Group, LLC
111 North Calhoun Street
Tallahassee, FL 32301
marshall@mott-smithconsulting.com
850-391-9835 work
850-591-1434 cell
www.mott-smithconsulting.com

April 15, 2024

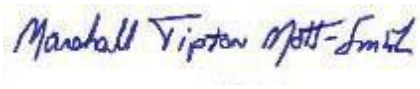
Amanda Dorsett,
Environmental Administrator
Florida Department of Environmental Protection
Division of Waste Management
Compliance Assistance Program
2600 Blair Stone Road
Tallahassee, Fl 32399-2400

Re: Equipment Registration Amendment Request for the Rafibra Internal Field-Fabricated Secondary Containment System

Dear Amanda,

We are submitting an Equipment Registration Amendment from Don Wood, Inc. for EQ 979, the Rafibra Internal Field- Fabricated Secondary Containment System to include ASTs. They would appreciate the expedient processing of this request. Don Wood, Inc. appreciates your consideration in this matter, and please feel free to contact me if you have any questions or if we need to provide additional information.

Best Regards,



Marshall Mott-Smith, President

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Table of Contents

1. Background

This Equipment Registration Amendment Submittal for EQ 979 is sought in accordance with Florida Administrative Code Rule 62-762.851(2) by Don Wood, Inc. With the exception of the cover letter of this Equipment Registration Request, Don Wood, Inc. is requesting that every document within the Equipment Approval Request be considered CONFIDENTIAL. The reason Don Wood, Inc.is requesting confidentiality is because the proprietary nature of the information. Don Wood, Inc. does not want to share this information with competitors and adversely affect the marketability of the Rafibra Internal Field-Fabricated Secondary Containment System

EQ 979 specifies that the Rafibra Internal Field-Fabricated Secondary Containment System is a system for the repair of existing double-wall steel or fiberglass USTs or the conversion of an existing single-wall steel or fiberglass system with a new double-wall secondary containment tank within an existing UST. The Rafibra Internal Field-Fabricated Secondary Containment System has several European third-party approvals by internationally recognized third-party laboratories. The purpose of this Equipment Registration Amendment is to expand the application of the technology to shop-fabricated aboveground storage tank systems. The Rafibra Internal Field-Fabricated Secondary Containment System also has European third-party approvals by internationally recognized third-party laboratories for aboveground tank applications. Therefore, in addition to USTs, the Rafibra Internal Field-Fabricated Secondary Containment System is for new construction or the upgrade of single-wall ASTs to double-wall ASTs with secondary containment and interstitial monitoring.

The Rafibra Internal Field-Fabricated Secondary Containment System is a field-constructed double-walled fiberglass tank system that is designed and constructed to be installed within an existing steel or fiberglass single-wall or double-wall aboveground or underground storage tank. The design employs the fiberglass laminate matrix in conjunction with a Parabeam interstice. The system can also be installed as a single-wall lining system on double-wall tanks in Florida.

Additionally, Rafibra has carried out numerous works in horizontal aboveground tanks in Spain and in other countries. They have extensive experience and are committed to offering high quality and reliable systems. Rafibra, S.L., with its facilities in Alberic, Valencia, Spain, has equipment and infrastructure necessary for the repair and coating of aboveground atmospheric shop-fabricated storage tanks and for the verification of the tightness of these systems. Rafibra has a worldwide presence, knowledge of systems, materials, and advanced procedures, and the proven experience in the procedure of in situ conversions of single- wall tanks to double-wall tanks. They have the capacity to manage and coordinate each one of the job phases and have the required inventory of the material, equipment, and instruments to effect and guarantee the proper installation of their system. They have a system for residue extraction, ventilation, and the measurement of the thicknesses of the metallic structures of tanks and tank coatings using ultrasonic methods, and other testing equipment and instruments.

Rafibra and Don Wood, Inc. have an experienced group of technical personnel, installers, and engineers, for the installation, testing, and monitoring of their Internal Field-Fabricated Secondary Containment System.

2. Third Party Approvals

Under the previous Equipment Registration, EQ 979, the Rafibra Internal Field-Fabricated Secondary Containment System had third-party approvals from LNE (The National Metrology and Testing Laboratory) in Paris, AIMPLAS, (the Technological Institute of Plastics) in Spain, and The Bureau Veritas in Spain. These Laboratories and Technological Institutes meet the definition of a Nationally Recognized Laboratory as defined in Rule 62- 762.201(47), F.A.C., and as required in Rule 62-762.851(2), F.A.C. The system meets the demonstration of equivalent protection and certification that is required in DEP Rule 62-761.850(2)(f), F.A.C. Copies of the third-party approvals are not provided because they were previously submitted with the initial EQ 979 request.

There are two additional standards that apply for AST applications by the Asociación Española de Normalización. The first standard is UNE 53991, "Repair and Internal Lining of Metallic Plastics for Liquid Petroleum Product Storage, with Reinforced Plastics". This standard establishes the specific procedures and requirements for the repair and interior coating of liquid petroleum product storage tanks, using reinforced plastic materials (See page three of the document in Attachment A).

The second standard is UNE 62425, "Construction of Double-Walled Bottoms in Vertical Shaft Overhead Tanks Manufactured on Site, in Single-Walled Steel". This standard defines the standards for the construction of double-walled bottoms in vertical-axis overhead tanks, fabricated on site and using fiberglass and resin. Additional documentation is provided in this request and is attached in Appendix A.

3. Installation and Other Requirements

The installation protocols are similar to what was specified in Attachment C of the initial submittal underground storage tanks. The fabric and resins are compatible with petroleum products, and the Rafibra Internal Field-Fabricated Secondary Containment System can be used inside of a steel aboveground tanks. The materials compatibility information was provided in Appendix F of the previous submittal. The installation requirements are specified in the UNE 53991 Standard for horizonal cylindrical shop-fabricated steel ASTs on saddles or supports. The installation requirements are specified in the Standard UNE 62425 for vertical cylindrical shop-fabricated steel or rectangular shop-fabricated steel ASTs on concrete foundations. There are specific surface preparation requirements included in the standards.

The installation process includes the testing protocols, the interstitial communication test, the testing of the interstitial integrity, safety, tank entry, and inspection, and installation checklists. The Rafibra Internal Field-Fabricated Secondary Containment System can only be installed by people that are trained, certified, and qualified by Don Wood, Inc. in accordance with the manufacturers and installation instructions. This includes the installation, cleaning, inspecting, repairing and preparing of the existing tank interior surface.

The System incorporates the field-proven Parabeam internal secondary containment technology, and owners can choose whatever type of method of interstitial monitoring they prefer (visual inspection, sensors, hydrostatic, vacuum, or pressure). The installation requirements for the interstitial monitoring system are contained in Appendix A in UNE 53991 and UNE 62425. Once the double-wall system is constructed, a permanent leak detection system must be installed for the detection of leaks in the interstitial space in accordance with Florida Department of Environmental Protection requirements.

The application of the Rafibra system on vertical cylindrical ASTs requires installation on the interior bottom of the tank and up along the interior tank shell. In order to ensure that the interstitial chamber is properly sealed, the double wall shall be extended a minimum of 70 cm over the tank's steel side wall. The component parts are identified and the minimum dimensions are shown in figures 2 and 3 of the attached standards. The maximum volume of interstitial chamber that a class 1 leak detection system can cover according to the UNE-EN 13160 series of Standards is 8 m3 for tanks and 10 m3 for pipes (see Standard UNE-EN 13160-7). Therefore, the interstitial chamber must be compartmentalized if its volume of is greater, and a class 1 leak detection system must be installed in each of said compartments

The average time of installation is between seven and ten days. The Installation Process was provided in Appendix C of the previous request and in accordance with UNE 53991 and UNE 62425 in Appendix A. Only Rafibra-and Don Wood Inc. trained and certified personnel are authorized to install the Rafibra Internal Field-Fabricated Secondary Containment System. They will use equipment with attention to quality control and will perform all required testing. The Quality Control provisions and the Installation safety measures are addressed in the installation requirements.

Surface preparation is a critical part of the installation process, and it is recommended that steel tanks be sand-blasted. Steel tanks should be inspected in accordance with API 1631, and measurements taken for tank deflections and thickness. Any repairs must be made in accordance with manufacturer's specifications.

The installation requirements specify the usual actions needed for tank entry such as safety, removal of sludges, and tank inspection. This is followed by surface preparation, final cleaning and inspection, photographs, and ultrasonic testing. New manways and fittings are installed as necessary, and existing gauge striker plates are removed.

4. Integrity Testing

The integrity test protocol for the Rafibra Internal Field-Fabricated Secondary Containment System is specified in Attachment A. The testing should be is performed at the time of installation, and if necessary, after the completion of repairs. No further integrity tests are required unless the tank has an incident that requires another repair and integrity test before the tank is put back into service.

The system meets the demonstration of equivalent protection and certification that is required in DEP Rule 62-762.851, F.A.C. The integrity of the interstitial space and leak detection system will be verified for each tank. Rafibra has a method to test the continuity of the interstitial space. This is accomplished by using a powerful light which verifies that the tridimensional fiber is not collapsed.

5. Release Detection

The Rafibra System is a secondary containment internal upgrade system that has the ability to use a number of different interstitial monitoring methods and systems, including vacuum, pressure, visual, or DEP-approved sensors. However, the SGB Vacuum or Pressure System is recommended for optimal performance. The interstitial spaces have sufficient strength and thickness to contain regulated substances for 30 days.

The installation of a permanent and automatic leak detection system in the interstitial space of the tank will be the choice of the tank owner. Once the double-wall system is constructed, a permanent and automatic leak detection system shall be installed for the detection of leaks in the interstitial space as described in Class I or Class II under standard UNE-EN 13160-1:2003, or in accordance with Florida Department of Environmental Protection requirements.

Leak detection system In Class I (SGB or THOMAS), are approved according to standard UNE-EN 13160-1:2003, and are recommended, but the Rafibra System can use other pressure, vacuum, electronic sensors, and visual methods of release detection manufactured by companies with release detection systems registered with the Department under Rule 62-762.851, F.A.C. For systems classified in the category of Class I by pressure, the manufacturer of the resin should confirm that the material used in the interstitial space is impermeable. It is not recommended to pressurize the interstitial space of the tank with air. It is recommended that an inert gas like nitrogen is used.

On Class I vacuum systems, the system of automatic regeneration by vacuum should conform to standard RD 400/1996, of March 1, as described under standard 94/9/CE, related to the leak protection system to be used in a potentially explosive atmosphere (ATEX) regardless of the fuel in storage at that moment. Only qualified (trained and company certified) field personnel may perform these tests.

Vacuum and Pressure release detection systems must meet European Class I requirements. The Rafibra System can also have electronic liquid float sensors within a low-point monitoring point, or use visual monitoring of the same monitoring point. Regardless of the type of release detection system selected and installed, the procedures for the annual operability tests must be performed in accordance with the procedure prescribed by the manufacturer and approved by the FDEP.

The sensors will have to perform an annual operability test in accordance with DEP rules and manufacturer's specifications for the specific leak detection system approved by the Department in accordance with Rule 62-762, F.A.C.

6. Materials Compatibility

All materials in the Rafibra Internal Field-Fabricated Secondary Containment System are non-metallic and will not corrode. The resins have physical properties and compatibility with the products stored within petroleum storage tank systems. In accordance with the requirements of Rule 62-762, F.A.C., the system is impervious, able to withstand deterioration and the secondary containment and interstitial space has sufficient strength and thickness to contain regulated substances for 30 days.

The materials used in the construction of the Rafibra System include Parabeam that creates an interlocking annular space, base resins for saturating the fiberglass materials, fiberglass mats, resins, catalysts, primer coats, putty and caulking materials, and fiberglass chopped strand mat. All of these materials are compatible with petroleum products. The fuel restrictions are specified to petroleum products, alcohol fuels, and alcohol fuel mixtures.

Appendix A

Third Party Approval Certification and System Requirements

Pol. Ind. Alberic C/ Avda. Ribera alta, nº 30 46260 Alberic VALENCIA Tfn: 962 443 646 Fax: 962 443 648

TECHNCAL REPORT

COMPLETE MAINTENANCE OF ATMOSPHERIC TANKS

Pol.ind. Alberic C/Avda. Ribera alta, No. 30 46260 Alberic VALENCIA

DOUBLE WALL IN-SITU CONSTRUCTION

RAFIBRA RDP SYSTEM

IN ACCORDANCE WITH R.D. 1523/1999, EN-13160, UNE 53991 AND UNE 62422 REGULATIONS

PETITIONER: RAFIBRA, S. L.

TECHNICAL REPORT WRITTEN BY

JOSE LUIS FOLGADO GARCIA

TECHNICAL INDUSTRIAL ENGINEER
COLLEGIATE No. 6548 (COPITI VALENCIA)
VALENCIA, SPAIN 09-10-2012

Pol. Ind. Alberic C/ Avda. Ribera alta, nº 30 46260 Alberic VALENCIA Tfn: 962 443 646 Fax: 962 443 648

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0 INTRODUCTION

Double wall tanks for petroleum products with interstitial space are designed to prevent leaks which can result in soil and groundwater contamination.

The outer wall prevents leaks that could result from the failure of the inner wall and vice versa. To ensure proper operation a leak detection system is installed. If liquid were to enter the interstitial space an audible and visual alarm is activated.

1 SUBJECT AND APPLICATION

The Technical Committee CEN/TC 221 under the CEN (European Committee for Standards), has developed the Standard series EN 13160, which refers to leak detection system, as defined in part 7 of the standard which includes general requirements, test measures, interstitial spaces, interior coatings, and leak protecting wrappers, distinguishing the following:

1 Interior coating protection against leaks (Chapter 6 of the standard UNE-EN-13160-7:2003)
   a. Interior coating protection for flexible leaks
   b. Interior cover protection against rigid leaks, (GRP)
2 Protected wrappers against leak (Chapter 7 of the standard UNE-EN 13160-7:2003). These two rules are excluded from the standard because they do not include tanks which are underground.

This procedure has the objective of establishing the standards to be followed by RAFIBRA, S.L. It defines the specific techniques to be followed to guarantee the proper construction of the In-situ double wall tank in a preexisting steel tank underground or aboveground.

This In-situ construction with a permanent leak detection system can be installed in the following:

a) New underground steel tanks used for the storage of petroleum products.

b) Existing fiberglass and steel underground steel tanks used for the storage of petroleum products which have maintained their structural integrity.

c) Existing fiberglass and steel tanks that have been properly repaired in accordance with standard UNE 53.991.

2.- ADVANTAGES

1. Through the installation of this system, you transform the simple wall tank into a double wall tank. The method is completed with the permanent installation of an automatic leak detection in the interstitial space created for a permanent detection system.
2. The system prevents the contamination of the environment.

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3. The system is compatible with other available leak detection systems in the interstitial space. It can be used with vacuum, pressure, and dry interstitial space sensors.
4. In the event of a failure of the primary wall, product would be contained in the secondary containment.
5. The new primary containment, interstitial space and secondary containment form a monolithic system since all the materials are of identical properties. The resin and fiberglass comply with the standards required in UNE 53991. Having a monolithic system prevents tension between layers which could result on separation.
6. The system considerably increases the structural integrity as well as the chemical resistance of the tank.

3 STANDARDS

UNE-EN 13160-1:2003 Leak Detection System. *Part 1: General Principles.*

UNE-EN 13160-2:2003 Leak Detection System. *Part 2: Pressure and vacuum Systems.*

UNE-EN 13160-7:2003 Leak Detection System. *Part 7: General Requirements and Test methods for interstitial space, interior coating and wrap protection against leaks.*

UNE-EN ISO 14125:1999 *Fiber-reinforced plastic composites — Determination of flexural properties (ISO 14125:1998).*

UNE 53991:2011 IN "Plastics. Repair and interior coating of steel tanks designed for the storage of liquid petroleum product using reinforced plastics."

UNE 53968:2005 IN Procedures for tank tightness test and leak detection on installations of petroleum storage tanks.

UNE 62422:2011 IN Construction of double wall tanks via In-situ transformation of steel tanks from single wall to double wall tanks.

4 TERMS AND DEFINITIONS

For this procedure, apply the terms and definitions, as follows:

4.1 Interstitial Space

Material used for the separation of the primary and secondary wall of the tank, which may be adhere or not to one of the two walls or to the two of them to guarantee the separation between the primary and the secondary wall.

4.2 Conditions of atmospheric pressure:

Conditions of pressure between 0.08 MPa (11.60 PSI) and 0.11 MPa (15.95 PSI)

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4.3 Leak detection by pressure:

Device which detects a leak using air or an inert gas as a medium to detect leak.

NOTE: With the leak detector by pressure, if there is a leak, the pressure drop in the interstitial space triggers an alarm.

4.4 Leak detection system by liquid (Brine):

The devices that detect a leak using the level of the liquid in the interstitial space.

4.5 Leak detection system by vacuum:

Device that detects a leak using air as a means of leak detection. With this type of detector, in case of a leak, the increase of the pressure in the interstitial space activates an alarm.

4.6 Gas Detector:

Device that detects the presence of a gas or vapor.

4.7 Liquid Detector:

Device that detects the presence of liquid.

4.8 Leak Detector:

Device that detects the conditions and status of all the leak sensors.

4.9 Authorized/Qualified installation company

Legal or physical person that repairs and provides maintenance to the storage in the facilities of fuel storage tanks.

4.10 Containment:

System designed to avoid the penetration of a leak of a primary system into the environment, resulting in the detection of a leak.

4.11 LEL (Lower explosive limit) and UEL (Upper explosive limit):

LEL, lowest concentration of gas or vapor which will burn or explode if ignited.

UEL, the highest concentration of gas or vapor which will burn or explode if ignited.

4.12 Primary wall:

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The ability of an enclosed tank designed or constructed to directly contact a confined liquid while in normal condition.

4.13 Secondary Wall:

The ability of a tank design or construction to directly contact and confine a liquid in abnormal use (from primary leakage) without leakage.

4.14 Retrofit system:

The combination of the two walls, the primary and the secondary, by themselves or associated with an intermediate material, create an adequate interstitial space.

4.15 Sensor System:

Provision that uses a liquid detector and/or vapor in contained or interstitial space controlled by a device used for leak detection.

4.16 Leak detector System:

Combination of elements that allow the early detection of the loss of strength of the walls of the tank and or leak, including all the equipment necessary for the detection of a leak.

4.17 Double wall Tank:

Tanks containing primary walls and secondary walls with an interstitial.

4.18 Single Wall Tank:

Tank with only one wall.

4.19 Shut-off Valve:

Valve used to interrupt the flow of a liquid beyond a point in a line connection.

4.20 Freeze protected zone:

Zone with temperature that does not go below the 32°F.

4.21 FRP

Fiberglass reinforced plastic.

4.22 LOAD

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Relative inert solid used to modify the resistance, stability, working conditions or other characteristics.

4.23 Epoxy, Vinyl ester and Polyester

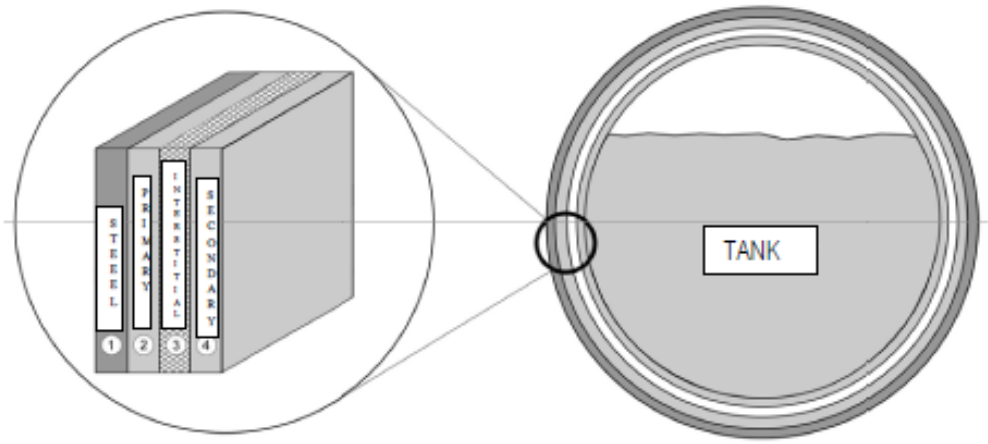
Epoxy, vinyl ester and polyester coating are the combination of 2 different materials which complement each other by their characteristics; a liquid resin that by polymerization results in a solid thermostable and insoluble fiber coating incorporated in the interior of the resin given strength to the traction efforts, while the solidified resin works develops a compression, improving the composition of the mix.
A resin solidified is known as matrix and the mix of resin and coating is also known as the composed material.

4.24. Polymerization.

Is the process in which various molecules of monomer identical or different, are united by adhesion or by condensation, forming a macromolecule known as polymer in the case of the resin thermostable, the polymerization produces a solid red tridimensional infusible and practically insoluble by the technical process known cured.

Explanation:

1 Steel
2 Primary wall (next to the steel wall)
3 Interstitial Space
4 Secondary wall (in contact with the product)



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5 MATERIALS

5.1. General Technical Features

The interior coating for leak protection (chapter 6 of standard UNE-EN 13160-7:2003) states, the following:

a) Interior coating protectors against flexible leaks.

They are made with flexible materials and are designed as a function of the dimension of the tank. The sheets should not have blisters, fissures, pores, and any other no-homogeneity. The irregularities which are evident and easily detectable, must be identified by means of visual examination.

The quality and compatibility of the materials must be approved and confirmed by a specific test, pursuant to the requirements determined in chapter 7 and 8 of the standard "Quality Control" and Tests, respectively.

b) Interior Coating protectors against rigid leak FRP.

The interior coating protectors against leakage may be reinforced with fiberglass, resin, of polyester, resin polyester non saturated resin (FRP-UP) and resin epoxy reinforced with fiberglass (FRP-EP). It can also be used with other adequate material.

The fitness of the materials must approve and confirmed by a specific test, pursuant to the requirements determined in chapters 7 and 8 of the Standard of Quality Control and Tests, respectively.

5.2. RAFIBRA Materials System - RDP

5.2.1.- Resins

Thermostable resin will be used, such as epoxy, vinyl, polyester, or other types of resin; with specifics features and special properties which are resistant dissolving action of the petroleum products, including the oxygenates; These resins must have enough coefficient of thermically dilatation superior to iron, to be able to support the movements of the tank. In the case of the RAFIBRA – RDP System, Epoxy vinyl ester resin is used without solvents (styrene) reinforced with fiberglass.

5.2.2.- Fiber Reinforcement

The reinforcements are made with fiberglass "E", composed of plastic compatible with resins used in the manufacturing of the product.

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8.4.4 Other EPA approved leak detection systems can be used with the new Rafibra Double Wall System

9 TESTING (COMPLIANCE CERTIFICATION)

9.1 Adherence

The test of adherence in the primary wall has been conducted, pursuant UNE 53991:2011. (Attachment 1)

9.2 Material Chemical Resistance

This test has the objective of proving the resistance that all the materials components must have of the coating versus the components that will be in contact in the interior of the tank

The test needs to be be conducted under the conditions described in the section that corresponds to standard UNE 53991:2011. (Attachment 1)

9.3 Mechanical Resistance

A resistance test should be conducted in accordance with standard UNE-EN ISO 14125:1999. (Attachment 3)

9.4 Test of continuity of the interstitial space

The test is conducted under the conditions described under section corresponding to standard UNE-EN 13160:2003. (Attachment 4)

10 FINAL VERIFICATION

After the job is completed, RAFIBRA will test the strength of the interstitial space. A qualified technician of Rafibra will evaluated the functioning of the equipment that indicates if there is any leak, will verify the performance of the vacuum system, pressure or liquid system in the interior of the interstitial space. Also, will verify the proper operation of the automatic leak detection system.

11 THE LABELING OF TANK AFTER RECONSTRUCTION

11.1 Labeling of converted tanks

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Each reconstructed tank will be marked by RAFIBRA, S.L. by means of a permanent plate which is resistant to corrosion as well as to the storage product.

The permanent plate will be fixed to the converted tank or on the manway cover of the tank or close to it. The plate should be visible and accessible.

The permanent plate will contain, as a minimum, the following information:

- Name and Address of RAFIBRA, S.L.
- Month and Year the tank was reconstructed.
- Identification number of the reconstructed tank in accordance with the sketch of the facilities.
- Number/Identification Number of the facility.
- Type of material Used.

11.2 Certificate of the repair company

For each tank converted, RAFIBRA, S.L. will issue a certificate indicating the details of the tests conducted pursuant, to chapter 8 standards.

12. MANAGEMENT OF WASTE

All the contaminated liquids obtained during the cleaning process of the tanks will be properly managed and disposed of at an authorized facility.

13. REFERENCES AND RAFIBRA S.L. PROFILE

13.1.- BACKGROUND OF THE COMPANY (ANNEX VIII)

13.2.- TECNICAL MEDIA

RAFIBRA, S.L., in its facilities of Alberique, has machines and the space necessary for the repair and coating of atmospheric deposits underground and for the verification of the tightness of said deposits described on the previous section, including the vehicles which the technical people use to conduct maintenance operations.

RAFIBRA S.L has the following characteristics:

- Has Worldwide presence
- Has the know-how of systems, materials, and advanced procedures.

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- Proven experience in the procedure of in situ conversions
- Capacity to manage and coordinate each one of the job phases.
- Has the required inventory of the material, equipment, and instruments to effect and guarantee the treatment of surface, cleaning, and product application, etc.,
- System of residue extraction.
- Autonomous System of ventilation.
- Equipment for the ventilation and extraction of air.
- System to measure the thicknesses of the metallic structure of the bank and the coating using ultrasonic methods.
- High pressure submergible pumps and auto absorption centrifuge, of diverse rates of flows.
- Luminaries with protection of ant deflagrant to be used in the interiors of the tanks and lantern of intrinsic securities.
- Compressors of different types and sizes.
- Oxygen and gases control Systems.
- Measurement instruments to measure and verify the thickness of the coated tanks.
- Means of Transportation for the personnel.
- Transportation of residuals in adequate containers to the appropriate plant.

Its technical department has studied and designed, using the latest information technology available, the different methos of thickness tank verification which after a specific and carefully test, conducted in our facilities, as well as, by other approved laboratories, we have developed the RAFIBRA-VSN VERIFICATION SYSTEM OF THICKNESS, accompanied by its continuing upgrades, resulting in the most dependable thickness verification system in the market.

We also design logistics systems that allow a more rapid response from the intervention of our equipment.

Considering the technical means available to the company, we cannot forget the human factor. RAFIBRA, S.L. has in its payroll a selected group of technical personnel with college degrees and without college degrees, engineers, experts in business administration, installers of petroleum product, as well as the technical petroleum product people that make possible the compliance and control of our services.

14.- ATTACHEMENTS

- ANNEX I: Industrial Registration of RAFIBRA, S.L. responsible for the installation, maintenance, and repair of tanks - RPPL - 3
- ANNEX II: Continuity Test in the interstitial space of the wall of the tank.
- ANNEX III: Market receipt C.E. from the manufacturer regarding the detector CLASS 1

Pol. Ind. Alberic C/ Avda. Ribera alta, nº 30 46260 Alberic VALENCIA Tfn: 962 443 646 Fax: 962 443 648

- ANNEX IV: Receipt compliance with rule 13160, detention of leakage detection system CLASS II
- ANNEX V: Test for the adherence effected by an approved Laboratory for the Testing Procedure.
- ANNEX VI: Tests of Chemical Resistance and strength effected by laboratories approved for the testing Procedure.
- ANNEX VII: Tests of Mechanic Resistance effected by approved laboratories specialized in testing procedures.
- ANNEX VIII: Authorizations from Portugal, France, and Italy.

Alberic, March 7, 2022

Fdo.: José Luis Folgado García
Rafibra S.L.

UNE
Normalización
Española

Spanish Standard
UNE 62425
March 2024

Construction of *double-walled bottoms (non-inspectable base) in vertical axle air tanks manufactured "in situ" of single-walled* steel

This standard was drawn up by the technical committee CTN-UNE 62 *Industrial equipment goods and pressure equipment,* for which the secretariat is held by BEQUINOR.

BEQUINOR

Asociación Española de Normalización
Calle de Génova, 6
28004 Madrid. Spain
915 294 900
info@une.org - www.une.org

UNE 62425

Construcción de fondos de doble pared (base no inspeccionable) en tanques aéreos de eje vertical fabricados *in situ*, de acero de simple pared.

Construction of double-walled bottoms (non-inspectable base) in vertical axle air tanks manufactured "in situ" of single-walled steel.

Construction de fonds à double paroi (base non susceptible d'être inspecté) dans des réservoirs aériens à axe vertical (bacs) fabriqués sur place, en acier à simple paroi.

Observations on this document must be addressed to:

Asociación Española de Normalización
Génova, 6
28004 MADRID-Spain
Tel.: (+34) 915 294 900
info@une.org
www.une.org

Contents

Notice is drawn to the possibility that certain elements of this document may be subject to patent rights. UNE is not responsible for identifying such patent rights.

0 Introduction

Double-walled tanks featuring an interstitial chamber between the walls were designed to store petroleum products with the aim of preventing spills and consequently contamination of the subsoil. The outer tank would retain any leaks produced by perforation of the inner tank and vice versa. These tanks are fitted with a leak-detection system that warns – and in some cases enables emission of a visible and/or audible signal – of the presence of fluid in the interstitial chamber, thus providing the tank with a permanent environmental prevention, control and protection system.

Accordingly, the Standard UNE 62422 defines the technical specifications that guarantee the "in situ" construction procedure for a double-walled tank by means of upgrading a pre-existing buried single-walled steel tank after carrying out the work under the conditions set forth in the Report UNE 53991 IN on the repair and internal covering of metallic tanks, used for the storage of liquid fuel, with reinforced plastics.

The purpose of a double bottom in a vertical axle tank built "in situ" is that in the event of a leak in the new upper bottom – the product container itself – spillage of the product towards the foundations and subsoil will not occur since it is unlikely that both bottoms will develop leaks at the same time.

The double bottom can be used as part of a leak or fluid-loss detection system to continuously monitor the tightness of the upper and lower bottoms.

1 Purpose and field of application

This Standard defines the technical specifications that guarantee the construction procedure of double-walled bottoms (non-inspectable base) in single-walled vertical axle steel overhead tanks manufactured "in situ". It covers vertical axle tanks, regardless of capacity, for storage of liquid petroleum products at ambient temperature and atmospheric pressure.

Due to the mechanical resistance requirements in the double bottom, only rigid GRP interior linings, as defined in Chapter 6 of the Standard UNE-EN 13160-7, are considered.

2 Standards for consultation

All or a selection of the documents set forth below are reference standards essential for application of this document. Only the cited edition is applicable for references that include dates. The latest edition (including any changes thereto) applies for undated references.

UNE 53991 IN, *Plastics. Repairing and internal covering of metallic tanks, used for the storage of liquid fuel, with reinforced plastics.*

UNE-EN 13160-1, *Leak detection systems. Part 1: General principles.*

UNE-EN 13160-2, *Leak detection systems. Part 2: Requirements and test/assessment methods for pressure and vacuum systems.*

UNE-EN 13160-7, *Leak detection systems. Part 7: Requirements and test/assessment methods for interstitial spaces, leak detection linings and leak detection jackets.*

UNE-EN ISO 844, *Rigid cellular plastics. Determination of compression properties.*

UNE-EN ISO 14125, *Fibre-reinforced plastic compounds. Determination of flexural properties* (ISO 14125:1998).

3 Terms and definitions

The following terms and definitions apply for the purposes of this document:

3.1 interstitial chamber:
material – which may or may not be fixed to one or both of the two walls – used to ensure separation of the tank's primary and secondary walls.

3.2 atmospheric pressure conditions:
pressure conditions between 0.08 MPa (0.85 bar) and 0.11 MPa (1.1 bar).

3.3 pressure leak detector:
a device that detects a leak using air or an inert gas as a leak detection medium. A drop in the pressure in the interstitial chamber triggers an alarm in the event of a leak with this type of detector.

3.4 leak detector for liquid systems:
a device that detects a leak using a fluid as a leak detection medium; a leak in one of the system walls is causes a drop in the level of the leak-detection fluid.

3.5 vacuum leak detector:
a device that detects a leak using air as a leak detection medium. With this type of detector, a pressure rise in the interstitial chamber in the event of a leak triggers an alarm.

3.6 gas detector:
a device that detects the presence of a gas or vapor.

3.7 liquid detector:
a device that detects the presence of a liquid.

3.8 leak indicator device:
a device that detects the operating and alarm status of all connected sensors or leak detectors.

3.9 repair company:
a company that performs the action object of the standard.

3.10 containment space:
a system designed to prevent leaks from a primary system from entering the environment. It also enables leak detection.

3.11 LEL and UEL:
lower and upper explosive limits as a percentage by volume of the fuel/air mixture.

NOTE They delimit the minimum and maximum percentages of fuel in the fuel/air mixture between which said mixtures are flammable.

3.12 lower wall:
the lower wall is located at the bottom of the interstitial space on the tank's inner steel surface.

3.13 upper wall:
the upper wall is located on top of the interstitial space, in contact with the stored product.

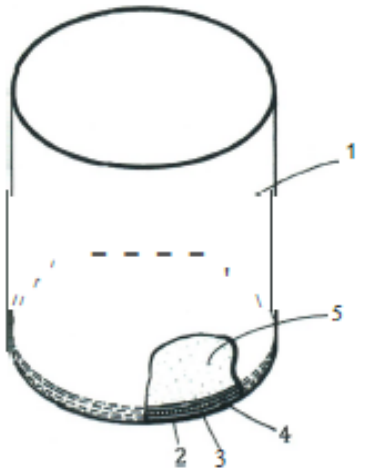
3.14 leak-resistant lining:
both walls, the lower and the upper which, alone or associated with an intermediate material, create a suitable interstitial chamber

3.15 sensor system:
an arrangement in which a liquid and/or vapor detector is used in the containment or interstitial spaces and monitored by a leak-detection device for leak-arrest purposes.

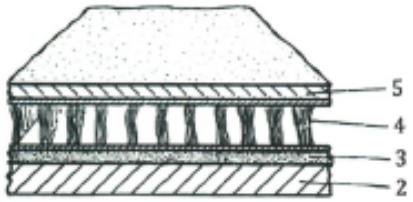
3.16 leak detection system:
a leak detection system is composed of leak-indicating units and consist of the space to be monitored (interstitial space), the leak protection linings, a leak indicating device, a leak detector, pipes, leak detection means and sensors.

3.17 double-walled bottoms:
a flat-bottom storage tank double-walled bottom of consists of an upper and lower wall and the interstitial space between them. Double-walled bottoms form part of a leak detection system in accordance with the Standard UNE-EN 13160-7.

3.18 single-walled tank:
a tank with a single wall (see figure 1).



1.1



1.2

Legend
1 Tank
2 Steel inner surface of the tank
3 Lower wall
4 Interstitial chamber
5 Upper wall

Figure 1 – Single-walled tank

4 Materials

4.1 GRP rigid leak-protection inner linings

Leak-protection interior linings can be reinforced with fiberglass, unsaturated polyester resin (GRP-UP) or glass-fibre reinforced epoxy resin (GRP-EP). Other suitable materials may also be used.

The suitability of the material must be tested and confirmed by a type test in accordance with the requirements laid down in chapters 7 and 8 of this Standard: "Quality Control" and "Installation of the Permanent Automatic Leak-detection System in the Interstitial Chamber" respectively.

done in the manner set forth in Section 6.5 above.

7.1.2 Detection of defects

Once the primary wall has been constructed and properly cured, the entire interior steel surface of the tank shall be explored with an electric holiday tester set to a voltage of not less than 15 kV in order to detect any pores or air bubbles in the laminate that cannot be observed during visual inspection. Table 1 of the Report UNE 53991 IN indicates the types of defects. If defects are detected, the laminate in the area involved shall be rectified and refurbished and then checked again by the same procedure.

7.1.3 Wall thickness measurement

A thickness measurement shall be carried out on completion of each lower and upper wall to verify that they are of uniform thickness at every point. At least one measurement shall be made every 50 cm in both the axial and longitudinal directions over the entire area of the tank bottom. Any areas below the necessary gauge shall be reinforced with the minimum amount of glass-reinforced resin to reach the required thickness.

7.2 Control of the general properties of the walls

7.2.1 Hardness

A Barcol, Persoz or Shore-D hardness test shall be conducted on the top layer in accordance with the methods set forth in the Report UNE 53991 IN.

At least two test specimens of 20 x 20 cm laminate shall be prepared under the same conditions as the tank's double wall before the works start. These samples shall be duly identified for the purposes of quality control in each tank, thus ensuring their traceability, for the purposes of checking the general property quality-control parameters. The number of test pieces shall be set before the start of the works.

7.3 Continuity test in the interstitial chamber

The integrity of the interstitial or leak-detection chamber in each tank shall be verified.

Check the continuity of the interstitial chamber. The following is an example of a method that could be valid for this purpose: insert a (non-polluting) fluid that can be visualised throughout the interstitial chamber or detect potential discontinuities by the volumetric test stipulated in the Standard UNE-EN 13160-7.

Any part of the interstitial chamber in which a leak is detected shall be removed and reconstructed.

8 Installation of the permanent automatic leak-detection system in the interstitial chamber

A permanent automatic leak-detection system shall be installed in the interstitial chamber once the double-walled system has been built. Said leak-detection system may be one of those designated as Class 1 in the Standard UNE-EN 13160-1.

The manufacturer must be authorised to apply the CE marking to its detection system in accordance with the Standard UNE-EN 13160-1.

In Class 1 pressure systems the fact that the chamber is made of impermeable materials must be substantiated. If not, the interstitial chamber cannot be pressurised with air. An inert gas such as nitrogen shall then be used.

The automatic vacuum regeneration system in Class 1 vacuum systems shall be suitable for use in explosive atmospheres regardless of the fuel stored at any one time.

In accordance with point 7.1 of the Standard UNE-EN 13160-2, the internal diameter of the interconnecting pipe may be 6 mm if the length is less than 50 m. Larger inner diameters must be adopted for longer pipes to ensure that flow resistance does not exceed 1 kPa (10 mbar) with a flow rate of (85 +/- 15) l/h.

9 Tests for certification of the double bottom application procedure

The materials used in construction of the double bottom shall comply with certain tests to be conducted by an ENAC-accredited laboratory as set forth in the following sections.

9.1 Adherence:

The adhesion test shall be carried out on the lower wall in accordance with Annex A of the Report UNE 53991 IN.

9.2 Chemical resistance of the materials

The purpose of this test is to check the chemical resistance of the lining components in relation to the substances with which they will come into contact during use of the tank.

The test shall be carried out under the conditions set forth in section 7.4.2 of the Report UNE 53991 IN.

9.3 Mechanical resistance

A flexural strength test shall be performed in accordance with the Standard UNE-EN ISO 14125.

A compression test shall be conducted in accordance with the Standard UNE-EN ISO 844. The compressive strength must be at least twice the load exerted by the hydrostatic pressure in the tank in under completely-filled conditions.

10 Final verification

After finishing all the scheduled work, the repair company shall check the tightness of the interstitial chamber in accordance with the instructions in the leak-detection system manufacturer's manual.

11 Marking of the upgraded tank and certification by the repair company

11.1 Marking of the upgraded tank

Each upgraded tank shall be marked by means of a permanent plate resistant to corrosion and to the product to be stored therein.

The plate – the permanence of which must be guaranteed – shall be fixed to the upgraded tank or to a visible, easily accessible substrate in the vicinity of the same.

The plate shall bear at least the following information:

- name and address of the repair company;
- month and year of the double-bottom upgrade;
- identification of the upgraded tank number;
- facility number/identification;
- type of material used.

11.2 Certification by the repair company

For each upgraded tank the repair company shall issue a certificate detailing the tests performed on the same as set forth in chapter 7 of this Standard and certifying the conformity of the same.

12 Bibliography

EN 14015, *Specification for the Design and Manufacture of Site-built, Vertical, Cylindrical, Flat-bottomed, Above Ground, Welded, Steel Tanks for the Storage of Liquids at Ambient Temperature and above*. [1)]

API Standard 650, *Lining of Above-ground Petroleum Storage Tank Bottoms*.

API Standard 653, *Tank Inspection, Repair, Alteration and Reconstruction*.

API Standard 2015, *Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks*.

1) Currently in progress.

For information concerning the development of the standards, please contact:

Asociación Española de Normalización,
Calle Génova 6,
28004 MADRID-Spain
Tel.: 915 294 900
info@une.org
www.une.org

For information concerning the sale and distribution of the standards, please contact:

AENOR INTERNACIONAL S.A.U.
Tel.: 914 326 000
normas@aenor.com
www.aenor.com

UNE Spanish standardisation body at:

Appendix B

Rafibra Letter

www.rafibra.es
AVDA. RIBERA ALTA, 30 46260 ALBERIC VALENCIA
Tfno. 96 - 244 36 46 Fax: 96 - 244 36 48 email: rafibra@rafibra.es

March 27, 2024

To whom it may concern:

We are pleased to inform you that Rafibra is fully authorized and qualified to carry out repairs and perform in place tank fabrication on horizontal aboveground tanks, as well as underground tanks; whether horizontal or vertical.

Rafibra has the necessary certifications and rigorously follows all regulations to guarantee the quality and safety of our work. We operate under the strictest quality standards and regulatory compliance. In this regard, we would like to point out that we have two important standards and authorizations that support our ability to perform this type of work.

The first standard is UNE 53991, "Repair and Internal Lining of Metallic Plastics for Liquid Petroleum Product Storage, with Reinforced Plastics". This standard establishes the specific procedures and requirements for the repair and interior coating of liquid petroleum product storage tanks, using reinforced plastic materials.

The second standard is UNE 62425, "Construction of Double-Walled Bottoms in Vertical Shaft Overhead Tanks Manufactured on Site, in Single-Walled Steel". This standard defines the standards for the construction of double-walled bottoms in vertical-axis overhead tanks, fabricated on site and using fiberglass and resin.

Additionally, we would like to emphasize that throughout our history, Rafibra has carried out numerous works in horizontal aerial tanks in Spain and in other countries. Our experience and trajectory endorse us as the leaders in the sector. We are committed to offering high quality and reliable solutions to all our clients. Attached are photos of various projects.

The Rafibra team is committed to complying with all applicable regulations and standards to ensure complete satisfaction and peace of mind among our customers. If you have any additional questions or would like more information about our services, please do not hesitate to contact us.

JOSE LUIS FOLGADO GARCIA
CEO RAFIBRA SL

Appendix C

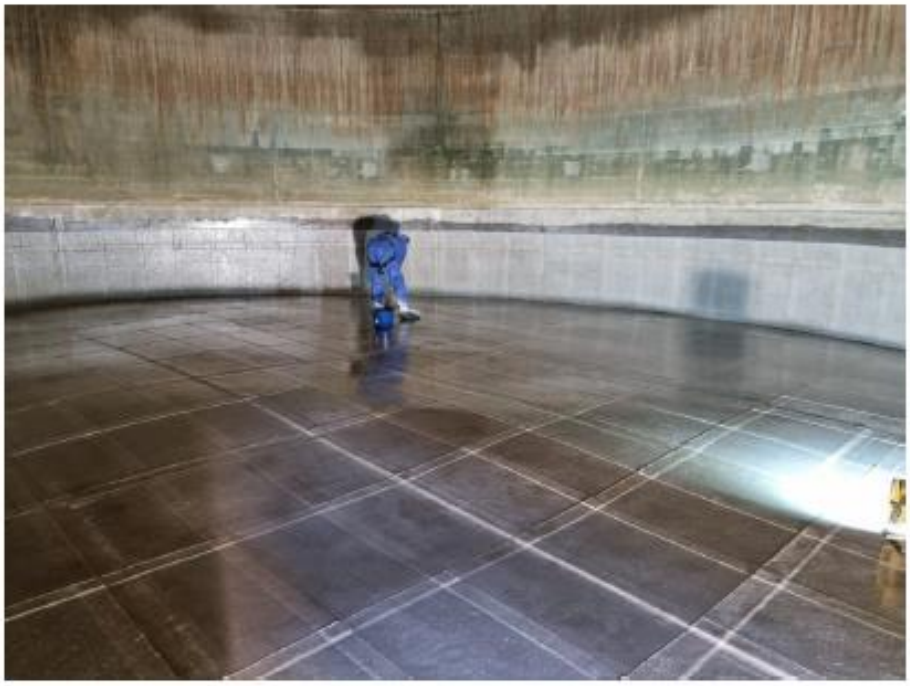
Photographs

www.rafibra.es

AVDA. RIBERA ALTA, 30 46260 ALBERIC VALENCIA
Tfno. 96 - 244 36 46 Fax: 96 - 244 36 48 email: rafibra@rafibra.es

PHOTOGRAPHIC DOSSIER OF SOME WORKS

AVDA. RIBERA ALTA, 30 46260 ALBERIC VALENCIA
Tfno. 96 - 244 36 46 Fax: 96 - 244 36 48 email: rafibra@rafibra.es



Appendix D

FDEP Form 62-761.900(9)

Department of Environmental Protection

2600 Blair Stone Road ♦ Tallahassee, Florida 32399-2400

DEP Form: 62-761.900(9)
Form Title: Storage Tank Equipment Registration Form
Effective Date: July 2019
Incorporated in Rule 62-761.850, F.A.C.

Storage Tank System Equipment Registration Form

Fill out completely

General Information

Company Name: Don Wood, Inc.
Contact Name: Luis A. Diaz
Company Address: 6501 Old Winter Garden Rd.
City, State: Orlando, Florida Zip: 32835
E-mail: ldiaz@donwoodinc.com
Contact Number: 407-293-0891
Product Name: Rafibra
Model Number(s): Rafibra
Product Type: Internal Field-Fabricated Sec. Containment
Rule(s) citation that registration is being requested within Chapter 62-761 (UST), and/or 62-762 (AST), 62-761.900 and 62-762.501, F.A.C.

F.A.C.: Write a brief description of equipment registration request including product limitations:

Rafibra is an internal field-fabricated secondary containment system that is co-structural that can be used as an upgrade for a single-wall UST or AST or a repair for an existing double-wall UST or AST. It will be installed and managed in the United States by Don Wood, Inc.

Information Checklist (Choose Yes, No, or N/A - Not Applicable):

		Yes	No	N/A
1.	Third-party Certification by a Nationally Recognized Testing Laboratory? (Required)	☑	☐	
2.	Documentation of third-party evaluation that the equipment meets DEP Rules?	☑	☐	☐
3.	Documents included about the qualifications of the Nationally Recognized Testing Laboratory?	☑	☐	☐
4.	Technical information and drawings included?	☑	☐	☐
5.	Installation instructions included?	☑	☐	☐
6.	Annual Operability Testing Requirements (Rules 62-761.500, 62-762.501, & 62-762.502 F.A.C.)?	☑	☐	☐
7.	Integrity Testing Requirements (Rules 62-761.700, 62-762.701, & 62-762.702, F.A.C.)?	☑	☐	☐
8.	Compatible with fuel blends containing >10% ethanol or >20% biodiesel?	☑	☐	☐
9.	Has the product been approved or registered in other countries or states? (If so provide list)	☑	☐	☐
10.	Any requirements for company-certified installers or trainers?	☑	☐	☐
11.	Was this product(s) previously approved or registered by the Department? If yes, EQ- 979	☐	☑	☐
12.	Any changes or modifications to the equipment since the last submittal to DEP?	☐	☐	☑

Document Information: Provide supporting documents indicated as "Yes" above including this form via email to Tanknotify@floridadep.gov, or documents can be sent to FDEP, Division of Waste Management, 2600 Blair Stone Road, MS 4560, Tallahassee, FL 32399.

Write a brief description of equipment installation and performance in the U.S.:

The Rafibra System is similar to other FDEP approved internal field-fabricated secondary containment systems but meets stringent European standards. The system is widely used in Europe.

Equipment Registration Certification:

To the best of my knowledge and belief, all information submitted on this form is true, accurate and complete.

Luis A. Diaz
Printed Name and Title

Signature (right click to sign)

4-15-24
Date

For Department Use Only:

Date Application Received: _____ Application complete: Yes: ☐ No: ☐

EQ- ☐ Date of complete or incomplete letter sent: _____ Date Equipment Requires Renewal: _____

Storage tank system equipment requires renewal every 5 years in accordance with subsection 62-761.850(2), F.A.C.

Contact Information

Luis A. Diaz
Don Wood, Inc.

6501 Old Winter Garden Rd.
Orlando, FL 32835

www.donwoodinc.com
Office - 407-293-0891
Cell – 407-747-7003
Fax - 407-299-0597

Equipment Registration Application to the Florida DEP Storage Tank Regulation Section prepared and completed by:

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Consulting Group LLC

Marshall Tipton Mott-Smith

April 15, 2024